Analytical Report n9

Analytical Report 9: The Economic Benefits of Open Data

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Executive Summary

Over the past years various studies have been conducted that focus on the potential that Open Data holds for governments, economies, and societies as a whole. Some of these studies focus on the macro and micro-economic impact of Open Data across Europe and the globe and quantify these benefits. They provide a series of scenarios for the impact that Open Data is expected to have on the economic growth at national, European or global level with predictions that range from conservative to optimistic and very ambitious scenarios, as well as methods that can be characterised as bottom-up or top-down. Despite the method applied by the studies and the estimates they provide, there is one finding that is beyond dispute: when opened, data can become a force of growth and development for all countries, regardless of geography and level of economic development.

The potential that data holds becomes even larger when public sector information is combined with privately held data. Privately held data of public interest constitutes another pillar in the EU data economy. When released and potentially combined with Open Data, it can be an important driver of economic, societal and environmental benefits and will most certainly play an important role in helping Europe maintain its competitiveness in the international arena. The estimates made in the context of the EU vision of building a European data economy underline the potential that a free flow of data holds for economic growth across Europe. With the value of the EU data economy expected to grow up to EUR 739 billion by 2020 (4% of the EU GDP) presented by the European Data Market Study in May 2017, this potential is again underlined.

The present report sheds light into the economic benefits and dives deeper into the impact of Open Data at both macro and micro-economic levels. In doing so, it breaks down the broader pool of 'data' into Open (Government) Data and privately held data that is of public interest. It looks at the evidence available so far and provides an overview of the most recent research conducted in the field. It concludes with a call for action for further evidence that needs to be gathered, at both EU and country level. With such facts and figures, support can be rallying more easily from all European regions and sectors to accomplish the vision of a European Data economy based on the free flow of data across Europe that is anchored in strong regulatory and at the same time investment-enabling frameworks.

The Economic Value of Open Data

EUROPEAN DATA PORTAL

Estimated values for 2020 for the EU28+

Market size and value added	Number of jobs created	Cost savings for the public sector	Efficiency and productivity gains
€ **325 billion direct market size** for the period **2016-2020** **36.9% increase in share of GDP** from 2016 to 2020 € **83,578 million** market for public administration in 2020	**100,000 jobs** in Open Data in 2020 **7.3% average increase** in Open Data jobs More than **2,500 jobs** in at least nine countries	€ **1.7 billion cost savings** for EU28+ public administrations in 2020	**7,000 lives** can be saved due to quicker response **2,549 hours** can be saved in terms of finding parking **629 million hours** saved, equivalent to € **27.9 billion**

The economic benefits of Open Data are being reaped at different extents across the EU28+ countries

Open Data per country

Direct market size in 2020 per EU28+ country

Classification:

< €0,5 bn | € 0,5 - 5 bn | > € 5 bn

Open Data has both direct and indirect economic benefits

Indirect economic benefits

2,549 hours saved in finding parking

16% less energy used

Direct economic benefits

25,000 Jobs created in Open Data in **2020**

> € 30 million of savings in public administration in **11 countries**

The benefits of Open Data are diverse and range from improved performance of public administrations, economic growth in the private sector to wider benefits for citizens and the society

Performance

Improving Efficiency of Public Services

Improving Quality

Economy

Developing Innovative Services

Creating New Business Models

Social

Improving Transparency & Accountability

Enhancing Participation

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1 The promise of Open Data

1.1 The EU data economy

Data lies at the core of the 4th Industrial Revolution. This is an essential resource for economic growth, competitiveness, innovation, creation and society's progress in general[1].

Commissioner Mariya Gabriel, Speech on the occasion of the
Digital Single Market Conference on the Free Movement of Data, Tallinn, 17 July 2017.

Today's economy revolves around data. As societies move into the digital age, more and more data is produced every day, every hour, every minute. Empires of data, data lakes, data clouds, data landscapes of multiple hues, shape, format and content. With the advent of the 'Internet of things', the amount of data across the world is expected to increase further exponentially. Data holds an enormous potential in various fields, and is considered "an essential resource for economic growth, job creation and societal progress"[2] by the European Commission. The 2017 European Data Market study[3] measured the size and trends of the EU data economy, and showed that the data economy is already a reality today. Approximately 6.1 million EU citizens could be considered as 'data workers' in 2016, and this number is expected to grow by around 2 to 3% per year, potentially rising up to 10.4 million by 2020. In terms of the data market as a whole (defined as the marketplace where digital data is exchanged as "products" or "services" as a result of processing raw data), the European data market in the EU28 was estimated at EUR 54,351 million in 2015 and at EUR 59,539 million in 2016, thus exhibiting a solid year-on-year growth of 9.5% (Figure 1).

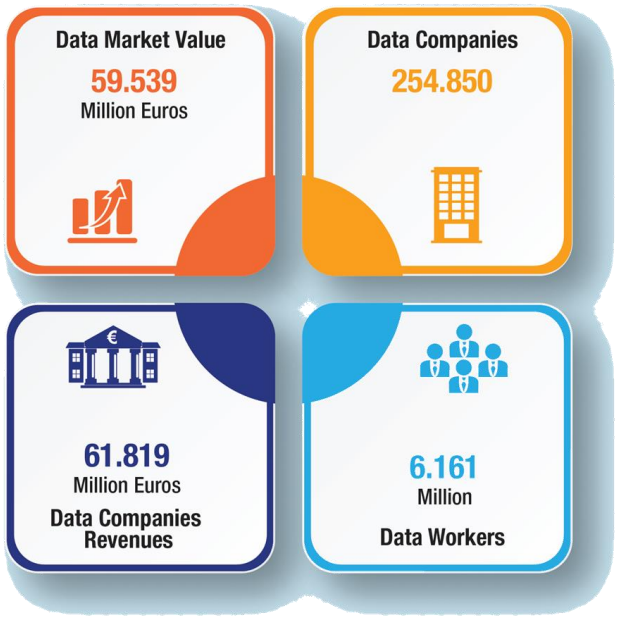

Figure 1 Key characteristics of the EU data economy[4]

[1] Speech by Commissioner Mariya Gabriel in charge of Digital Economy and Society, Digital Single Market Conference on the Free Movement of Data, Tallinn, 17 July 2017. Available at: http://europa.eu/rapid/press-release_SPEECH-17-2062_en.htm
[2] https://ec.europa.eu/digital-single-market/en/building-european-data-economy
[3] Available at: https://ec.europa.eu/digital-single-market/en/news/final-results-european-data-market-study-measuring-size-and-trends-eu-data-economy and http://www.datalandscape.eu/
[4] https://ec.europa.eu/digital-single-market/en/building-european-data-economy

Although the data economy is already a reality today, more needs to be done in order "to fully unleash the data economy benefits", by for example "allowing companies and public administrations to store and process non-personal data wherever they choose in the EU"[5]. As shown also by other studies commissioned by the European Commission, "taking away obstacles to data mobility is expected to generate an additional growth of up to 4% of the GDP by 2020"[6]. In addition, other studies such as the assessment of the ODINE incubator programme[1] conducted by IDC[2] showed that each euro invested by the European Commission in the ODINE project will have generated up to 14 euros in cumulative revenues by 2020. The growth in cumulative revenues in the period 2016-2020 was estimated to EUR 110 million. The study highlighted once again the importance of timely investments in the Open Data driven business, as it will provide quantified benefits at both micro- and macroeconomic levels.

Recognising the importance of the overall data economy, it is important to bear in mind that different types of data exist and carry their own key characteristics. One of them is Open Data. This report specifically focuses on Open Government Data, but Open Data cannot be considered in isolation of what is happening in the overall data landscape. It should be understood in the broader context of what is referred to as (big) data. The figure below provides a conceptual overview of five different data categories that fall under the broader umbrella of (big) data.

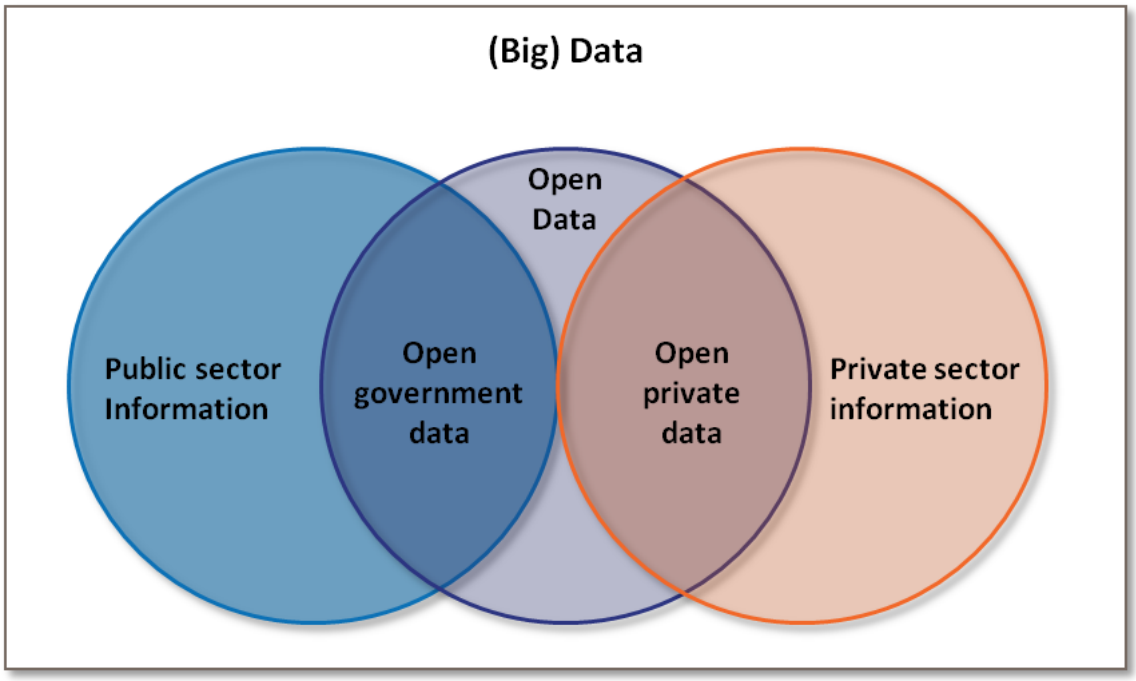

Figure 2 Open Data in the broader data economy

- **(Big) Data** is a popular term to describe the exponential growth and availability of data, both structured and unstructured;
- **Public Sector Information** is information generated, created, collected, processed, preserved, maintained, disseminated, or funded by or for the Government or public institution;
- **Open Government Data** is data produced or commissioned by public bodies or government controlled entities which is made accessible, can be freely used, reused and redistributed by anyone;

[5] https://ec.europa.eu/digital-single-market/en/free-flow-non-personal-data
[6] Ibid.

- **Open Data** refers to data which is open in terms of: access, redistribution, reuse, absence of technological restriction, attribution, integrity, no discrimination. As in the context of Open Government Data, the licence will specify the terms of use;
- **Private Sector Information** is the data collected, produced and owned by either private natural or legal entities.

Although Open Data is the core subject of analysis in this report, this study also explores the evidence available about the economic benefits of data that is privately held but that can be of general public interest.

1.2 Zooming in on Open Data

Publishing Open Data matters. The potential value of Open Data can only be unlocked if the data is made available in the first place. We see more and more governments opening up the data they hold, setting up Open Data portals increasingly backed by solid Open Data policy frameworks[7]. Nevertheless, the full potential of Open Data is only then fully exploited, when the data is being reused. But what is the economic potential of such re-use? And to what extent and how is the available data being re-used?

To answer these questions, it is important to know more about the economic impact of public data resources. Over the past years, several publicly available studies have provided evidence for the impact generated by Open Data: studies at a European level, such as the 2015 Creating Value through Open Data report, but also studies at Member State level, with examples coming from, to name a few, Denmark[8], Germany[9], Finland[10], the Netherlands[11] and Spain[12]. On a global level, initiatives such as the Open Data Barometer[13] and the OECD Government at a Glance[14] assess the impact of Open Data.

Governments are further developing Open Data initiatives, because they expect them to have an impact – impact in terms of economic benefits and cost savings for public administrations, for society (e.g. increasing transparency of government action and the inclusion of marginalised groups) as well as environmental benefits (e.g. improvement of energy consumption, reduction of environmental damages caused by pollution of water, soil and air etc.). The several areas in which Open Data is expected to be beneficial are presented in Figure 3.

[7] European Data Portal (2016), Open Data Maturity in Europe 2016. Available at https://www.europeandataportal.eu/sites/default/files/edp_landscaping_insight_report_n2_2016.pdf

[8] Danish Agency for Data Supply and Efficiency (2017). The impact of open geographical data – follow-up study. Available at http://sdfe.dk/media/2917052/20170317-the-impact-of-the-open-geographical-data-management-summary-version-13-pwc-qrvkvdr.pdf

[9] Konrad Adenauer Stiftung (2016), Open Data. The Benefits. Available at http://www.kas.de/wf/doc/kas_44906-544-1-30.pdf?160418125028

[10] Finnish Prime Minister's Office (2017), Avoimen datan hyödyntäminen ja vaikuttavuus. Available at https://www.etla.fi/wp-content/uploads/VNK_2017_40.pdf

[11] TU Delft (2017), Maatschappelijke kosten-baten analyse Open Data. Available at https://repository.tudelft.nl/islandora/object/uuid%3Ab34165f8-7a62-431f-8b20-6120cafc6ae8

[12] ASEDIE (2017), Infomediary sector, 5th edition. Available at http://www.asedie.es/assets/asedie-infomediary-sector-report-2017-.pdf

[13] World Wide Web Foundation (2017), Open Data Barometer, fourth edition. Available at http://opendatabarometer.org

[14] OECD (2017), Government at a Glance 2017. Available at http://www.oecd.org/gov/government-at-a-glance-22214399.htm

Figure 3 Benefits attributed to Open Data

Acknowledging that Open Data offers benefits in several areas, this report will specifically focus on the economic benefits derived from publishing and re-using Open Data.

1.3 Aim of this report

Various studies have made an attempt to provide evidence about the economic value of Open Data. Especially since Open Data generally has a marginal cost of zero, economic benefits are likely to result from more organisations re-using Open Data. But the results of the studies vary, and figures are sometimes outdated.

This report will synthesise the findings of the different reports drafted by the EDP about the financial benefits of Open Data (e.g. macroeconomic study, re-use report, analytical reports) as well as the findings from other studies on the (Open) Data Economy. Building on the mid-term review of the Digital Single Market (DSM)[15], the report explores data which is publicly funded as well as data held privately which can be of public interest. In addition, this report will include references to other recent studies published in the field of Open Data and the Data Economy.

1.4 Method

To identify and delve into the economic benefits of Open Data, the approach of this study was built upon three pillars:

- The method and results of previous European Data Portal reports were analysed, with particular attention to the European Data Portal's Creating Value through Open Data report from 2015 and the Re-using Open Data report from 2017. For instance, the calculation method for

[15] OECD (2017), Government at a Glance 2017. Available at http://www.oecd.org/gov/government-at-a-glance-22214399.htm

the indicators of the Creating Value through Open Data was re-assessed based on recent research and more up-to-date data. In addition to these two reports, previous analytical reports and the EDP report on sustainability were assessed.

- In addition, further studies were consulted. Over the past years, several studies assessing the impact of Open Data have been published, particularly on Member State level.
- Focusing not only on Open Data, studies on the overall data economy were included in the research, most notably the recent work of the European Commission on the EU data landscape.

1.5 Structure of the report

The report is structured as follows:

- Chapter 2 assesses the evidence available concerning the economic impact of Open Data and provides an overview of the economic benefits of Open Data for the public sector;
- Chapter 3 focuses on economic benefits of privately held data of public interest;
- Chapter 4 focuses on the costs associated with Open Data initiatives;
- Chapter 5 highlights the main findings and provides a series of recommendations.

2 The economic benefits of Open Data

Generally speaking, benefits result from an increase in the usage of the Open Data, more areas in which Open Data is applied, new products and services, a better data quality, efficiency gains for both data publishers and users, improved user satisfaction and increased trust, as well as a better image of the Open Data providers[16]. The economic benefits that this report covers are related to Open Data, i.e. data available for commercial re-use at a zero or low cost. At the same time, it is important to emphasise that the estimations presented in the following section will not materialise if the data is closed or charged for, or otherwise restricted. But what kind of economic benefits can actually be realised?

In its Digital Single Market Mid-Term Review, the European Commission also emphasised once again the value that the data economy in Europe can bring to the current status-quo. In absolute numbers, the data economy is estimated to reach EUR 739 bn. by 2020, and represent 4% of the overall EU GDP. This would mean doubling today's figures[17]. Along the same lines, and based on a high-growth scenario, the number of data professionals is expected to increase from over 6 million in 2016 to reach and even exceed 10 million by 2020[18]. In addition to this, the EU Data Market Study of 2017[19] observed a growth between 2015 and 2016 of 5.03% on average per year, with an overall value of the data economy that grew from EUR 247 bn. in 2013 to EUR 285 bn. in 2015, almost reaching EUR 300 bn. in 2016. According to the same report, the value of the data economy in 2016 was worth nearly 2% of the EU GDP, with 15 EU countries having an impact of the data economy above the EU average.[20]

The European data industry as a whole is showing comparable growth figures: in 2016, the European data industry comprised almost 255,000 companies with a share of 14.1% of the 1.8 million enterprises populating the ICT and professional services sectors. Growth in these numbers is constant in the period 2013-2016, and occurs across the EU, albeit more strongly in countries with a more highly concentrated ICT industry. Nonetheless, there is a margin for improvement: only 661,000 enterprises in 2016, corresponding to 6.4% of the 10.3 million potential user companies (excluding the government sector) can be characterised as data driven users. This is relatively modest, and shows that significant gains are still possible. Under high growth scenarios, an increase to around 359.000 companies in the data industry by 2020 should be viable.

Against this backdrop, it is important to quantify the economy impact that Open Data has Europe and its share within the broader data economy.

The European Data Portal Study 'Creating value through Open Data' quantified the economic benefits for Open Data, in particular the Open Data potential market size in the EU28+ by looking at four key indicators: direct market size, number of jobs created, cost savings and efficiency gains. The study clusters the economic benefits derived from the use of Open Data into 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

[16] OECD (2017), Government at a Glance 2017. Available at http://www.oecd.org/gov/government-at-a-glance-22214399.htm
[17] IDC (2017). European Data Market Study Final Report SMART 2013/0063. Published February 2017. Available at: http://datalandscape.eu/.
[18] ibid
[19] European Commission (2017). The European Data Market Study: Final Report. Available at: http://www.datalandscape.eu/study-reports
[20] Ibid, page 126.

of related markets. The economic impact of Open Data has been assessed in different ways. In addition to macroeconomic studies, case studies such as the Open Data Impact Study[21] published by GovLab and Omidyar Network in March 2016 provide valuable insights, such as a taxonomy of impact for Open Data initiatives, outlining various dimensions (from improving government to creating economic opportunities) in which Open Data has proven to be effective.

Furthermore, Open Data is also observed beyond the EU context. The most recent study from July 2017 looks at Open Data in developing economies[22]. It examined the wide spectrum of attempts to provide evidence for the development of what the authors call a 'plausible theory of change', that explains the role of Open Data in the international development field. This study will focus primarily on the impact Open Data has in Europe, but will also look to lessons learned, data and conclusions from relevant studies beyond the EU. The next section outlines how Open Data is actually transformed into value, whereas sections 2.2 to 2.6 outline the benefits of Open Data as measured by various indicators.

2.1 How is Open Data being turned into value?

Studies have also been conducted to document the economic benefits of Open Data at company level, showing how organisations can turn Open Data into value. Studies such as the Report on the re-use of Open Data[23] confirm the diversity of applications of data and how data can be used to benefit businesses. Business use data across the Data Value Chain. Zooming in further on the exploitation and commercialisation of Open Data, it appears that Open Data has a high potential for organisations of all sectors and sizes, and that these organisations turn Open Data into value in various ways. Several different actors are involved in the process, from data creation to data services and products as shown in the figure below.

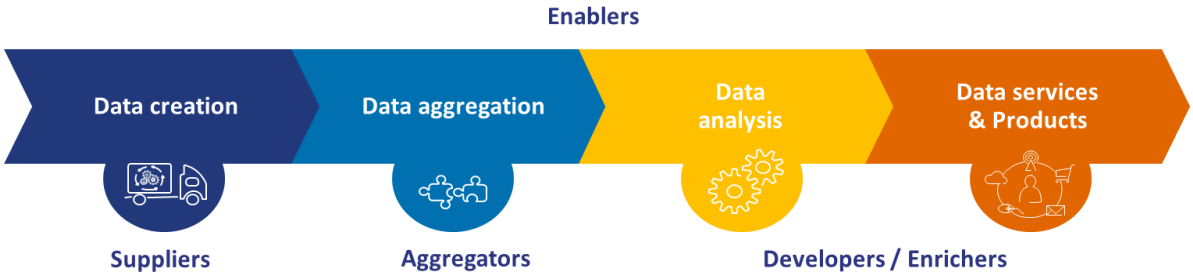

Figure 4 The Data Value Chain and Data Value Chain Archetypes

Data creation is done by the Suppliers. The data is subsequently collected and aggregated by the so-called Aggregators. Developers use the data for the development of new applications, while Enrichers use data to gain new and/or better insights from the analysis of the data. Enablers facilitate the supply or use of Open Data for the other archetypes, for instance by providing platforms from which the data

[21] ODI (2016). Open Data Impact. When Demand and Supply Meet. Key Findings of the Open Data Impact Case Studies. Available at: http://odimpact.org/files/open-data-impact-key-findings.pdf
[22] Open Data in Developing Economies: Toward Building an Evidence Base on What Works and How. Available at: http://odimpact.org/files/odimpact-developing-economies.pdf
[23] European Data Portal (2017), Re-Using Open Data, A Study on Companies Transforming Open Data into Economic and Societal Value, January 2017. Available at: https://www.europeandataportal.eu/sites/default/files/re-using_open_data.pdf

can be extracted. Following the recent EuDEco publication on modelling the data economy, data holders (suppliers), data users and data distributors constitute the core of the data economy[24].

According to the report, 38% of the organisations working with Open Data can be classified as Aggregators. In terms of business models based on Open Data, it appears that in many cases Open Data is complementary to the services already provided. It serves to enrich an existing service, or it is used as contextual data. Only 12% of the organisations use Open Data as their main source towards developing web- or mobile applications. Models through which services are provided for the client are 'answers as a service', 'information as a service' and 'data as a service'. The use of Open Data also not always directly translates into more turnover or profit. When asked about the benefits Open Data brings to companies, innovation was by far the most mentioned benefit, mentioned by 47% of the companies, followed by reduced costs and increased efficiency (26%).

A study conducted by The International Data Corporation (IDC) confirms that there is a strong correlation between Open Data maturity in the terms of data publishing and the ROI at company level[25]. Leading sectors where Open Data is re-used by the 57 incubated companies in the ODINE programme are predominantly business services, health and wellness and finally agrotech, fishing, and mining. One of the conclusions of the ODINE project is that the role of Open Data in businesses is not well defined as its level of importance varies according to each business' value proposition[26].

The development of the data economy has provided a further stimulus to the emergence of the infomediary sector. Companies in this sector have built a business model around the linkages in the data value chain. It refers to companies that analyse and process information from the public and/or private sector to create value-added products for third parties or the public, that amongst others enable a better and more effective decision-making process. ASEDIE, the Spanish Multisectoral Information Association, annually publishes a report on the state of play of the infomediary sector. In 2017, the fifth edition of the report was published, which entails a comprehensive analysis of 636 companies whose activity is based on the re-use of public and/or private information towards developing value-added products for third parties and/or citizens. With their activities in a broad variety of sectors ranging from culture, directory services, economic and financial, publishing, market research, to geographic or meteorogical information and/or tourism, these companies bring in a total turnover of 1.7 billion EUR per year and employ approximately 19.362 people (a positive variation of 4.3% compared to previous measurement). The largest growth has been recorded in the economic and financial sectors, with 219 employees more than in 2014, followed by the geographic information industry, with 215 more employees compared to 2014. The study also showed that the use of Open Data drives public sector's innovation by contributing to the identification of patterns that enable better decision-making and better implementation of public policies, as well as the improvement of data quality thanks to public feedback. With regard to the total revenues (for the year 2015), the study showed that they increased to €1,705 billion which means an average turnover of 2.68 million euros per company.

In line with the 2017 Re-using Open Data report of the European Data Portal, this study shows that the group of re-users is not homogenous. For instance, there is high level of heterogeneity with regard to the age of the companies, although companies with more than 20 years of experience have a slightly

[24] EuDEco (2017), Report on the final model on the European data economy. Available at http://data-reuse.eu/wp-content/uploads/2017/09/Final-model-of-EuDEco-on-the-European-data-economy.pdf
[25] Independent impact assessment of ODINE by IDC, August 2017
[26] ODINE deliverable D3.3 Summary of the programme, lessons learned and best practices

higher proportion in the overall number of interviewed companies. This strong diversity was also found in a study by the Open Data Institute (ODI), stating that Open Data companies vary in age, size and the sectors they are active in[27]. The study of the 270 companies under scrutiny has identified a turnover of over £ 92bn per year and over 500 thousands employees, highlighting once again the potential that Open Data holds for economic growth.

Providing further evidence for the wide variety in which Open Data is used by companies, a recent survey conducted in Italy[28] found that data is used by different types of companies, from data and technology companies to media, software and communications firms; as well as tourism, finance, health, transportation, and environmental entities. The companies also seemed to show a preference for the data made available by national sources. The research shows that 77% of survey respondents (companies) used 18 of national data sources available, whereas 58% of respondent companies used 21 of the regional data sources available. The most visited websites and downloaded datasets stem from the National institute for Statistics (ISTAT) with 56% of companies tapping into the data available there and the national Open Data portal (dati.gov.it) with 51% of companies using this data. The research also shows that the landscape of private enterprises seeking to utilise and ultimately leverage Open Data is becoming vaster and more varied. The diversity of data being used makes it necessary to sustain Open Data initiatives, as more and more companies become dependent on the data. As shown in the European Data Portal's 2017 study on Re-using Open Data[29], 38% of companies working with Open Data can be classified as aggregators (as illustrated by Figure 4), working on the collection and aggregation of data. Others use Open Data for instance to enrich their already existing services. There are also companies who build their business entirely on Open Data, particularly in the area of application development. These types of companies classify into one of the other archetypes and amount to 14% to 17% per archetype category.

Going further, a recent Spanish report showed that the 636 companies made up the Spanish infomediary sector in 2016[30]. Looking at the subsectors in which these companies are active, 24% of the companies works in the 'geographical information' sector, 23% in market research, 22% in economic and financial and both the publishing and cultural sector account for 9% each. This contradicts findings of a European Data Portal report[31], though the Spanish study looked at the total turnover, whereas the European Data Portal study looked into the share of the turnover that can be attributed to the use of Open Data. In the latter study, the annual turnover of companies working with Open Data was in most cases less than 50,000 Euro. This relatively low amount was attributed to the young age of the organisation surveyed, as half of them did not exist five years ago.

The recent EU Data Market study[32] looks into the amount of companies working with data in general, covering the whole data spectrum – and not just Open Data. This study provides figures for both the supply and the demand side of the market. The supply side refers to data suppliers' organisations,

[27] Open Data Institute (2015) Open data means business: UK innovation across sectors and regions. London, UK. Available at http://theodi.org/open-data-means-business-uk-innovation-sectors-regions

[28] http://italy.opendata500.com/index.html

[29] European Data Portal (2017), Re-using Open Data. Available at: https://www.europeandataportal.eu/sites/default/files/re-using_open_data.pdf

[30] ASEDIE (2017), Infomediary sector (5th Edition). Available at http://www.asedie.es/assets/asedie-infomediary-sector-report-2017-.pdf

[31] European Data Portal (2017), Re-using Open Data. Available at https://www.europeandataportal.eu/sites/default/files/re-using_open_data.pdf

[32] European Commission (2017), The European Data Market Study: Final Report. Available at http://www.datalandscape.eu/study-reports

whose main activity is the production and delivery of digital data-related products, services and technologies. The demand side refers to data users, organisations that generate, exploit collect and analyse digital data intensively. With regards to the latter, data user companies, the study estimated the amount of companies at 661.050 in the EU28 in 2016, a share of 6.4% of the total number of private enterprises in the EU. The supply side comprised of 254,850 companies in 2016, growing 2.3% as compared to 2015.

2.2 Market size

The benefits of Open Data materialise in terms of a growing Open Data market size, indicating the total sales volume based on Open Data. Existing macroeconomic studies provide ambitious forecasts about the potential value of Open Data, estimating large gains as a result of Open Data. Estimations vary from EUR 27 bn.[33], to EUR 40 bn. per year[34], to EUR 59.7 bn. per year (2017)[35] in the EU, to even an amount of USD 900 bn. in the EU[36]. The 2015 Creating Value through Open Data report is the most recent and comprehensive study that considers the market size of Open Data at the European level. The study estimated a total market size between EUR 193 bn. and EUR 209 bn. for 2016, with an estimated projection of EUR 265-286 bn. for 2020, including inflation corrections. The cumulative total market size is expected to reach EUR 1.138 to 1.229 bn. by 2020. In these calculations, a distinction was made between the direct market size and the indirect market size. For 2016, the direct market size of Open Data was expected to peak at EUR 55.3 bn. for the EU28+. Between 2016 and 2020, the market size was estimated to increase by 36.9%, to a value of EUR 75.7 bn. in 2020. For the period 2016-2020, the cumulative direct market size is estimated at EUR 325 bn. The cumulative total market size for Open Data is forecasted to be between EUR 1,138 and 1,229 bn. The figure below provides a visual depiction of the total market size numbers listed above, highlighting the direct and indirect market size of Open Data (high bound).

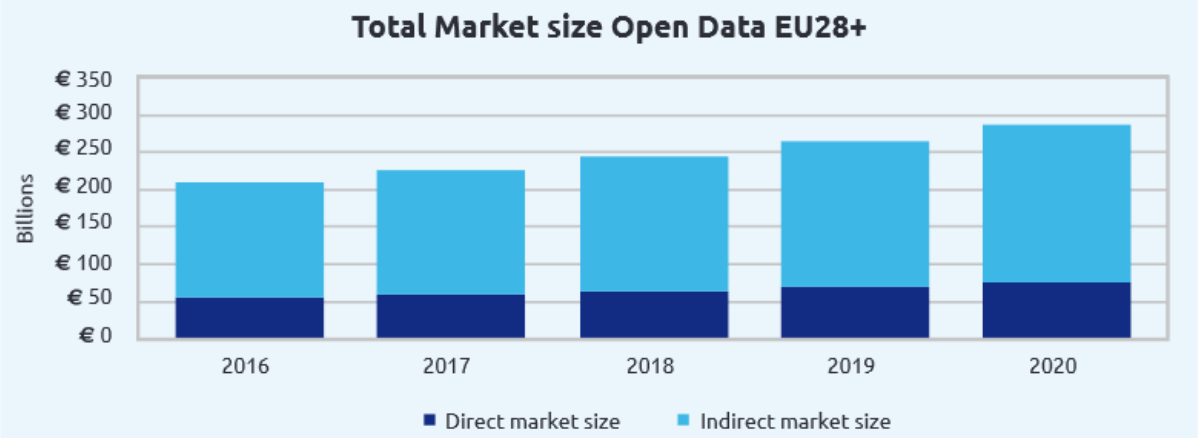

Figure 5 Total market size (high bound), break-down direct & indirect market size, EU28+ (2016-2020)

[33] Dekkers, M., F. Polman, R. te Velde and M. de Vries (2006). Measuring European Public Sector Information Resources (MEPSIR) Study. Final report of study on exploitation of public sector information - benchmarking of EU framework conditions, HELM Group of Companies of Moira, Northern Ireland & ZENC, the Netherlands: 94. http://ec.europa.eu/information_society/newsroom/cf/dae/document.cfm?doc_id=1198.

[34] Vickery, G. (2011). Review of recent studies on PSI re-use and related market developments. Paris, Information Economics: 44. http://ec.europa.eu/digital-agenda/en/news/review-recent-studies-psi-reuse-and-related-market-developments

[35] European Commission (2017), The European Data Market Study: Final Report. Available at http://www.datalandscape.eu/study-reports

[36] McKinsey (2013). Open Data: Unlocking innovation and performance with liquid information, McKinsey Global Institute: 116. Available at http://www.mckinsey.com/insights/business_technology/ open_data_unlocking_innovation_and_performance_with_liquid_information

When looking at the impact of Open Data at a sectorial level, public administration is expected to have the highest share in the direct market size, with a value of EUR 22,111 million (Figure 6).

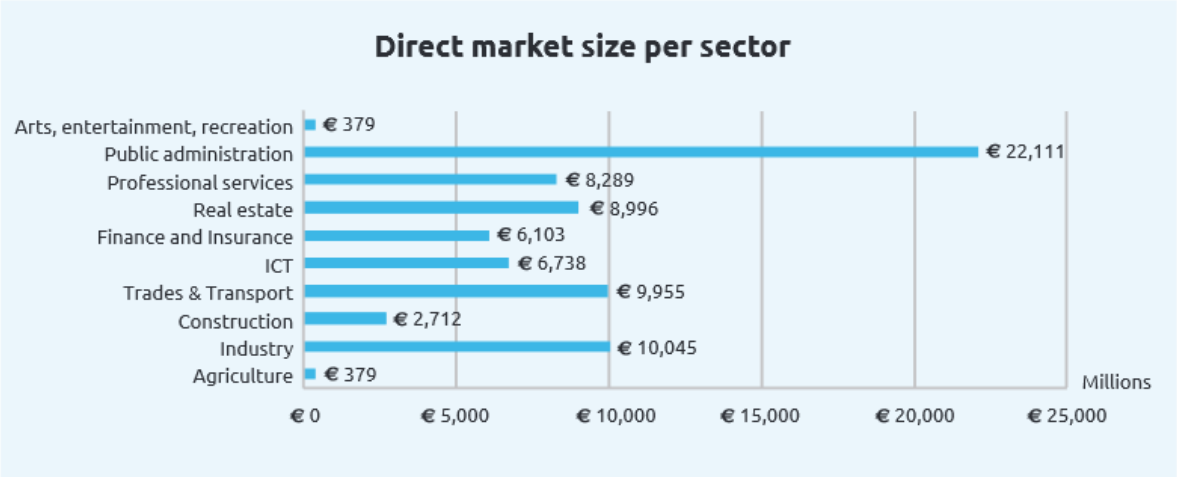

Figure 6 Direct market size of Open Data per market sector for EU28+, (2020, million Euros)

With regards to the market share as percentage of GDP, the EU28+ GDP is estimated to grow between 2016 and 2020 to reach a value of 15,998 bn. EUR in 2020. The market share of Open Data as a percentage of GDP is therefore expected to have increased to 0.47% by 2020, as presented in the table below[37].

	2017	2018	2019	2020
Share of GDP	**0.39%**	**0.42%**	**0.44%**	**0.47%**

Table 1 Forecasted share of direct Open Data in EU28+, GDP, 2016-2020

As mentioned before, over the past ten years, different studies have raised different expectations as regards the potential value of Open Data. Generally speaking, the majority of studies performed previously are ex-ante estimations. These are mostly established on the basis of surveys or research and provide a wide range of different calculations. Limited comprehensive and detailed ex-post evaluations of the materialised costs and benefits of Open Data are available, and where available, they do not include macro-economic figures but are rather based on an individual organisation. Economic evaluations of the impact of Open Data can focus on particular applications, companies, sectors, or whole economies. Over the years, such economy-wide evaluations have varied in scope and approach. Differences exist in the following dimensions[38]:

- *The approach taken top-down versus bottom-up*. For instance, the DemosEurope and Warsaw Institute for Economic Studies (WISE)[39] based their quantitative analysis of the impact of Open Data in the EU28 on a bottom-up macroeconomic model. In bottom-up analyses, researchers usually start with sectoral impact assessments and then try to aggregate them to the entire

[37] European Data Portal (2017), Re-using Open Data. Available at: https://www.europeandataportal.eu/sites/default/files/re-using_open_data.pdf

[38] Open Data Institute (2016), Permission granted: The economic value of data assets under alternative policy regimes. A Lateral Economics report for the Open Data Institute. Available at https://theodi.org/research-economic-value-open-paid-data

[39] DemosEuropa and Warsaw Institute for Economic Studies (2014), Big & Open Data in Europe. A growth engine or a missed opportunity? Available at: https://www.microsoft.com/global/eu/RenderingAssets/pdf/2014%20Jan%2028%20EMEA%20Big%20and%20Open%20Data%20Report%20-%20Final%20Report.pdf

economy. On the other hand, the top-down approach is assessing the value of Open Data from an aggregate level, mostly expressed in GDP. Adopting a top-down approach, the Omidyar Network (2014)[40] quantified the impact of Open Data in the G20 and Australia in particular. Both approaches have their advantages and disadvantages (overestimation and underestimation), but the general approach taken to quantify the economic benefits is a combined top-down and bottom-up approach.

- *The sources of data considered.* Some studies have focused only on PSI, while others also considered research data and private sector data;
- *The region considered*. Most studies have been limited to a single country or a select group of countries (e.g. the EU). What makes it more complex, is that in the studies under consideration different subsets of the EU are considered (e.g. EU15, EU27, EU28+);
- *The sectors considered*. Some studies have focused on a specific sector (e.g. transport), and most, if not all studies, adopt different definitions of Open Data and the sectors being assessed;
- *The scope of benefits considered*, in particular, whether wider benefits (such as social benefits, environmental benefits) are included, or to whom the benefits apply. This ranges from data companies, the public sector, to the economy in general. Some studies take also indirect benefits into account, where others do not;
- *Whether the value considered is an existing value or a potential value*. Some studies have just focused on the net benefits; that is the value added less the cost of production.

To illustrate the diverse scope and results of studies measuring the economic impact of Open Data, an overview is provided in the figure below.

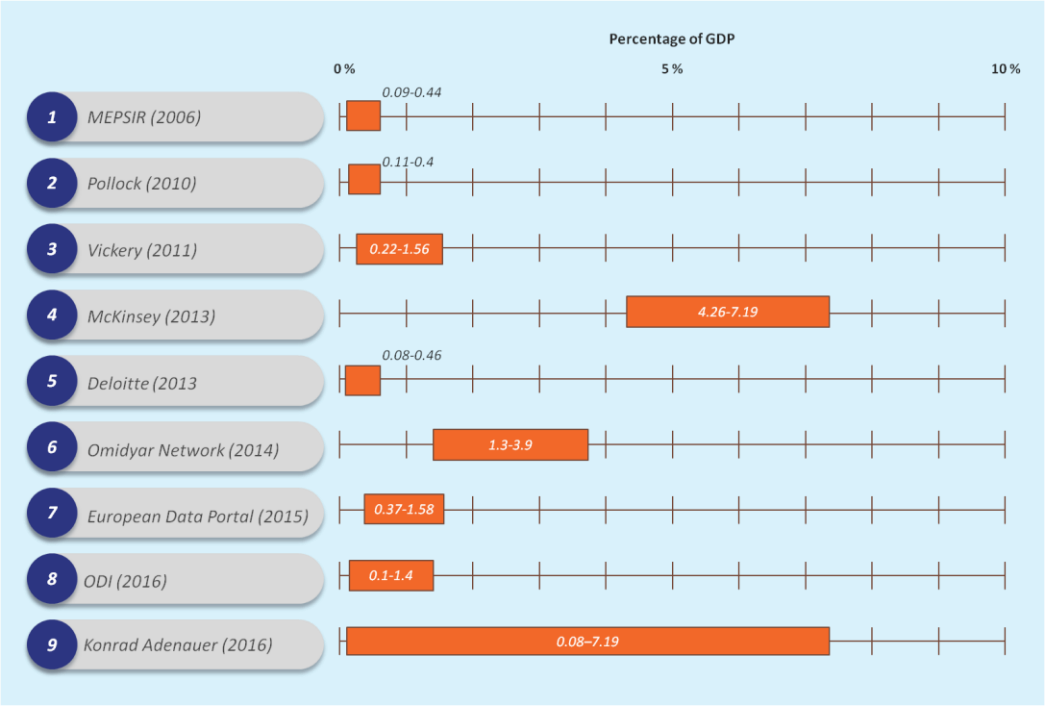

Figure 7 The value of Open Data as a percentage of GDP according to different studies[41]

[40] Omidyar Network (2014), Open for Business: How Open Data Can Help Achieve the G20 Growth Target. A Lateral Economics report commissioned by Omidyar Network.

[41] Based on: Konrad Adenauer Stiftung (2016), Open Data. The Benefits. Das volkswirtschaftliche Potential für Deutschland. Available at http://www.kas.de/wf/de/33.44906/

When we apply these percentages to the overall GDP[42] of the EU28+ (selecting the lower bound to avoid overstating the impact), it becomes clear that the McKinsey study can be considered as an outlier, which is to a lesser extent also true for the Omidyar study. The ODI estimate refers to an estimation based on existing studies.

Furthermore, in their study the Konrad Adenauer Foundation divided the available studies into the economic benefits of Open Data in different scenarios based on the different outcomes of the estimations – with a conservative scenario, an ambitious scenario and an optimistic scenario. The same principle has been applied in Figure 8. According to this categorisation, most studies from the overview above can be clustered in the 'conservative' scenario, whereas the Vickery study and the European Data Portal study can be clustered into the 'ambitious' scenario.

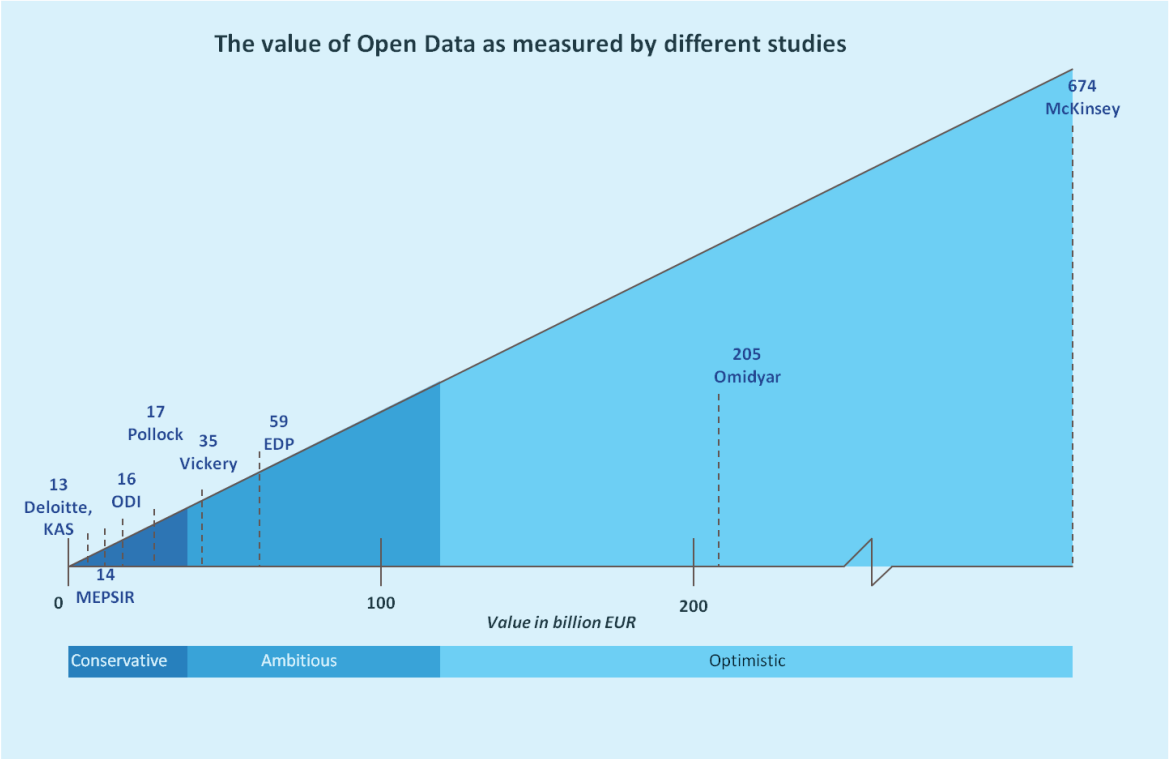

Figure 8 The value of Open Data as measured by different studies[43]

Zooming in from an overall view of the European Open Data economy into subsets of the Open Data economy, clear benefits are found in terms of market size and added value. On a national level, more and more studies have been recently undertaken to demonstrate the impact of Open Data. Examples come from, to name a few Austria, Denmark, Germany, Finland, France, the Netherlands, Spain and the UK.

[42] Omidyar Network (2014), Open for Business: How Open Data Can Help Achieve the G20 Growth Target. A Lateral Economics report commissioned by Omidyar Network. Available at: https://www.omidyar.com/sites/default/files/file_archive/insights/ON%20Report_061114_FNL.pdf

[43] Konrad Adenauer Stiftung (2016), Open Data. The Benefits. Das volkswirtschaftliche Potential für Deutschland. Available at http://www.kas.de/wf/de/33.44906/

In Denmark for instance, research into the impact of opening up address data showed that both the direct and indirect benefits added up to a total gain EUR 63 million in the 2005-2009 period[44]. The most recent study conducted in Denmark undertaken in this regard estimates the socio-economic value of the open geodata is estimated at DKK 3.5 billion in 2016[45]. In the Netherlands, the impact of opening up the basis registry topography was estimated at EUR 11.5- 14.5 million in 2013 and EUR 13.6 million in 2015[46].

Looking at the economic value of specific datasets, the United Kingdom Department of Business, Innovation and Skill conducted a study in 2013 into the value of opening up a portfolio of eleven Ordnance Survey (OS) digital datasets. The study estimates that the OS Open Data initiative will deliver a net GBP 13.0 million - 28.5 million increase in GDP in 2016. The main components of this increase are net productivity gains (GBP 8.1 million – 18.2 million) and additional real tax revenues (GBP 4.4 million – 8.3 million). The Finnish report "The value of Open Data for innovation activities"[47] published in March 2017 looks into the state of play in terms of openness of data collected by public administrations and the relationship between firms' use of Open Data and their innovation production and growth. The report provides a series of concrete recommendations on how to enhance the impact of Open Data in our society and underlines the economic benefits of Open Data by comparing the revenues of ICT companies that use Open Data for the development of new services and products with companies who do not use Open Data. The study shows that the revenue of ICT companies utilising Open Data grew in 2012–2014 on average by over 17% more than the revenue of companies in the same sector that did not utilise data in their innovations.

The recently published Open Data Impact Study[48] in Austria also provides an overview of four macro-economic impact studies conducted in this field, in order to deliver an accurate measurement and estimation of the economic value created by Open Data for the Austrian market. Overall, the study estimates in the case of Austria, an increasing market potential of 1% or more of the country's GDP, approximately €39 million in terms of savings of government expenditure in 2020, as well as a 32% increase of jobs in the field in Europe, including up to 2000 direct jobs in Austria alone, in 2020. In particular for Austria, the study underlines the potential that Open Data has towards increasing efficiency in the political decision-making processes as well as achieving efficiency gains at individual level, by reducing the time spent on the road or the time needed for deployment of life saving measures in emergency situations. In terms of the non-monetary and indirect benefits can incur with regards to enhanced transparency, the development of innovative services and applications as well as from exploiting the full potential of linked Open Data.

[44] DECA [Danish Enterprise and Construction Authority] (2010). The value of Danish address data, Available at: http://www.adresseinfo.dk/Portals/2/Benefit/Value_Assessment_Danish_Address_Data_UK_2010-07-07b.pdf

[45] DECA (2017). The impact of open geographical data – follow-up study. Available at http://sdfe.dk/media/2917052/20170317-the-impact-of-the-open-geographical-data-management-summary-version-13-pwc-qrvkvdr.pdf

[46] Bregt, A., L. Grus & D. Eertink (2014). Wat zijn de effecten van een open basisregistratie topografie na twee jaar? Wageningen, Wageningen University: 49; Grus, L., A. Bregt & D. Eertink (2015). De effecten van open data BRT na 3 jaar, Wageningen University & het Kadaster: 7.

[47] Finnish Prime Minister´s Office (2017), Avoimen datan yödyntäminen ja vaikuttavuus. Available at https://www.etla.fi/wp-content/uploads/VNK_2017_40.pdf

[48] Bundeskanzleramt Austria (2017). Volkswirtschaftliche und gesellschaftliche Potentiale of Open Data. Report of the Impacts of Open Data V2. Published 10 November 2017. Available at: https://www.data.gv.at/katalog/dataset/ff51457a-2c9f-4553-b5f0-ea10a0c71119/resource/cf99ede9-fa36-4fc4-9075-404d7215696f/download/171031ogdimpactsberichta4.pdf

The report published by the UK-French Data Taskforce[49] on Data Driven Growth, Innovation, Infrastructure, Skills and Empowerment in the Digital Age highlights the progress that both UK and France have made in supporting activities to enable data reuse across a broad range of sectors. In the UK, significant investments were made in initiatives boosting the UK's digital and data economies which led to the achievement that 43% of the European tech unicorns (that is to say private companies with valuations of over $1 bn) are based in the UK. Furthermore, the report shows that datamanagement and data analytics companies make up 12% of digital businesses in the UK and are still growing. A similar dynamic is observed in France, where initiatives have been implemented to develop both supply and demand in the data economy. One example provided in the study is the "Nouvelle France Industrielle" initiative launched in 2013, which supported existing initiatives such as French Tech, Cap Digital Cluster, Mes Infos and enabled stakeholder dialogue and interaction across the data ecosystem. The taskforce report summarises the findings of further research and emphasizes the increasing importance of (big) data as a key driver for growth, with 61% of French companies recognising the potential that data holds and acknowledge data as equally important to their future development as their current products and services[50]. Furthermore, the French data ecosystem is expected to grow fast, with French big data market expected to reach 652 million euros in 2018 - an increase of 129% compared to the market in 2014[51].

Against the backdrop of the positive trends expected in many European countries, it is worth highlighting that the economic benefits of Open Data are not equally reaped across the EU28+, with a direct market size of Open Data differing per country. This was also highlighted by the recently published EU Open Data Maturity Report of 2017 that highlights the existing discrepancies in terms of setting the framework for Open Data publishing and re-use across Europe[52].

Setting a solid framework for Open Data is key to ensuring that the (economic) benefits of Open Data can be fully harnessed at country level. Generally speaking, the market for Open Data still needs to be developed in the Baltic and Eastern European countries, whereas in countries such as France, Germany, Spain and the United Kingdom the market for Open Data is already significant[53].

2.3 Efficiency gains

Open Data is expected to improve not only the quality of public services, but also the efficiency. Open Data allows for improved resource allocation, as releasing data could for instance mean that an organisation (helpdesk department) receives lesser customer enquiries, allowing the organisation to focus resources on its core business activities. On the demand side (Open Data re-users), Open Data can also result in improved efficiency, as they need less time to discover and retrieve data. The Creating Value through Open Data study offered a combination of the insights around the efficiency gains of Open Data and real-life examples. Three exemplary indicators were assessed in more detail: how Open Data can save lives, how it can be used to save time and how Open Data helps achieve environmental benefits. For example, Open Data has the potential of saving 1,425 lives a year (i.e. 5.5% of the European

[49] UK-French Data Taskforce (2017). Data Driven Growth, Innovation, Infrastructure, Skills and Empowerment in the Digital Age. Available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/537234/Rapport_VEN_clean-ek_mod_NS.pdf

[50] Ibid, quoting Markess 2015.

[51] Ibid, quoting IDC 2015 Report.

[52] European Data Portal (2017), Open Data Maturity in Europe. 2017 Report. Available at https://www.europeandataportal.eu/sites/default/files/edp_landscaping_insight_report_n3_2017.pdf

[53] European Data Portal (2015), Creating Value through Open Data. Available at https://www.europeandataportal.eu/sites/default/files/edp_creating_value_through_open_data_0.pdf

road fatalities). Applying Open Data in traffic can save 629 million hours of unnecessary waiting time on the road in the EU (Figure 9).

Figure 9 Efficiency gains from Open Data

From an environmental perspective, individual households can equally benefit from Open Data, by assessing and reducing 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. The report estimates a reduction of energy consumption of 16% by using Open Data.

Zooming in on the national level, in 2017 the Danish Agency for Data Supply and Efficiency published the study 'The impact of open geographical data – follow-up study', an update of a previous report published in 2014. The analysis showed that open geospatial data has both a production (market) effect and an efficiency effect, with the total socio-economic value of open geospatial data estimated at DKK 3.5 billion (DKK 2.5 billion production effect, DKK 1 billion efficiency effect)[54]. Whereas the production effect yields most benefits at the municipality level, it is expected that private enterprises will benefit the most in terms of improved efficiency, mostly as a result of reduced search and transaction costs, as depicted below:

DDK (millions)	2012	2016
Production effect of the open geodata	**1,402**	**2,542**
Private enterprises	116	446
Government agencies	321	373
Municipalities	959	1,376
Regions		151
Independent institutions etc.		196
Efficiency effect of the open geodata	**190**	**999**
Private enterprises	40	726
Utility companies	100	229
Government agencies	50	22
Municipalities		18
Regions		2
Independent institutions etc.		2
Total socio-economic value of the open geodata	**1,592**	**3,541**

Table 2 Production and efficiency effects of open geospatial data in Denmark[55]

[54] ECA (2017). The impact of open geographical data – follow-up study. Available at http://sdfe.dk/media/2917052/20170317-the-impact-of-the-open-geographical-data-management-summary-version-13-pwc-qrvkvdr.pdf
[55] ibid

Furthermore, other studies provide evidence about the efficiency gains of Open Data at an organisational level:

- The Dutch Education Executive Agency, noticed a 60% decrease in the number of enquiries after releasing their data as Open Data[56];
- The British Companies House witnessed an improved efficiency thanks to opening up their data, both for the Companies House itself as for companies. The costs for companies decreased with 51% from 2005/2006 to 2012/2013, and the Companies House expects this to improve further thanks to (linked) Open Data[57].
- At the Australian Bureau of Statistics, releasing data as Open Data resulted in a decrease of customer enquiries[58]. However, the impact has not been quantified.
- In the German state of Nord-Rhein Westphalia, publishing data as Open Data freed up time in terms of the time previously spent on facilitating transactions. This included all the administrative tasks required to make sure that the organisation received the payment for data[59].

2.4 Job creation

As a result of the growing market size, the demand for skilled Open Data workers increases. New jobs are created through the stimulation of the economy. The number of studies measuring Open Data jobs are limited, as only a few studies are conducted at a European and national level.

At a European level, the Creating Value through Open Data report estimated there will be 80,000 Open Data jobs within the EU 28+ private sector in 2017. By 2020, this number will increase to just under 100.000 Open Data jobs, creating approximately 20.000 new direct Open Data jobs by 2020 compared to 2017 (Figure 10).

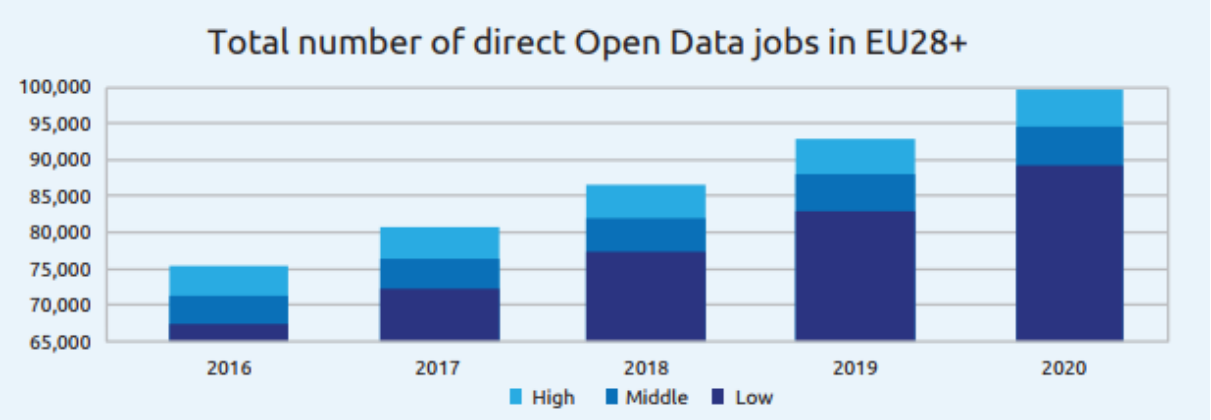

Figure 10 Forecasted total number of direct Open Data jobs (in persons) per annum, 2016-2020

[56] Algemene Rekenkamer (2014), Trendrapport Open Data. Available at https://www.rekenkamer.nl/publicaties/rapporten/2014/03/27/trendrapport-open-data

[57] TU Delft (2017), Maatschappelijke kosten-baten analyse Open Data. Available at https://repository.tudelft.nl/islandora/object/uuid%3Ab34165f8-7a62-431f-8b20-6120cafc6ae8

[58] European Data Portal (2017), Re-using Open Data. Available at: https://www.europeandataportal.eu/sites/default/files/re-using_open_data.pdf

[59] ibid

However, with Open Data being placed higher and higher on the political agendas of countries in Europe and beyond and with more and more organisations conducting Open Data assessments this number might need to be updated, as the figures were based on a Spanish study from 2014[60] estimating the amount of direct jobs in the Spanish infomediary sector at a level of 4,200 - 4,700. More recently, the amount of jobs in the Spanish infomediary sector was measured by ASEDIE[61] which found that the sector created 19,362 jobs in 2015. Here, the 'Geographic Information' subsector stands out in terms of employment compared to the rest, as it accounts for 30% of the total employees in the overall Spanish infomediary sector, followed by 'Market Research' (23%) and 'Economic & Financial' (17%).

If we were to base the amount of Open Data jobs in the EU on the updated Spanish research (percentage derived from expressing Spanish Open Data jobs against total employment in knowledge intensive activities[62]), this would multiply the amount of jobs by a factor 4. Hence, the initial estimates for EU28+ in 2016 – estimated at 71,370 (middle bound) by the 2015 EDP study, would need to be adjusted to amount to 269,000 Open Data jobs created in the EU28+ in 2016. However the definition of the infomediary sector observed in the Spanish study is slightly broader than the share of companies what have an Open Data based business models. This caveat would in turn imply some caution with regards to this estimation.

Taking into account not only Open Data but the European data economy as a whole, the recent EU Data Market study[63] measured the amount of data workers in the EU. Data workers are here defined as workers who collect, store, manage and analyse data as their primary, or as a relevant part of their activity. The amount of data workers in the EU was estimated at 6.1 million, reporting a growth of almost 5% between 2015 and 2016. The average number of data workers per user company is stable at around 9 workers per company. Data workers are not equally spread across Europe: six Member States (UK, Germany, France, Italy, Poland, and Spain) account for 72% of the total data workers[64], with the six mentioned Member States also accounting for approximately 71% percentage of the EU28 population. The same study also shows that the data economy has become already a reality: around 6.1 million EU citizens worked in data-related fields in 2016, a number that is forecast to grow by around 2 to 3% per year. According to this forecast, the number of 'data workers' is expected to reach 10.4 million by 2020. Despite the potential expectations, these are not merely ICT jobs. The study shows that the ICT industry accounts for only 11% of data workers, as opposed to professional services (20%), wholesale and retail (18%), and manufacturing (12%). The distribution of these jobs shows that the economy is increasingly becoming data-driven, including in more traditional sectors.

Building on this, other research looks at the hiring trends of companies working in the Open Data field as well as the skills profiles that such companies are looking for. As presented in the European Data Portal on Open Data Re-use[65] as well, 76% of the surveyed organisations (of which 58% were organisations employing 10 or less people) expect to hire new staff in the near future. A possible explanation

[60] Datos.gob.es (2014), Estudio de Caracterización del Sector. Available at http://www.ontsi.red.es/ontsi/sites/ontsi/files/executive_summary_public_infomediary_sector_2014.pdf

[61] ASEDIE (2017), Infomediary sector (5th Edition). Available at http://www.asedie.es/assets/asedie-infomediary-sector-report-2017-.pdf

[62] Eurostat (2017), Available at http://ec.europa.eu/eurostat/web/products-datasets/-/htec_kia_emp2

[63] European Commission (2017), The European Data Market Study: Final Report. Available at: http://www.datalandscape.eu/study-reports

[64] Eurostat (2017), Available at: http://ec.europa.eu/eurostat/tgm/refreshTableAction.do?tab=table&plugin=1&pcode=tps00001&language=en

[65] European Data Portal (2017), Re-Using Open Data, A Study on Companies Transforming Open Data into Economic and Societal Value, January 2017. Available at: https://www.europeandataportal.eu/sites/default/files/re-using_open_data.pdf

for this is the fact that most respondents were start-ups. Their hiring forecasts match the growth predictions described earlier. Once their product has matured, they expect to grow exponentially which will result in more employees. Furthermore, and depending on the nature of the organisations' work with Open Data, the same report also shows that particular sets of skills represent the focus of firms working with Open Data. As presented by Figure 11 below, the surveyed companies show a clear preference towards the data scientist profile, followed by sales and developer profiles.

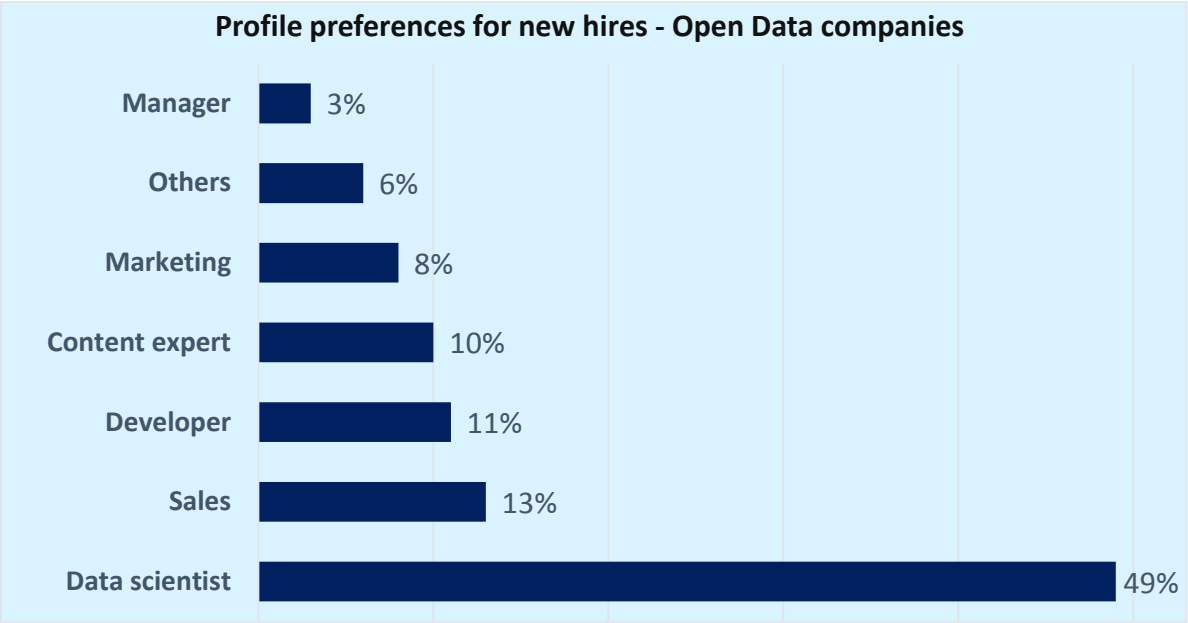

Figure 11 Profile preferences for new hires of Open Data companies (% of total responses)

The report also underlines the correlation that was found between the founding year of an organisation and the profile preference, with a strong tendency amongst young organisations (founded from 2011 on) for the data scientist profile. Of this group of respondents (accounting for 58% of the entire survey respondents), 61% indicate to look for a data scientists. A similar relationship could be identified when plotting the size of the organisation and the profile preference, with organisations that on average have less than 10 employees over the last five years, 50% indicate that they are looking for a data scientist. At the other end of the spectrum, and as expected, medium and large-size organisations have more diverse hiring preferences than smaller organisations. In addition to this, the European Data Economy Report published in February 2017[66] also emphasises the need for data skilled workers across Europe and the great positive impact that data will have for job creation. The report forecasts that the data skills gap will grow at more than 16% over the next four years amounting to almost 770,000 unfilled positions in 2020 (in a baseline scenario), and even reach 2.8 million positions unfilled (in the high-growth scenario)[67]. The same report also highlights the imbalance between demand and supply of 420,000 unfilled data workers positions that was observed in Europe in 2016, corresponding to 6.2% of total demand and an increase of 0.3% from the same value for the year 2015[68]. The study calculates the gap between the total EU supply and demand (including vacancies) of Data Workers between 2016 and 2020 along three scenarios, as depicted by Figure 12 below:

[66] Ibid op cit.
[67] Ibid.
[68] Ibid.

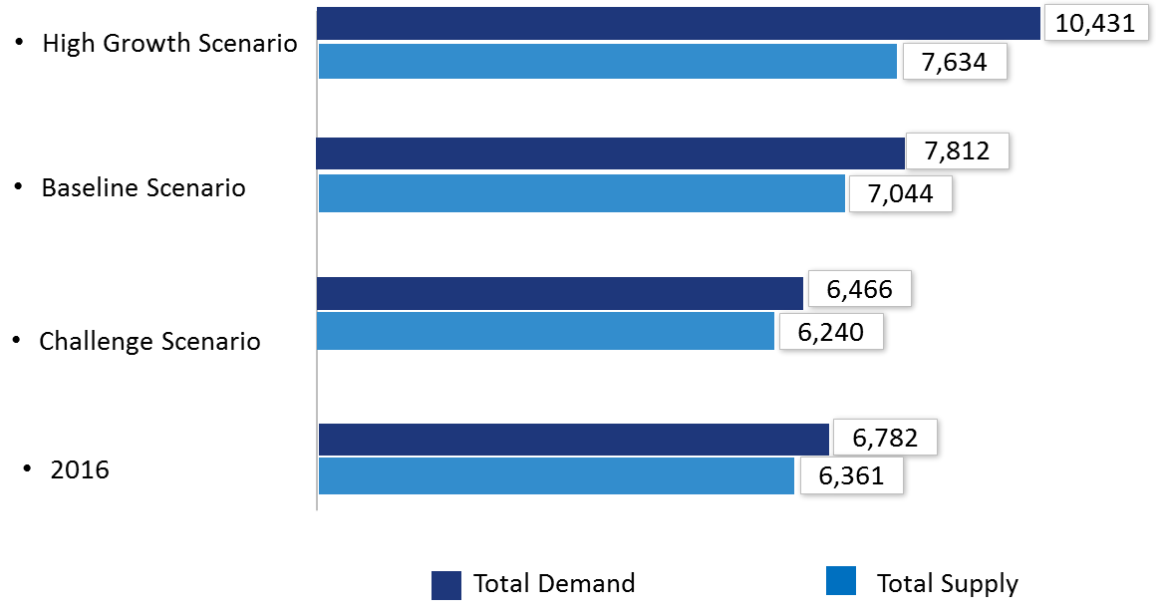

Figure 12 Total EU demand versus supply, per scenario (2016-2020, in 000s)

This also highlights an important aspect – the speed at which data-driven jobs are growing does not match the pace at which people with the needed data skills to fill these positions enter the labour market and points out to the importance of timely measures that need to be taken in this regard across Europe.

2.5 Zoom in on the value of opening up scientific data

Opening of scientific data from publicly funded research

In the academic world, there is currently a push for open access, trying to remove the pay-wall that surrounds most research papers. Open Access refers to the practice of providing online access to scientific information that is free of charge and re-usable for the end-user. As Tennant et al. (2016) emphasise Open Access is believed to have an impact in three major areas[69]: academic, economic and societal.

With regard to the academic aspect, the two main ways in which Open Access affects academia is through association with a higher documented impact of scholarly articles, as a result of availability and re-use, and secondly through the possibility of non-restrictively allowing researchers to use automated tools to mine the scholarly literature. It clearly results in a citation advantage for researcher, as their research is available to a wider audience. With note to the societal dimension, scholarly articles also have an impact, such as when they are covered in the (social) media. The impact is especially strong in areas such as advancing citizen science initiatives, and levelling the playing field for researchers in developing countries. Open Access makes research available to anyone with an Internet connection who has the ability to search and read the material.

With regards to the economic benefits, Tennant et al. (2016) highlight that the current business model of publishing journals is unsustainable. The concept of transitioning from a subscription-based model to one driven by Article Processing Charges will be financially appealing to journals that operate with minimal profits or at a loss. As such, increasing revenues is a strong incentive for Open Access. On the user side, with access to scholarly articles, entrepreneurs and (small) businesses in a wide range of industries can accelerate innovation.

A UK case study on cancer research showed that there is substantial evidence for the economic benefit of Open Access. The total expenditure on research relating to cancer in the period 1970–2009 was 15 billion GBP, while the benefit (net-monetized quality adjusted life years) was estimated at 124 billion GBP[70]. Only 17% of the net-monetary benefit was estimated to be attributable to research performed in the UK, and the other 83% is attributable to research from non-UK sources. Furthermore, in the area of environmental impact, Vickery (2011)[71] has shown that Open Access to R&D results could result in recurring gains of around € 6 billion annually.

[69] Tennant JP, Waldner F, Jacques DC et al. (2016), The academic, economic and societal impacts of Open Access: an evidence-based review. F1000Research 2016, 5:632 (doi: 10.12688/f1000research.8460.2)

[70] Ibid.

[71] Vickery (2011), Review of recent studies on PSI re-use and related market developments. Information Economics. Available at: ec.europa.eu/newsroom/document.cfm?doc_id=1093

2.6 The benefits for the public sector

When discussing the added value that Open Data entails, it is worth highlighting that this depends on the sector in which Open Data is scrutinised as well as to whether or not the main prerequisites for Open Data are already met (availability of data, high-quality of datasets etc.). Public data is believed to have a high potential for re-use in new services and applications, as well as in addressing societal challenges, fostering participation of citizens in the political and social life, increasing transparency and accountability and achieving efficiency gains by sharing data between public administrations. In this regard, the public sector is expected to gain the most from opening up data, with a value of 22 billion EUR in 2020. This confirms that the public sector is the first re-user of its own data, as underlined by the European Data Portal Creating Value through Open Data Study of 2015[72]. Furthermore, the same study estimates a total market size of Open Data per market sector for EU28+ of € 836 million of the estimated direct market size of 325 billion in 2020.

An important benefit derived from the opening up of data by the public administrations is the cost savings that can be realised by opening up data. The afore-mentioned report of the European Data Portal estimates a cost savings of € 1.7 bn. by 2020 for EU28+, an estimates that is based on the same model used by the study conducted by the Danish government to forecast the cost savings that would incur from opening up government held data. In the case of Denmark, the cost savings would amount to € 35 million in 2020 (0.22% of the government expenditure expected in 2020). The calculation was based on the forecasted Danish GDP for 2020 and the average government expenditure in the period 2010-2014. When extrapolating this to the entire EU28+, the highest cost saving can be seen in the countries such as Germany (€ 262 mio), France (€ 277 mio), United Kingdom (€ 262 mio), Italy (€ 182 mio) and Spain (€ 112 mio).

The figure below provides an overview of the classification in terms of cost savings on government expenditure per EU28+ country. In addition to this, the publication of Open Data by public authorities helps foster innovation with regard to the development of new services and business opportunities. It is therefore not surprising that the above mentioned countries also appear in the rankings when it comes to the highest numbers of start-ups or, if going one step further, in the top 5 countries of the ODINE programme of the European Commission, when looking at the applicants' county of origin[73].

[72] European Data Portal (2015), Creating Value through Open Data. Available at https://www.europeandataportal.eu/sites/default/files/edp_creating_value_through_open_data_0.pdf

[73] ODINE Website, total applications from programme beginning to present. Retrieved October 2017. Available at https://opendataincubator.eu/

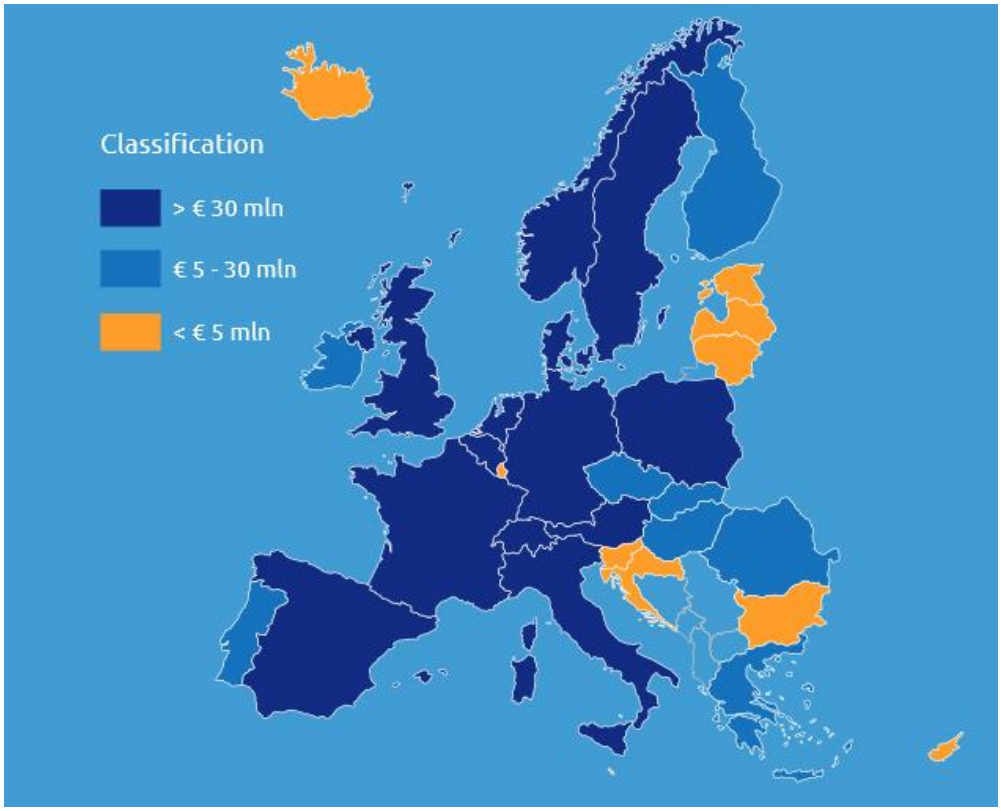

Figure 13 Classification cost savings on government expenditure per EU28+ country

One of the further benefits when opening up data is the potential of Open Data to enable better decision-making – also known as "data-driven decision making". The recent numbers of the Open Data Maturity report also show good numbers in terms of use of data in policy and decision making, with 19 EU Member States (68%) using Open Data to enable the decision and policy-making processes – an increase from 16 countries in 2016[74]. Best practice examples in this regard come from the UK, where 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 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. Another more recent example from the UK is the Ask Churchill application, developed by the Department for Work and Pensions. The "Churchill" app allows civil servants to request and visualise requested data in a fast and user-friendly manner with the help of visualisation tools. In Denmark, free geospatial data is used to a very high degree in the public sector decision-making, for example in municipal planning and regulation. In Slovenia, the administrative unit responsible for approving building permits uses Open Data while Open Data on public procurements has been used in order to show the statistics and e.g. monetary savings compared to the previous year. In Italy, public administrations have not only begun to implement a data-driven decision making policy, they also base it on the use of Open Data. In addition to this, Open Data enables faster and easier access to information, better resource allocation, increased automation, standardisation and interoperability.

[74] European Data Portal (2017), Open Data Maturity in Europe. 2017 Report. Available at https://www.europeandataportal.eu/sites/default/files/edp_landscaping_insight_report_n3_2017.pdf

3 The economic benefits of privately held data of public interest

The private sector does not only re-use Open Data published by governments. They generate and collect a lot of valuable data themselves, which has the potential to become Open Data. This section further explores the evidence available about the economic value of privately held data of public interest. It first zooms further in on the subject, then outlines why it is important and concludes with some insights into the economic benefits based on a number of case studies.

3.1 What are we talking about?

Over the past years, not only more and more governments have accelerated their Open Data initiative, the push towards private data sharing has gained prominence as well. Initiatives such as the Open Company Index[75] stimulate companies to open up their data. On a European level the Commission also actively stimulates private sector involvement, among others through the Big Data Value Public-Private Partnership[76]. The Commission is looking not only at public Open Data, but also at the potential of privately held real-time data and big data[77].

The GovLab has introduced the notion of 'data collaboratives'[78], which refers to a new form of collaboration, beyond the public-private partnership model, in which participants from different sectors (including private companies, research institutions, and government agencies) can exchange data to help solve public problems. Several societal challenges – climate change, disease prevention – require a better access to both public and private data, hence more collaboration between public and private organisations and an increased ability to use and analyse datasets. Data collaborative can be essential vehicles for exploiting privately held data for the public good.

Three mechanisms[79] are identified for companies willing to share data. The first one refers to the use of Application Programming Interfaces (APIs), as an established means of opening up data to the wider public. In contrast to APIs, industrial data spaces and data marketplaces are designed for individual data transactions with one or a limited number of buyers. The concept of the industrial data space includes the possibility for data experimentation to happen inside the space. The data marketplace refers to a secure and easy-to-use place for sellers and buyers to meet and make data transactions.

A recent EuDEco report[80] states that many European organisations still lack a data reuse culture. The high cost of data acquisition has deterred many actors from sharing data and creating a sustainable data market. EuDEco concludes that even though this trend has been broken by efforts from the public sector (PSI Directive) and the private sector (e.g. Tesla's strategy for open innovation that includes sharing the patent portfolio[81]), there is still a long way to go in order to develop a sustainable data market.

[75] Open Corporates registries, available at: http://registries.opencorporates.com/

[76] DSM Big data value public private partnership, available at: https://ec.europa.eu/digital-single-market/en/big-data-value-public-private-partnership

[77] CEF building blocks at the second FIWARE summit, available at: https://ec.europa.eu/cefdigital/wiki/display/CEFDIGITAL/2017/06/02/CEF+Building+Blocks+at+the+2nd+FIWARE+Summit

[78] GovLab (2017), Selected readings on data collaboratives. Available at http://thegovlab.org/the-govlab-selected-readings-on-data-collaboratives/

[79] European Commission (2017), Workshop on data access and transfer with a focus on APIs and industrial data platforms. Available at https://ec.europa.eu/digital-single-market/en/news/workshop-data-access-and-transfer-focus-apis-and-industrial-data-platforms

[80] EuDEco (2017), Report on the final model on the European data economy. Available at http://data-reuse.eu/wp-content/uploads/2017/09/Final-model-of-EuDEco-on-the-European-data-economy.pdf

[81] https://www.tesla.com/blog/all-our-patent-are-belong-you

Impact of technical tools – API's

Application Programming Interfaces (APIs) are technical enablers of (data) interactions within one organisation and business partners, allowing for instance machines to access large amounts of data. An evaluation of the current use made of APIs as an established means of opening up data to a wider ecosystem showed that this approach is largely tested and relatively well used[82]. In a recent European Commission consultation on the data economy, 68% of respondents clearly support the increased use of APIs[83]. Challenges include data security and licensing conditions, as the usage of an API raises a sufficient number of legal questions. Another big hurdle in API adoption is the lack of skilled resources to take advantage of the API economy[84].

There are three types of behavioural patterns describing companies' choice to open up data through an API:

- Companies can feel to be pushed to use APIs as a means to remain competitive in an ever-changing business environment, pushing out relevant data in return for new business opportunities;
- Companies can feel to be pulled into an emerging 'API economy' in which business can benefit from network effects among those having adopted APIs for the interactions;
- Companies can regard APIs as a safe and tested technology that can be adapted without major business risks.

Regarding the impact of APIs, a case study from Transport for London provides an example of how an API can create impact[85]. 200 data elements were made available through an API by Transport for London, to some 12,000 developers producing some 600 apps that 40% of Londoners use. Going beyond case study evidence, Benzell et al. (2017)[86] studied the impact of APIs on firm performance, and showed that API adoption is related to increased sales, operating income, and decreased costs. It is especially related to increased market value - API adoption predicts a 10.3% increase in a companies' market value. Furthermore, the creation of API developer portals is associated with a decrease in R&D expenditure inside the company, supporting the hypothesis that outside developers can substitute for internal spending.

3.2 Why is it important

Public value can be created by exchanging both public and private data. A number of examples illustrate the value of public-private data sharing[87]:

- Nearly 3 billion people worldwide will have a smartphone by 2020. If location data is shared, one can find out how people behave and move in cities in case a disaster strikes;
- Currently over 1,000 satellites orbit the Earth. This data allows for analyses of how poverty changes over time, by allowing insights into the economic conditions and economic activities

[82] European Commission (2017), Workshop on data access and transfer with a focus on APIs and industrial data platforms. Available at https://ec.europa.eu/digital-single-market/en/news/workshop-data-access-and-transfer-focus-apis-and-industrial-data-platforms
[83] European Commission (2017), Summary report of the public consultation on Building a European Data Economy. Available at https://ec.europa.eu/digital-single-market/en/news/summary-report-public-consultation-building-european-data-economy
[84] CA Technologies (2017), How APIs are at the core of the EU data economy. Available at: https://www.ca.com/en/blog-highlight/how-apis-are-at-the-core-of-the-eu-data-economy.html
[85] European Commission (2017), Workshop on data access and transfer with a focus on APIs and industrial data platforms. Available at https://ec.europa.eu/digital-single-market/en/news/workshop-data-access-and-transfer-focus-apis-and-industrial-data-platforms
[86] Benzell, Seth G. and LaGarda, Guillermo and Van Alstyne, Marshall W. (2017), The Impact of APIs in Firm Performance. Boston University Questrom School of Business Research Paper No. 2843326. Available at: SSRN: https://ssrn.com/abstract=2843326
[87] http://datacollaboratives.org

in the more remote areas around the globe, based on collected satellite data on road conditions, electricity coverage etc.
- Over 6,000 Tweets are posted every second – sharing this data allows governments to better anticipate and to directly respond to citizens' needs.

Sharing private data allows other private organisations and governments to base their decisions on data analytics, combining private data with other data sources. Firms that adopt data-driven decision-making have been found to have a 5-6% higher output and productivity[88]. An increasing number of private sector players already recognises the innovation and business growth potential Open Data can unlock, and they now join the EU vision of enabling a free flow of data not just as re-users but also as data publishers. There are several reasons why the private sector should open up their data[89]:

- To comply with legal or regulatory obligations;
- To sell data-related services;
- To support public-private partnerships;
- To improve collaboration and support (collaborative) innovation;
- To help (supply chain) partners and to support industrial communities;
- To build trust and improve reputation;
- To demonstrate transparency and anti-corruption measures;
- To crowd-source solutions;
- To create a platform for engagement with customers and talent.

The next section further explores the economic benefits based on a number of cases studies.

3.3 What do we know – facts and figures

In a recent public consultation from the European Commission on the data economy[90], a large majority of respondents agrees that wider data sharing should be facilitated and incentivised. Almost half of business respondents declare they depend on data generated by others, and report difficulty with respect to data access. In order to achieve better access to privately held data, most respondents do not favour regulatory intervention, but prefer soft measures (increased use of APIs, non-binding guidance, sharing best practices). Despite the difficulties faced with regards to accessing private data, a couple of case studies provide evidence about the added economic value of sharing privately held data to the wider public.

Transport for London (TfL), a local semi-government body, has adopted an Open Data policy that is guided by principles of transparency, reach, facilitation of niche products, creating additional economic activity and facilitating innovation. Before the Open Data policy was adopted, developers tried to scrape information from the TfL website, leading to multiple errors in the data and suboptimal results. In terms of additional economic activity, it has been calculated that this policy generates GBP 100 mil-

[88] Brynjolfsson, E., Hitt, L. M. and Kim, H. H., (2011), 'Strength in numbers: How does data-driven decision making affect firm performance?', SSRN 1819486, 22 April 2011

[89] Deloitte (2012), Open Data driving growth ingenuity and innovation, available at: https://www2.deloitte.com/content/dam/Deloitte/uk/Documents/deloitte-analytics/open-data-driving-growth-ingenuity-and-innovation.pdf

[90] European Commission (2017), Summary report of the public consultation on Building a European Data Economy. Available at https://ec.europa.eu/digital-single-market/en/news/summary-report-public-consultation-building-european-data-economy

lion of direct value and has enabled around 1,000 new jobs. To enrich the data, TfL has formed partnerships with major IT players such as Apple (for mobile payment, rental of bikes), Twitter (for pushing alerts out) and Google (enriching the maps application with real-time data). Whereas Transport for London is under a statutory obligation to make certain data it holds accessible to third parties, TfL has timely understood that this required fundamental changes in organisational culture and in the IT architectural design.

A second example comes from the Spanish mobile phone operator Telefonica. Customers can agree to allow third parties to access data they generate as part of the usage of their mobile phone with the aim of new services being offered. For this, the operator developed a platform called Aura. One of the objectives is to incentivise the individual to share its data in a trusted and secure manner. Users can see at one glance what data they share and with whom. The application provides a concise and a much more 'digestible' overview of the Terms and Conditions and enables the user to consent to them in an informed manner. It moves away from the voluminous consent notices and entangled privacy settings that websites and applications provide. This information can for instance be combined with other data sources, resulting in information such as "your credit card company signals cash withdrawals with your card in place X whereas your mobile phone data suggest you were in place Y". Furthermore, anonymised datasets from telephone companies make it possible to track calling and commuting patterns and gain better insight into social problems[91].

A third example comes from the Dutch energy network operator Liander. In September 2013, Liander published the complete small-scale energy consumption dataset as Open Data, including historical data. A study[92] assessing the impact of opening up this data stated that the impact of releasing data as Open Data will only be noticeable in the long term. Short-term effects are mainly more downloads and page views, and more communication between data suppliers and users. Prior to the Open Data initiative there were no regular re-users of the datasets apart from municipalities and building corporations. Within a few weeks after the release, one company had re-used the data for energy usage apps and web services. The expected long-term effects were initially that more apps and services would be developed, new user groups would be accessed, transaction costs would decrease and fewer questions about Liander's activities would come in. The study states that only lower transaction costs have been realised so far. Before releasing Open Data, to obtain energy consumption data, the average transaction costs for a user (e.g. municipality) were about 32 man-hours to locate required data, contact the data holder, and to negotiate and exchange contracts. From the follow-up, it emerged that Liander's Open Data are used by a wide range of users and have had a positive effect once opened, for example by enabling re-users to design energy consumption visualisation applications. However, the study could not quantify such effects. Liander has successfully demonstrated that private energy companies can release Open Data. In 2015, other network administrators in the Netherlands followed Liander and also published their small-scale energy consumption data.

[91] Forbes (2015), Data Collaboratives: Sharing Public Data in Private Hands for Social Good. Available at https://www.forbes.com/sites/bethsimonenoveck/2015/09/24/private-data-sharing-for-public-good/#506bc5c951cd

[92] Welle Donker, F. van Loenen, B., Bregt, A.K. (2016), Open Data and Beyond. ISPRS Int. J. Geo-Inf. 2016, 5, 48. Available at http://www.mdpi.com/2220-9964/5/4/48

4 The costs associated with Open Data initiatives

Open Data initiatives come at a cost. To get a balanced view of the added value of Open Data, we should not only take into account the benefits, but also the costs associated with an Open Data initiative. Public Open Data portals need financing, both for the infrastructure of the portal and maintenance, as well as for training and support activities for publishers and re-users. This section further explores the types of costs, available facts and figures and what can be done to ensure sustainable financing of the portal.

4.1 Types of costs and recovery models

With the increase in demand from behalf of citizens towards public sector bodies in Europe countries to publish their data and provide infrastructures on which such data is available, the question of costs comes to the fore. Setting up and sustaining Open Data initiatives come with different types of costs. The Technical University Delft[93] distinguishes three types of costs: transformation and adaptation costs, infrastructure costs and structural management costs. The first category refers to required changes and edits needed before data is ready for publishing: it might be necessary to anonymise or aggregate data, to put data in the required formats or to edit the metadata. This category also refers to transformation costs associated with change management, such as the training of employees and awareness raising programmes. Secondly, an infrastructure is needed to release the data – a place or portal where the data will be made available for instance. In case of an existing infrastructure, additional server capacity might be required. To further promote the re-use of the data, one has to invest in tools and apps facilitating the re-use of Open Data. Thirdly, management costs refer to the costs needed to keep the data up-to-date and to handle enquiries from users. Lastly, the category 'other costs' include costs such as a loss of certain revenue streams, given the fact that data that one formerly had to pay for to access is now available free of charge.

As the 2017 Open Data Maturity Report also showed, all EU28 state that the available data is provided at a zero-cost model. At the same time the report highlights that the most frequently mentioned barriers for publishers of Open Data continues to be represented by the financial aspects, with 71% of European public administrations mentioning this amongst the main obstacles on the publishing side[94]. However, research also shows that cost-based pricing models do not bring cost savings to public authorities in the long run, with cost-recovery models even creating further obstacles to the access and the re-use of Open Data in most cases[95], in particular by preventing economically weaker citizens (such as students) and start-ups from making use of the available data[96]. There are, however, other ways in which data publishers can generate revenues, such as setting up training courses and service level agreements for high-volume API access, or by embedding data analytics services into their portals. As the European Data Portal report on Barriers in working with Data emphasises, there are only a few cases where such practices are used. Examples of such cases come from the cities of Bath and Aragon where the development of such revenue streams are considered in order to help fund their portals. The Data Mill North portal shows an example of how revenue can be generated via trainings

[93] TU Delft (2017), Maatschappelijke kosten-baten analyse Open Data. Available at https://repository.tudelft.nl/islandora/object/uuid%3Ab34165f8-7a62-431f-8b20-6120cafc6ae8

[94] European Data Portal (2017), Open Data Maturity in Europe. 2017 Report. Available at: https://www.europeandataportal.eu/sites/default/files/edp_landscaping_insight_report_n3_2017.pdf

[95] Trojette (2013), quoted in European Data Portal Report 2017 on Barriers of Working with Open Data, available at: https://www.europeandataportal.eu/sites/default/files/edp_analytical_report_n5_-_barriers_in_open_data.pdf

[96] European Data Portal (2015), Creating Value through Open Data. Available at https://www.europeandataportal.eu/sites/default/files/edp_creating_value_through_open_data_0.pdf

and other services and how partnering up with other institutions (in this particular example the Open Data Institute Leeds) can help achieve such goals[97].

On the same lines, the ODI also looked at the effect that a price change regime has on the value of Open Data re-use. The ODI research found that a shift from a cost-recovery to an open-access regime is likely to more than double the value of re-use of Open Data, adding around 0.5% to the GDP[98]. The same research also stresses that 'free-but-restricted' data licences creates more value than paid access but less value than Open Data. The transaction costs of processing the licence and the restricted uses to which the data can be put reduce the value that is created. Figure 14 presents the data demand curve under different pricing regimes.

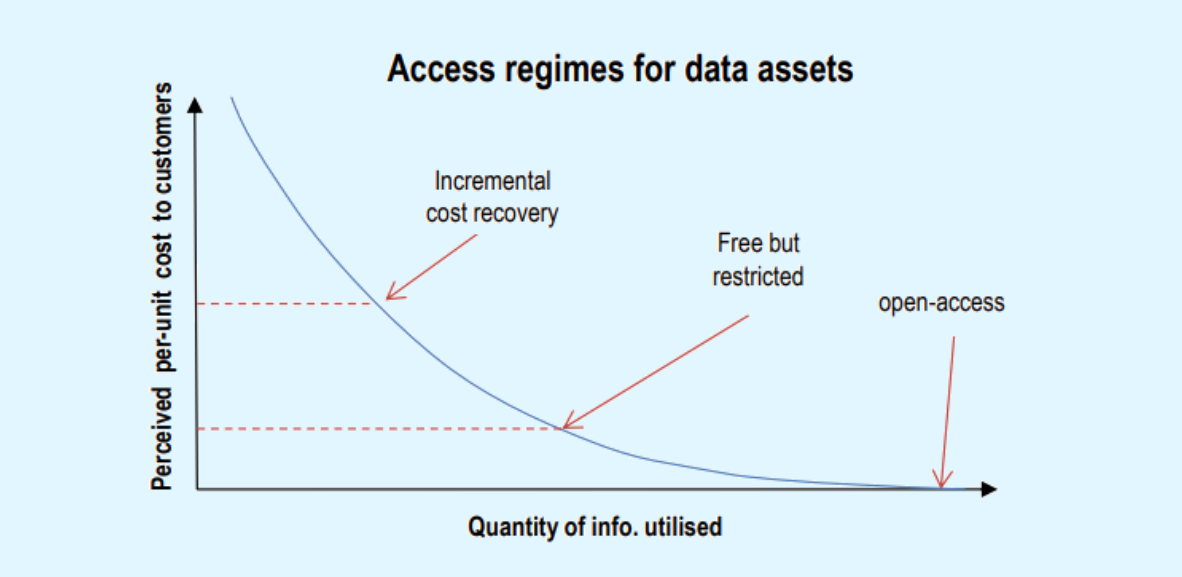

Figure 14 Demand for core data assets under different pricing regimes[99]

4.2 Facts and figures on the costs and benefits of Opening Data

Studies assessing both the costs and benefits of Open Data initiatives agree that generally speaking the benefits outweigh the costs, but there is no consensus on the extent to which they do so. The cost-benefit ratio of an Open Data initiative ranges from 1:1.57[100] to 1:70[101]according to different studies. The following case examples shine some further light specifically at the costs associated with Open Data initiatives:

- The Dutch Algemene Rekenkamer (General Court of Auditors) has estimated that for Government institutions, releasing Open Data costs about 0.01% of the budget[102].

[97] European Data Portal Report 2017 on Barriers of Working with open Data, available at: https://www.europeandataportal.eu/sites/default/files/edp_analytical_report_n5_-_barriers_in_open_data.pdf
[98] Open Data Institute (2016), Permission granted: The economic value of data assets under alternative policy regimes. A Lateral Economics report for the Open Data Institute. Available at https://theodi.org/research-economic-value-open-paid-data
[99] Ibid.
[100] OSTP [Ocean Science and Technology Partnership] (2011), Lessons learned from OOS in Canada: Preliminary Assessment of OOS Value: 19. Available at http://www.qc.dfo-mpo.gc.ca/publications/science/documents/Preliminary%20OOS%20value%20assessment_e.pdf
[101] DECA [Danish Enterprise and Construction Authority] (2010). The value of Danish address data: Social benefits from the 2002 agreement on procuring address data etc. free of charge: 8. Available at http://www.adresseinfo.dk/Portals/2/Benefit/Value_Assessment_Danish_Address_Data_UK_2010-07-07b.pdf
[102] Algemene Rekenkamer (2014), Trendrapport Open Data. Available at https://www.rekenkamer.nl/publicaties/rapporten/2014/03/27/trendrapport-open-data

- Based on cases delivered by the Dutch Weather Institute KNMI, the Dutch Cadastre, and some municipalities, De Vries (2014)[103] states that the transformation costs per publisher are approximately EUR 50,000 and the infrastructure and structural management costs are between EUR 15,000 and 45,000 yearly. However, at the same time, the Dutch Cultural Heritage Agency estimated their transformation costs to be approximately EUR 7.5 million. Moreover, RDW – the Dutch Vehicle Authority – estimated their transformation costs to be EUR 92,000, and the infrastructure and management costs to be at approx. EUR 100,000 per year[104].

De Vries (2014) concludes that these differences can be explained by the nature of the organisations: on the one hand organisations whose core task is already the provision of data (e.g. cadastre agencies, weather institutes), and on the other hand organisations such as municipalities. For instance, for the Cadastre and the weather institute, the infrastructure is to a large extent already available.

Another example comes from Denmark[105] based on releasing address data in the 2005-2009 period. The direct financial benefits to society of the open address data were EUR 62 million through especially improved government back-end capabilities and more efficient service delivery. The total cost of the programme was EUR 2 million. Approximately 30 percent of the benefit was for the public sector, with the remainder going to the private sector – including, the organisation Post Danmark, which saw major efficiency increases based on access to the data.

Recent research also suggests that proactive support for Open Data companies, e.g. through an incubator programme, increases the survival chances of these companies and results in economic benefits and additional jobs created. The recent assessment of the ODINE programme[106] showed that each euro invested by the European Commission in the ODINE project will have generated up to 14 euros in cumulative revenues by 2020. The impact of ODINE on the growth perspective of the 57 companies funded was substantial, resulting in an estimated EUR 110 million of cumulative revenues in the period 2016-2020, and 784 new jobs created. Without ODINE, only 34 companies were forecast to survive by 2020, generating half as much cumulative revenues and 228 less jobs than in the main scenario.

In light of the evidence presented above on both the benefits and costs of Open Data, it is important to investigate when costs actually incur and when benefits can be expected. Figure 15 shows a schematic, phased, overview of the different economic effects of Open Data, developed by Preische (2014)[107]. It shows that Open Data benefits will follow the typical S-curve. During the introductory phase, an increase in indirect benefits can be expected with higher investment costs in the public sector. The growth phase will then be characterised by innovations and other market dynamics as well as efficiency improvements within the administration. Only in the pay-off phase is the benefit of Open Data anchored wider, and the initial investment costs will be outbalanced by higher tax revenues and wider employment and welfare effects.

[103] De Vries, M. (2014). Wah kos'dah dan? Onderzoek naar de incrementele kosten van aan Open Data doen: 60. http://openoverheid.nl/open-overheid/open-data-wah-kos-dah-dan/

[104] Welle Donker, F. & B. van Loenen (2015). Duurzame businessmodellen voor open data. Delft, Kenniscentrum Open Data.

[105] GovLab & Omidyar Network (2016), Denmark's Open Address Data Set. Available at http://odimpact.org/case-denmarks-open-address-data-set.html

[106] IDC (2017), Impact Assessment of ODINE Programme. Available at https://opendataincubator.eu/files/2016/01/ODINE-Final-report-by-IDC.pdf

[107] Preische, J. (2014), Digitales Gold. Nutzen und Wertschöpfung durch Open Data für Berlin. Available at https://www.technologiestiftung-berlin.de/fileadmin/daten/media/publikationen/140201_Studie_Digitales_Gold_Open_Data.pdf

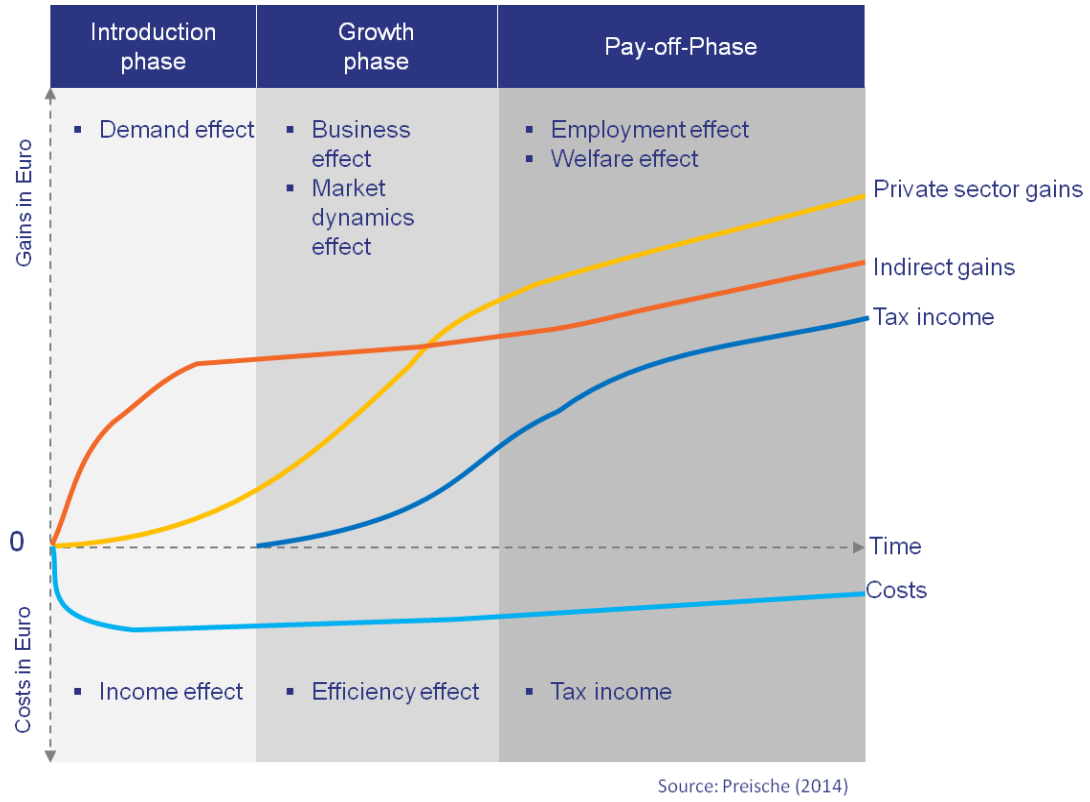

Figure 15 Evolution of costs and benefits of Open Data initiatives over time[108]

The process to achieve the full potential of Open Data will require several years, depending on the frequency and scope of data releases and the resulting network effects. Benefits take time to emerge, as for instance entrepreneurs are more likely to act as a result of spotting a market opportunity, and then seek the data needed to build a product or service to address it, rather than observing the availability of data and then try and invent ways of using it[109].

4.3 How to control costs and ensure sustainable financing

The previous sections already showed that generally speaking, the benefits of an Open Data initiative outweigh the costs. But what can organisations do to actively control and limit the costs of opening up data and where applicable to ensure sustainable financing of their portals?

A recent (2017) European Data Portal study on the sustainability of Open Data portals provides the following recommendations for making portal financing more sustainable[110] (see Figure 16 below):

- Be open about your funding strategy, so that people publishing and accessing data from the portal can identify future needs, use cases and potential funding shortfalls;
- To maximise scope for portal improvements, and reduce the impact of funding cuts, ensure your priorities (training, support for publishers, user engagement) align with those of your funding source(s);

[108] Konrad Adenauer Stiftung (2016), Open Data. The Benefits. Das volkswirtschaftliche Potential für Deutschland. Available at http://www.kas.de/wf/de/33.44906/

[109] World Bank (2014), Open Data for economic growth. June 25, 2014, Transport & ICT Global Practice.

[110] European Data Portal (2017), Recommendations for Open Data Portals: from setup to sustainability. Available at https://www.europeandataportal.eu/sites/default/files/edp_s3wp4_sustainability_recommendations.pdf

- Ensure that your own role as portal owner includes responsibility for setting funding strategies and budgets;
- Perform, commission or identify research into the impact of your portal's current or potential activities, to develop and support a business case for future funding.

Figure 16 Recommendations for sustainable Open Data portal financing

Going one step further, the study also presents a series of recommendations regarding potential funding models to assist public administrations and other organisations in reducing the financial burden incurring from the set-up and maintenance of Open Data portals. The described models range from cost distribution amongst the different government levels, as well as schemes for cost distribution between public and private organisations, to securing funding and grants and advocating towards sponsorships. The report also emphasises the economic arguments that can be made towards rallying support and funding for the development of Open Data portals. These range from the arguments of increased general tax revenues obtained from enhanced economic activity, compliance with regulation and/or national strategies to increase a country's or region's digital economy or achieving an open government, to arguments related to achieving operational efficiencies and improved public sector services[111].

[111] Ibid.

5 Conclusions

With Open Data having entered the mainstream, the literature about the economic impact of Open Data has evolved rapidly over the past years. Several Member States have conducted studies about the impact on a national level, complemented by studies on a European or even global level. This has resulted in a better understanding of the benefits of Open Data, which in turn has also helped governments across Europe and the world to push forward the topic, given the increased evidence available on the impact of Open Data on society, economy and on the political level. The higher prioritisation of Open Data on the political agendas of Member States is also reflected by the Open Data maturity landscaping exercise that the European Data Portal is conducting every year. In particular on the policy indicators of the measurement, the progress made by the Member States is significant compared to previous years. The EU28 show an overall increase in terms maturity of 14 percentage points to now 73% compared to 2016, with progress registered on both Open Data Readiness dimensions (from 57% in 2016 to now 72%) and Portal Maturity (from 66% in 2016 to 76% in 2017). This emphasises once again the better understanding at Member State level as well as the increased importance that the topic has gained across Europe. However, in terms of commissioning studies that prove the Open Data impact, the European countries need to undertake more efforts. The 2017 report shows a relatively modest development in terms of the economic impact of Open Data from 51% in 2016 to 54% in 2017. This reflects the low numbers of newly commissioned studies to measure the economic impact at national level, also when considering the fact that more than half of European countries situated below this EU28 average[112]. Such studies are important elements to rally further support around Open Data, in particular by showing the positive impact that this has at micro-economic level.

This report has compiled the various studies conducted with regard to the economic benefits of Open Data and showed that Open Data can have a substantial economic impact, both on the level of the individual organisation and the national and European economy as a whole. On the individual level, studies assessing both the costs and benefits of Open Data initiatives agree that for organisations, generally speaking, the benefits outweigh the costs. On an aggregated level, although existing empirical estimates of the value of Open Data vary considerably in scope and outcome, they suggest that the value added associated with Open Data varies between roughly 0.4% and 1.58% of GDP. The potential value of Open Data is related to price regimes under which the data is released. Moving from a cost-recovery model to free access adds around 0.5% to the GDP, and 'free-but-restricted' access limits the value as compared to a completely open licence.

At the same time, it needs to be stressed that the Open Data economy evolves rapidly, with figures from 2014 already being outdated today, best illustrated by the growth of Open Data jobs in the Spanish infomediary sector. This underlines the demand for close monitoring of the rapidly growing industry of Open Data suppliers, re-users and intermediaries. The potential of Open Data is even larger when combined with privately held data. Over the past years, the push towards private data sharing has gained prominence as well, although barriers still need to be overcome. This report provided examples of successful data-sharing practices, resulting in benefits for both data publishers and data re-users. Privately held data of public interest constitutes another pillar in the EU data economy, and when released and potentially combined with Open Data, it can be an important driver of economic, societal

[112] UK-French Data Taskforce (2017). Data Driven Growth, Innovation, Infrastructure, Skills and Empowerment in the Digital Age. Available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/537234/Rapport_VEN_clean-ek_mod_NS.pdf

and environmental benefits and will most certainly play an important role in helping Europe maintain its competitiveness in the international arena.

It therefore becomes salient to promote and push forward the opening of more government data as well as paving the way for access to privately held data of public interest across Europe. The considerations of the European Commission on to develop policies in this field are a significant step in the right direction. At the EU level, new studies that look into the economic benefits of Open Data at macro-economic level need to be conducted. More recent figures are needed and more accurate estimates in terms of 2020 outlook and even beyond this landmark are required, in line with the growth that this sector has registered, that has superseded some of the more optimistic scenarios depicted for 2020. The same holds true at country level, with governments needing to re-inforce their efforts in this regard as well by commissioning studies that focus on the macro as well as micro-economic impact of Open Data. The number of such studies remains scarce across Europe, which begs the questions of the possible correlation between these low numbers and the actual economic growth generated by Open Data in a given national setting.

In addition to this, more research is needed that provides evidence for the economic impact of privately held data at both EU and Member State level. This will enable political elites across Europe to rally further support around Open Data and provide the needed impulses for the private sector to open up their data and/or develop products and services based on Open Data. Strengthening the market for Open Data re-use is expected to have direct and indirect benefits on the economic growth of a country.

In a nutshell, concerted efforts are therefore needed at both EU and Member State levels to gather new evidence on the economic impact of Open Data – both public sector information and privately held data. With more accurate figures and estimates that are expected to be significantly higher than figures from the initial reports, the enormous potential that data offers to economies in Europe will yet again be highlighted. Open Data should be understood as one subset of the broader European data economy with the PSI being the cornerstone for additional data reuse such as statistical, budget, geo-spatial and urban data. However with the potential introduction of a reverse PSI – that is to say with the opening up of private data for public interest – further sectors that hold tremendous potential could be explored and this untapped potential harnessed. In addition to this, studies would need to be commissioned at both EU and national level that tackle the development of Open Data beyond 2020. Such actions should be undertaken in a timely fashion in order to make sure that – amongst others – the vision around building a European Data Economy is carried by stakeholders of all sectors and from all over Europe.

[1] https://opendataincubator.eu/

[2] IDC (2017), Impact Assessment of ODINE Programme. Available at https://opendataincubator.eu/files/2016/01/ODINE-Final-report-by-IDC.pdf