Dubai Open and Shared Data Economic and Social Impact Study

Final Report by KPMG, with support from CS Transform

March 2017
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<th>Full Form</th>
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<tr>
<td>AED</td>
<td>United Arab Emirates Dirham</td>
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<tr>
<td>API</td>
<td>Application Programming Interfaces</td>
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<td>DDE</td>
<td>Dubai Data Establishment</td>
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<td>DSC</td>
<td>Dubai Statistics Center</td>
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<td>EU</td>
<td>European Union</td>
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<td>GBP</td>
<td>Great British Pound</td>
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<tr>
<td>GDP</td>
<td>Gross Domestic Product</td>
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<td>GVA</td>
<td>Gross Value Add</td>
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<td>ICT</td>
<td>Information and communication technologies</td>
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<td>IoT</td>
<td>Internet of Things</td>
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<td>KPI</td>
<td>Key Performance Indicator</td>
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<td>MNCs</td>
<td>Multinational Corporations</td>
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<td>OECD</td>
<td>Organisation for Economic Co-operation and Development</td>
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<td>PSI</td>
<td>Public Sector Information</td>
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<td>R&amp;D</td>
<td>Research and Development</td>
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<td>ROI</td>
<td>Return on Investment</td>
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<td>ROW</td>
<td>Rest of World</td>
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<tr>
<td>SDO</td>
<td>Smart Dubai Office</td>
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<td>SME</td>
<td>Small and medium sized enterprise</td>
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<td>TFP</td>
<td>Total Factor Productivity</td>
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<td>UAE</td>
<td>United Arab Emirates</td>
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<td>UK</td>
<td>United Kingdom</td>
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<tr>
<td>USD</td>
<td>United States Dollar</td>
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Executive summary

Dubai has an ambitious and far-reaching smart city strategy. It aims for Dubai to be “the world’s best-connected, smartest and happiest city”.¹ This vision is underpinned by the Dubai Data initiative which aims to open or share 100 per cent of public sector data by 2021.

What constitutes ‘open’ and ‘shared’ data?

Open data, as defined by the Dubai Data Law of 2015, is any Dubai data which is published and can be downloaded, used and re-used without restrictions by all types of users.

Shared data is the data that has been classified as either confidential, sensitive or secret. It can be accessed only by other Government Entities or by other authorised persons. The Data initiative leads the way for the sharing of this data more widely than is currently the case.

The Dubai Data Law of 2015 allowed for the opening and sharing of data, paving the way to allow the private sector to also open and share some high-priority datasets. Collaboration with the private sector is planned for later this year.

This study provides the Dubai Government with insight into the potential impacts of opening and sharing data.

The Smart Dubai Office commissioned KPMG, with support from CS Transform², to undertake a study to provide the Government with insight into the potential impacts of opening and sharing government data in Dubai. The two key objectives of the study are to:

1. provide a high level estimate of the potential economic and social impacts of open and shared data for Dubai³; and

2. develop a methodology for more rigorous measurement of the economic and social impacts of open and shared data, to allow regular assessment of the actual impacts in the future.

Our analysis has involved reviewing data and information provided by the Smart Dubai Office and Dubai Data Establishment (DDE), desk-based research and stakeholder consultation.

To date, the use of open and shared data has been on ad hoc and inconsistent basis – some examples have been cited by representatives from Government Entities. For example, The Dubai Business Map (DBM) has been developed and launched by the Department of Economic Development. DBM is a smart digital platform that provides an interactive guide to investors and business-oriented professionals to explore trade licenses and activities.

¹ Smart Dubai website. 2015. ‘The World’s most Ambitious and Comprehensive Data Initiative to Date’. Available at: http://www.smartdubai.ae/dubai_data.php
² CS Transform are smart city and government transformation specialists and are working with KPMG on this project.
³ Our study does not capture every possible economic and social impact, however focuses on the most significant and well-defined areas of impact.
indicators. It enables insight into the number of new investors, the entry rate of businesses (based on license growth) and overall trends – all mapped using geospatial data.

However, the Dubai Data initiative represents an opportunity to ensure future sharing and opening of data is smoother, timelier and more automated. This will go some way in overcoming the ad hoc and complex approval processes currently in place to obtain data from other Entities.\(^4\) The impacts from enabling this sharing and opening, as well as improving the visibility of the data that is available, could be significant.

There are a number of key stakeholders involved in the supply, use and re-use of open and shared data in Dubai. These stakeholders play an important role in the process of generating the economic and social impacts.

**Figure 1: Stakeholders in the supply, use and re-use of open and shared data in Dubai**

The Dubai Government and its Entities have an important role in each stage of the supply, use and re-use of data (as value creators). The value creators can also be private sector actors that use the data to create additional value or uses.

As can be seen above, there are a number of ways value is created, including by:

— data enrichers, who combine open data with their own sources and or knowledge;
— data enablers who do not profit directly from the data, but do so via the platforms and technologies they are provided on;
— data developers who design and build Application Programming Interfaces (APIs); and,
— data aggregators who collect and pool data, providing it to other stakeholders.

\(^4\) Information on current processes was gathered from stakeholder consultation undertaken in Dubai. It was stakeholders’ view that processes were currently ad-hoc and complex.
The extent to which enrichers, enablers, developers and aggregators engage with, and create value from, open and shared data varies across different ‘types’ of data, with evidence suggesting that geospatial, environmental and meteorological information and economic and business information data generate the greatest value from use and re-use.\(^5\)

**A range of social and economic impacts arise from the use and re-use of data.**

As a result of the enrichers, enablers, developers and aggregators and the products/services they produce, a number of activities are enabled that create social and economic impacts. Numerous examples of types of economic and social impacts from open and shared data exist in the literature, ranging from, for example, social benefits such as enhanced transparency and trust in government as well as economic benefits such as innovation and entrepreneurship. We have summarised into the following main groups:

- Additional collaboration and engagement with Government (by different stakeholders, including: citizens; the private sector; and other Government Entities);
- Private sector innovation and efficiency gains, including the creation of new businesses, growth of existing businesses as a result of new products and services enabled through open data; and greater efficiency in operation; and
- Enhanced engagement of residents and visitors directly with data to influence or inform their decisions.

**Our high level estimates show that the opening and sharing of data in Dubai presents an important opportunity to realise significant economic impacts.**

Our high level estimates, based on benchmarks from other jurisdictions, suggest that the net additional Gross Value Added generated could be in the region of AED 4.3 billion to AED 6.6 billion per annum from 2021.\(^6\) This is equivalent to approximately 0.8 to 1.2 per cent of the forecast for the whole economy.

Government consultation with the private sector is also planned in Dubai to understand the feasibility of opening up some private sector data in the future. The benchmark estimates suggest that if private sector data is also opened at some point in the future, as the Dubai Data Law envisages, there are additional economic gains to be made. These could be in the region of an additional AED 4.3 billion to AED 5.2 billion per annum. The extent to which this could be realised in Dubai will depend on how this is implemented and taken-up by private sector businesses.\(^7\)

How this economic value is generated by different industry sectors of the economy varies depending on the extent to which open data is valuable and useful to their economic activities. Figure 2 overleaf illustrates the proportion of the estimated impact from open and shared public data may be realised by each major sector in Dubai.

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\(^6\) It is recognised that open and shared data may generate positive economic impacts for players in the market however there may also be some disbenefits, for example job losses due to increased digitisation enabled by data.

\(^7\) We recognise that it is important that the opening of private sector data is carefully planned to protect consumers, adhere to privacy and confidentiality laws and does not result in anti-competitive practices.
Based on our estimates, it is clear that the big value drivers of impact for Dubai are the transport, storage and communication; public administration; wholesale, retail trade, restaurants and hotels; and real estate. These four biggest value drivers account for three-quarters of the potential impact for Dubai.

While the high level estimates provide an indication of what could possibly be achieved, the actual impacts that are realised from open and shared data should be monitored and evaluated over time.

The high level estimates only provide an ex-ante assessment of the potential size of opportunity from opening and sharing data. Achieving this scale of impacts is by no means certain and will require inputs and activities from the Government and from other public and private sector players in the Dubai economy to realise them.

Therefore, in order to understand the impacts that are actually being realised in Dubai once data becomes open and is shared via the electronic platform, we have designed a monitoring and evaluation approach for Dubai that we recommend is implemented. This will allow the Dubai Data Establishment to track progress and to understand the key levers that it needs to pull to enhance the scale of outcomes and impacts that are achieved.

The focus of ex-post estimation is monitoring based on actual experience of the use of open and shared data. Our research of publicly available information suggests that such monitoring has not been undertaken in other smart cities across the world, with the exception of San Francisco which has a framework in place to measure impacts from smart data. It has
in place a logic model and evaluation plan, based on gathering information from an annual survey and case studies.

In future, Dubai can undertake ex-post impact evaluations using two main approaches:

1. A macro-economic level assessment could be conducted, using a so-called ‘top-down’ approach. This approach looks at overall changes in the economy and key economic variables, such as GVA, and seeks to understand the extent to which those economy-level changes can be attributed to the policy or intervention. This approach requires sufficient data points for each of its variable and it is often difficult to establish a cause and effect relationship between the policy or intervention and changes observed in the macro-economic impact measure.

   For Dubai, a macro-economic level assessment could be conducted in the future if sufficient data is available.

2. An alternative approach can be used, which is a so called ‘bottom-up’ approach. This is based on a theory of change of how the inputs and activities associated with a policy or intervention ultimately lead to end impacts in the economy. This approach generally requires the collection of more data than a macro-economic model and can require greater resources to implement. It can also be susceptible to underestimation, however generally provides a much greater level of granularity of the factors driving the end impacts and allows for more detailed insights to be gained into how the impacts are generated.

   For Dubai, we consider that a bottom-up approach would be the most suitable evaluation technique at this stage.

A robust impact monitoring and evaluation framework should be implemented in Dubai to enable the rigorous measurement of social and economic impacts in the future.

It is important for Dubai to put in place a robust monitoring and evaluation framework if it is to properly understand how the opening and sharing of data is impacting on the Dubai economy, businesses, residents and visitors. Therefore, the economic impact monitoring and evaluation framework we have developed for Dubai is based on best practice evaluation approaches and guiding principles drawn from the OECD principles of impact evaluation, the European Commission Evaluation approach and methodology and UK Government Green Book. It also draws insights from findings of our review of how other comparable cities with smart city and/or data strategies in place have approached monitoring and evaluation.

Our framework provides a suggested approach to assess the impact of open and shared data over time, building on the logic model we developed that sets out the pathways to achieving these impacts. We define the Key Performance Indicators (KPIs) that we believe should be tracked, and suggest how they can be measured and at what frequency, recognising the need for a proportionate evaluation approach.

By tracking these KPIs, and adopting our framework to estimate the end impacts, Dubai should be well placed to assess the realised value from open and shared data going forward and to use this to inform its future policy making. It also stands to lead the way among other smart cities in evaluating what its open and shared data initiative is achieving.
About the study

2.1 Dubai as the smartest and best-connected city

Sheikh Mohammed Bin Rashid Al Maktoum inspired a vision for Dubai to unleash the greatest value from data, creating new opportunities and improved experiences for all. The vision is for Dubai to become “the world’s best-connected, smartest and happiest city.”

The Smart Dubai vision is the overarching strategy encompassing six dimensions: economy; living; governance; environment; people; and, mobility. It aims to be more holistic than other cities’ open data strategies. Recognising this, the United Nations’ specialised agency for information and communication technologies (ICTs) has selected Dubai to be the first city to test the Key Performance Indicators (KPIs) developed for Smart Sustainable Cities.

This Smart Dubai vision is underpinned by open and shared data which will enable new analyses and applications, integrated services and enhanced governance.

The opening and sharing of data is the focus of this study.

The Dubai Data initiative was decreed in the Dubai Data Law of 2015, and is leading the way for the opening up and sharing of Government Entity data. It also paves the way to allow for the private sector to also open or share some high-priority datasets. Consultation with the private sector to understand the extent to which sharing and opening of their data is feasible is planned for 2017.

Since the Dubai Data Law was introduced in 2015, the Smart Dubai Office has been working to implement Sheikh Mohammed’s vision. This vision is explained in more detail in Section 3.1.

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8 Quoted on Smart Dubai website. 2015. ‘The World’s most Ambitious and Comprehensive Data Initiative to Date’. Available at: http://www.smartdubai.ae/dubai_data.php
9 Smart Dubai website. 2015. ‘The World’s most Ambitious and Comprehensive Data Initiative to Date’. Available at: http://www.smartdubai.ae/dubai_data.php
10 Established in conversations with stakeholders from the Smart Dubai Office and Dubai Data Establishment.
13 The DDE is keen to explore opportunities for sharing of private sector data as part of the Dubai Data initiative. To do this, it will consult with the private sector to understand their willingness and appetite to share and/or open some of their datasets. This will be done as a collaboration and is due to get underway later this year.
2.1.1 **Purpose and objectives of the study**

The Smart Dubai Office commissioned KPMG, with support from CS Transform\(^{14}\), to undertake a study to provide the Government with insight into the potential impacts of opening and sharing data in Dubai.

The study has two key objectives:

1. To provide a high level estimate of the anticipated economic and social impacts\(^{15}\) of the Dubai Data initiative and the impact of open and shared data more generally, based on a benchmarking of similar initiatives in other jurisdictions; and

2. The development an appropriate methodology for more rigorous measurement of the economic and social impacts of open and shared data in Dubai, to allow regular assessments of actual impacts being realised to be conducted in the future.

This report details both those high level estimates and our proposed methodology and framework to measure economic and social impacts in the future. It is the first step towards understanding the potential economic and social impacts of open and shared data in Dubai.

Our high level estimates demonstrate the potential contribution of open and shared data to the Dubai economy in terms of Gross Value Added (GVA). GVA is a measure of the contribution to an economy made by a firm, sector or activity. GVA is directly linked to Gross Domestic Product (GDP), however it excludes taxes and subsidies on products/services.

The high level estimates that we have developed are indicative and are based on benchmarks developed for other jurisdictions using approaches widely cited in the literature. We have adapted these benchmark estimates for the economy of Dubai and specifically its sectoral make-up.

While our estimates provide an indication of the potential impacts of open and shared data for Dubai, the impact is hard to predict in advance. Therefore, ex-post monitoring and evaluation of the actual impacts being realised in Dubai will be required. Our study sets out a proposed approach, including a series of KPIs that we recommend are tracked.

2.1.2 **Sources of information**

The analysis presented in this study is predominantly based on data and information provided by the Smart Dubai Office and Dubai Data Establishment (DDE); wider evidence gathered through desk-based research focussing on reviewing relevant literature on open and shared data; and information gathered through stakeholder engagement, predominantly with representatives from across Dubai Government Entities.

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\(^{14}\) CS Transform are smart city and government transformation specialists and are working with KPMG on this project.

\(^{15}\) Our study does not capture every possible economic and social impact, however focuses on the most significant and well-defined areas of impact.
Data and information provided by the Smart Dubai Office and DDE

Information with regard to the Dubai Data initiative and the ongoing work streams was provided to KPMG. This included:

— background documentation on the Dubai Data initiative and Smart Dubai strategy;
— draft versions of the relevant Policies;
— the primary registry of datasets;
— the draft versions of the Dubai Data manual;
— access to required datasets, such as employment;
— screenshots of the Smart Dubai platform being developed; and
— resourcing information regarding the budgets and number of staff required by the Dubai Data initiative.

Desk-based research

We have undertaken desk-based research to develop a firm understanding of the Dubai Data Law, policy and other work streams. This research has focused on publicly available information regarding Dubai, its open and shared data use as well as broader academic evidence regarding the impact of open and shared data. We have also drawn on available evidence and research from other smart cities.

As part of the extensive literature review, we considered over 20 published articles and research pieces which assessed, and quantified to some extent, the impact of open and shared data. Findings from the literature are summarised in Section 4.2 and detailed in Appendix 3.

Stakeholder consultation

As part of the study, we spoke with a range of stakeholders, including representatives from Dubai Statistics Centre, Department of Economic Development, the Road and Traffic Authority, the Knowledge and Human Development Authority, the Dubai Health Authority and the Department of Tourism and Commerce Marketing. We also spoke with representatives from the Smart Dubai Office, DDE and NeXgen, all of whom have been involved with the Dubai Data initiative, in addition to two private sector organisations using open data as part of their business model. These companies are in the logistics and telecommunications sector.

These structured interviews and workshops allowed us to develop a firm understanding around current work with open and shared data, the plans and work streams in place to deliver the Dubai Data initiative and associated work happening in parallel by other stakeholders, particularly in the private sector. These interviews supported our understanding of the context and potential impacts.
2.2 The structure of this report

The structure of the remainder of this report is as follows:

— Section 3 provides background information on Dubai, the Smart Dubai strategy and Dubai Data initiative. It also provides an insight into current practices across Government Entities regarding opening and sharing of data.

— Section 4 describes how economic and social impacts are realised from open and shared data. The stakeholders involved in the supply, use and re-use of data are explored, along with how end users utilise data and derive benefits from it. This section provides evidence from the literature regarding these social and economic impacts.

— In Section 5, we present our high level estimates of the potential GVA impact that open and shared data could have on the Dubai economy. We explain how these estimates were derived and how we estimate this impact by sector.

— Finally, Section 6 describes the importance of future monitoring and evaluation of the social and economic impacts due to open and shared data in Dubai. In it we present an impact evaluation framework that can be implemented by Dubai to ensure rigorous measurement of the actual impacts in the future.
3 Opening and sharing data in Dubai

The Dubai Data Law and Dubai Data initiative set out the vision for opening and sharing data in Dubai, initially government data but with ambitions also for the release of some private sector data. In this section of the report we first provide a brief introduction to the Dubai economy and the vision for the city in terms of its Smart Dubai strategy and the Dubai Data initiative. We then detail how the DDE has been working to implement the Law and initiative. We also provide details of the extent to which data is already opened and shared in Dubai and how this is likely to change going forward under the Dubai Data initiative.

3.1 The vision for Dubai as “the best-connected, smartest and happiest city” by 2021

Dubai, one of the seven Emirates in the United Arab Emirates (UAE), is regarded as a financial gateway and cosmopolitan hub of the Middle East. It represents a quarter of UAE’s GDP. Its economy is less reliant on oil and production than its UAE neighbours, with a focus on wholesale, retail, transport and tourism. And the economic composition of Dubai suggests that it is well placed to realise benefits from smart logistics and transportation.

Figure 3: Dubai versus UAE economic composition, as a proportion of total GDP

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<thead>
<tr>
<th>Sector</th>
<th>Dubai</th>
<th>UAE</th>
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<tr>
<td>Oil &amp; gas</td>
<td>14%</td>
<td>44%</td>
</tr>
<tr>
<td>Distribution, transport, hotels &amp; restaurants</td>
<td>42%</td>
<td>18%</td>
</tr>
<tr>
<td>Financial and insurance</td>
<td>11%</td>
<td>8%</td>
</tr>
<tr>
<td>Professional &amp; support activities</td>
<td>7%</td>
<td>2%</td>
</tr>
<tr>
<td>Construction</td>
<td>7%</td>
<td>9%</td>
</tr>
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There is high level of digital take-up in the region - 92 per cent of UAE individuals use the Internet. These levels of ICT penetration are on a par with the UK, Sweden, the Netherlands and Japan (and far above some Western countries, including the USA).

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21 Japan 93.3%, Netherlands 93.1%, Sweden 90.6%, UK 92.0% and the USA 74.6%.
In line with its vision of becoming a leading business hub, the Dubai Government has sought to use its ICT infrastructure extensively and simplified its regulations and services. The eGovernment initiative has aimed to simplify processes for individuals, businesses and Government Entities. For example, eClaims enables all medical claims to be made online with all messages between providers and insurance companies taking place on this platform. At the end of 2016, over 1 billion transactions had taken place on this platform with reported benefits to revenue cycle management, verification and investigations.\(^\text{22}\)

Following the eGovernment initiative, his Highness Sheikh Mohammad Bin Rashid Al Maktoum, Vice-President and Prime Minister of the UAE and Ruler of Dubai, launched the Smart Dubai initiative in 2014.\(^\text{23}\) It aims to establish Dubai as “the happiest and smartest city” globally. This vision encompasses both the Government Entities and the private sector and has six key dimensions: smart economy; smart living; smart governance; smart environment; smart people; and, smart mobility.

The overall Smart Dubai strategy is underpinned by a Roadmap that details a clear set of initiatives and services. It is a catalogue of 545\(^\text{24}\) current and planned smart services and initiatives for city-wide implementation.\(^\text{25}\) More than half of these initiatives will benefit a mixed audience of citizens, Government Entities and businesses. Within this Roadmap, opening and sharing data is a key enabler.\(^\text{26}\) The Dubai Data initiative details the vision for the opening and sharing of government data and how this will be executed amongst Government Entities.

### 3.2 The Dubai Data initiative

The Dubai Data initiative is led by the DDE and decreed by the Dubai Data Law of 2015.\(^\text{27}\) It underpins the Smart Dubai strategy and is an essential component that facilitates connectivity and access to services and information, enhances decision-making and seamless service delivery for both the public and private sectors.\(^\text{28}\)

Dubai data refers to datasets relating to any aspect of the Government, economy, culture and life within the Emirate of Dubai.\(^\text{29}\) The initiative calls for 100 per cent of government data to be open or shared by 2021, and also allows for the opening and sharing of some private sector datasets.\(^\text{30}\)

\(^{22}\) Gathered based on stakeholder interviews as part of this study. Interview with a representative from the Dubai Health Authority.

\(^{23}\) Smart Dubai website. 2015. ‘The World’s most Ambitious and Comprehensive Data Initiative to Date’. Available at: [http://www.smartdubai.ae/dubai_data.php](http://www.smartdubai.ae/dubai_data.php)

\(^{24}\) This includes 200 Smart Initiatives and 345 Smart Services owned and delivered by eight Government Entities.


\(^{26}\) Smart Dubai website. 2016. ‘Our vision’. Available at: [http://www.smartdubai.ae/foundation_vision.php](http://www.smartdubai.ae/foundation_vision.php)

\(^{27}\) Smart Dubai website. 2016. ‘The World’s most Ambitious and Comprehensive Data Initiative to Date’. Available at: [http://www.smartdubai.ae/dubai_data.php](http://www.smartdubai.ae/dubai_data.php)

\(^{28}\) Smart Dubai website. 2016. ‘Dubai Data’. Available at: [http://www.smartdubai.ae/dubai_data.php](http://www.smartdubai.ae/dubai_data.php)

\(^{29}\) Smart Dubai website. 2016. ‘The World’s most Ambitious and Comprehensive Data Initiative to Date’. Available at: [http://www.smartdubai.ae/dubai_data.php](http://www.smartdubai.ae/dubai_data.php)

\(^{30}\) Arrangements for opening and sharing of private sector data is yet to be confirmed by the Smart Dubai Office and Dubai Data Establishment. This phase of work will involve extensive consultation and collaboration with the private sector and is due to commence in 2017.
The vision is for all government data to be either open or shared, with the following classifications:

**Table 1: Classification of Dubai data**

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<th>Classification of data</th>
<th>Description</th>
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<tr>
<td>Open data:</td>
<td>Any Dubai data which is published and can be downloaded, used and re-used by all types of users. There may be a registration process for users but no restrictions will be placed on users.</td>
</tr>
<tr>
<td>Shared data:</td>
<td>All Dubai data classified as either confidential, sensitive or secret data. Shared data can only be accessed by other permitted Government Entities and any other authorised persons.</td>
</tr>
<tr>
<td>Value-added data:</td>
<td>This includes any data that Government Entities have added value to and can sell (above cost).</td>
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Further information on the legal and policy framework for the Dubai Data initiative can be found in Appendix 2.

To implement the Dubai Data initiative, the DDE has been working on a number of policy-related programmes including:

— the regulatory framework to underpin the Dubai Data Law, as set out in the Dubai Policy framework, which came into effect in January 2017;

— the Dubai Data Manual which describes in detail the new operating model for data governance in Dubai that is needed to put the Law into effect, setting standards which must be met both at a technical level (for individual data sets) and at a governance and business process level. The first version of the Dubai Data Manual was published in October 2015, with Version 2 released in June 2016 and Version 3 published in November 2016;

— the technical infrastructure which includes the electronic platform (the Smart Dubai platform) being developed in collaboration with Du, due to be launched in April 2017. This involves working with Government Entities to ensure functionality and that data can be pulled directly onto the platform via a file transfer protocol;

— readiness within Government Entities to implement the data standards and comply with the Law and policies – this has been done via stakeholder engagement and training that is underway to assist Entities with implementation and understanding the requirements they face; and

— consultation with the private sector to understand the willingness and appetite to allow for their data to also be made open and shared, where appropriate. This work is scheduled for 2017.

These streams of work are important to ensure the maximum value, and thus impact, can be generated from Dubai’s open and shared data. The actions of the DDE provide support to

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31 Du is an Emirates Integrated Telecommunications Company. They have a Public-Private Partnership agreement with the Dubai Data Establishment to develop and operate the Smart Dubai platform on an ongoing basis, with associated revenue sharing agreements.
other Dubai Government Entities throughout the various stages of value generation. This is explored in further detail in Section 4.

3.3 Current approaches to opening and sharing government data in Dubai

To date, most Government Entities have opened up elements of their data online for public use. For example, the DSC publishes a comprehensive list of economic and social indicators annually. This data is open and available in downloadable formats. Other Entities, such as the Department of Tourism and Commerce Marketing, publish annual reports which provide insights into the data it holds.32

Sharing of data between Entities has, however, been handled on a more ad hoc and inconsistent basis and often requires lengthy written approval processes.33 During our stakeholder consultation with Entities, it was indicated the Dubai Data initiative represented a real opportunity to ensure future sharing of data would be smoother, timelier and more automated. Representatives from various Government Entities said it would go some way in overcoming the complex approval processes currently in place in order to obtain required data from other Entities.

During stakeholder engagement, it was also indicated that the Dubai Data initiative meant the future sharing and opening of data would be smoother, timelier and more automated. It also represents opportunities for the data to be visible for all Entities so awareness of the types of data available improves. This represents opportunities for innovation in policy making and the development of potential value-added services, combining datasets from across Entities. Further work by the Entities and DDE to build up these use cases for shared data is ongoing.

These opportunities already being identified by Government Entities demonstrate how the raw data held by Entities can be used to create economic and social impact. The next section of the report explores the process of how this impact is created and the role of different stakeholders.

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32 Example annual reports can be found here: https://www.visittDubai.com/en/tourism-performance-report-old
33 Information regarding how data is currently shared between Government Entities was gathered during stakeholder consultation.
4 The economic impact of open and shared data

Evidence shows greater availability and accessibility to data and information can boost innovation and efficiencies, facilitating economic growth. Governments and the private sector are aiming to better use data to capitalise on the impacts it can deliver.

This section considers the evidence regarding the role of different stakeholders in the supply, use and re-use of open and shared data. It explores the evidence from the literature regarding how economic and social impacts are realised as well as the different types of data that are most conducive to generating these impacts. This evidence has been gathered from an extensive literature review of published studies of open and shared data.

4.1 Stakeholders in the supply, use and re-use of open and shared data

There are a number of key stakeholders that will be involved in the supply, use and re-use of open and shared data in Dubai. These stakeholders will play an important role in the process of generating the economic and social impacts. This process is displayed in Figure 4.

Figure 4: Stakeholders in the supply, use and re-use of open and shared data in Dubai

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The Dubai Government and its Entities have an important role in each stage of the supply, use and re-use of data.

They are responsible for the data supply, and ensuring the quality and quantity of the data made available for use and re-use. The intention of the Dubai Data initiative is to encourage additional supply of open and shared data – from Figure 4, it can be seen that this should result in a greater volume of activity throughout the use and re-use process.

The intermediate activities in terms of the initial use of open/shared data occur in the ‘infomediary’ sector – a term coined by Proyecto Aporta35 (2011) to describe “the set of companies and actors that create applications, products and/ or added-value services for third parties, using public sector information”. Although this is not a recognised as a standard industry classification, it underpins the business models using open government data.

The value creators are both private and public sector entities that use the data to create additional value or uses.36 They include:

— Enrichers: individuals/Entities who combine the open data (or also shared data in the case of Entities) with their own sources/knowledge to add value. For example, news organisations who use the data, digest it and make it meaningful for the wider population.

— Enablers: usually larger organisations who do not profit directly from the open data but provide platforms and technologies that others can use to better understand and analyse the data. For example, mobile phone companies provide the infrastructure for applications to operate. In Dubai, the Smart Dubai Platform itself will be an enabler, disseminating information and facilitating the use of the open and shared data.

— Developers: those that design and build Application Programming Interfaces (APIs) which enable users to make better decisions. For example, the application CityMapper, used in 29 cities across the world, has used metropolitan transport data to enable citizens and visitors to make better informed travel decisions, resulting in impacts such as reduced travel time.37

— Aggregators: collect and pool data and provide it to other stakeholders. For example, the World Bank and the International Monetary Fund aggregate country-level data and enable easier analysis of global data in aggregate form. In Dubai, the DDE will provide aggregated data (potentially at a fee to reflect the additional cost of production), yet the underlying raw data will be openly available for other Government Entities and the private sector to aggregate themselves, providing aggregated data in competition with the DDE.

Some of this enriching, enabling, developing and aggregating of open/shared data is already taking place in Dubai within Government Entities. Some examples of this are described in Table 2.

37 CityMapper. 2016. See: https://citymapper.com/london
### Table 2: Examples of sharing of data by Government Entities

<table>
<thead>
<tr>
<th>Government Entity</th>
<th>Data used</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dubai Statistics Centre (DSC)</td>
<td>Economic and social data.</td>
<td>The DSC has a portal for all Government Entities to access, pulling in all published and open statistical data from other Entities. It enables each user to set up a dashboard and interact and visualize the data as required. This is used to help inform policy decisions.</td>
</tr>
<tr>
<td>Department of Economic Development</td>
<td>Business licenses. Geospatial data.</td>
<td>The Dubai Business Map (DBM) has been developed and launched by the Department of Economic Development. DBM is a smart digital platform that provides an interactive guide to investors and business oriented professionals to explore trade licenses and activities indicators. It enables insight into the number of new investors, the entry rate of businesses (based on license growth) and overall trends – all mapped using geospatial data.</td>
</tr>
<tr>
<td>Department for Knowledge and Human Development</td>
<td>Quality of schools and happiness.</td>
<td>The Department for Knowledge and Human Development has an interactive directory on schools, linking details about education establishments with their latest rating, the relevant curriculum and tuition fees. This is linked with geospatial data. This Entity also publishes open data in the form of survey information collected from students and schools.</td>
</tr>
<tr>
<td>Road and Transport Authority</td>
<td>Traffic congestion data</td>
<td>Information on traffic congestion is currently used by other Entities to identify potential advertising revenue (i.e. where would be the most effective use of road advertising signs).</td>
</tr>
<tr>
<td></td>
<td>Traffic incidences</td>
<td>Information on traffic incidences are often shared with Dubai Police to ensure they are investigated.</td>
</tr>
<tr>
<td>Department of Tourism and Commerce Marketing Dubai</td>
<td>Tourist visits</td>
<td>Mandatory information is submitted to the DSC by the Department of Tourism and Commerce Marketing each year on visitors, events and hotels. This is published in an annual report.</td>
</tr>
</tbody>
</table>

Source: KPMG, based on stakeholder consultation undertaken as part of this study.

The final step in the supply chain for open/ shared data is its end use. Following the process of value generation, the data is accessed in its new form by the end user. There are a wide range of potential end users for open data, including Government Entities, citizens, residents and the private sector. These end users derive economic and social impacts from this use – the next section explores, in more detail, what these impacts include.

### 4.2 The economic and social impacts enabled by data

As a result of the enrichers, enablers, developers and aggregators and the products/services they produce, a number of activities are facilitated that create social and economic value. We recognise that open and shared data may generate for positive economic impacts for players in the market, however there could possibly be some negative impacts, or disbenefits. This could include, for example, job losses due to increased digitisation enabled by data – this is known as creative destruction. We explore some of these further disbenefits in Section 4.2.2.

There are numerous examples in the literature of the type of social and economic impacts that can be realised, however they can be summarised into the following groupings:

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38 Creative destruction is an economic terms coined to refer to the impact of innovation mechanism by which new production or services replace outdated ones.
— Additional collaboration and engagement with government (by different stakeholders, including: citizens; the private sector; and other Government Entities);
— Private sector innovation and efficiency gains, including the creation of new businesses, growth of existing businesses as a result of new products and services enabled through open data; and greater efficiency in operation; and
— Enhanced engagement of residents and visitors directly with data to influence or inform their decisions.

By enabling the above activities, economic and social value is generated. The supporting evidence relating to each of these is set out below. We describe relevant literature and, where possible, draw out key lessons for Dubai considering its vision for open and shared data and the supporting policy framework that is being developed.

4.2.1 Collaboration and engagement with government by stakeholders

Open and shared government data allows for engagement and collaboration between a range of stakeholders: within the public sector; between public and private sector entities; and between the government and the citizens of the country.

These different forms of co-operation can enable stakeholders to identify better ways of doing things or allocating resources. It potentially releases cost savings, increases economic growth (GVA and GDP); improves the transparency of government; and enhances the happiness and well-being of residents and visitors.

Greun et al\(^{39}\) state the cost saving for government makes up the biggest portion of economic value as a result of open data. These savings are predominantly driven through more effective and efficient use and allocation of resources, receiving feedback on effectiveness of policy as well as encouraging the sharing of best practice.\(^{40}\)

There is a track record of such cost savings being achieved in a range of cities.

For example, in California the State Transparency Portal\(^{41}\) was able to save the state over $20 million per annum in public sector expenditure. This cost saving was able to be realised as individuals were able to look at the breakdown of how the state spends its funds and were able to question expenditure, identifying unnecessary spend which would have otherwise been ignored and continued to cost money.\(^{42}\)

Another example comes from New Jersey where rail transport passenger flow data was released to the public who were then able to identify underutilised rail stops.\(^{43}\) As a result, more express trains, with fewer stops, were put into operation which led to a time saving of, on average, six minutes for the average commuter during rush hour.

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\(^{41}\) Transparent California, which is the state’s open government data portal and has many of the state’s datasets including expenditure, available at: [http://transparentcalifornia.com/](http://transparentcalifornia.com/)

A second channel for savings is through greater efficiency in the use of resources as a result of different Government Entities sharing data more effectively. This reduces transaction costs, staff time and duplication efforts.

Capgemini Consulting\(^{44}\) references a study on the Danish Government\(^{45}\) which, through opening up public sector data, was able to realise savings of 0.22 per cent of expenditure\(^{46}\).

The dissemination of data has the potential to release further cost savings through encouraging best practice sharing among entities. Capgemini’s report for the European Commission\(^{47}\) emphasises this potential value by referencing a study on the effect of the UK National Health Service (NHS) publishing the MRSA infection rates per hospital on the open data portal. This data sharing enabled those healthcare providers with high rates (the worst performers), to contact the ones with the lowest rates to learn from them. It is noted\(^{48}\) that this specific initiative brought down infection rates annually from 5,000 patients per year to 1,200. Overall, the initiative achieved an approximate cost saving of £34 million per annum to the UK Government.

A further way in which cost savings can be realised is through better policy decisions driven by gathering feedback from third parties. This enables policy makers to understand better the needs of, and challenges faced by, the population and enterprises.\(^{49}\)

In the case of Dubai, the overarching strategy within the Dubai Data initiative is to actively encourage Government Entities to collaborate with the private sector to find out what datasets they require and would be most useful for their business needs. The intention is that this will facilitate greater partnerships and understanding of business needs. In addition, feedback from residents and visitors who access the open data (in its raw or enriched form) can enable superior policy decisions and more personalised services to be developed which ultimately can lead to happier citizens – a key goal for Dubai.

As well as achieving cost savings, there is the potential for revenue generation through providing value added data for a fee. Although there can be detrimental impacts from charging for data, as suggested by Granickas\(^{50}\) and Pollock\(^{51}\), the intention in Dubai is that this will be minimised as the underlying raw data will be available without charge or at the marginal cost of distribution. Any revenue generation has the potential to lead to additional government spending which may spur incremental economic growth.

\(^{44}\) Hereafter referred to as Capgemini.
\(^{46}\) Representatives from the Smart Dubai Office have cited this as a particular cost-saving opportunity for Dubai as Government Entities often work in silos. This means there is commonly some duplication in operations with associated transaction costs. Therefore the opportunity for cost savings could be high.
\(^{49}\) Granickas, K. 2013. ‘Understanding the impact of releasing and re-using open government data, ePSIplatform’.
\(^{50}\) Pollock, R. 2011. ‘Welfare gains from opening up public sector information in the UK’.

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Document Classification - KPMG Public
4.2.2 **New and improved products and services through the use of open data**

The generation of new or enhanced products and services potentially creates:

— new or increased revenue streams for existing businesses; and

— new businesses based on products/services not previously supplied in the absence of an open data initiative.

MNCs, SMEs and budding entrepreneurs can use the open data to create new and/or improved offerings to consumers through aggregation, development, enrichment and enablement of the open data. This innovation and creation of new business, or expanded operations has the potential to create greater economic activity and value (GVA) directly through employment and increased business output, as well as indirectly through the supply chain, and spending in the economy of employee wages.

Part of the additional growth and investment arising from open data comes from the creation of the “infomediary” sector. This sector captures the new businesses that rely solely on the use of public sector information, for example businesses that create products or services to market them to third parties based on public sector information. However, the sector also includes the businesses that already exist across other sectors and have created and marketed new products or services based on public sector data. Very few studies have considered this sector and attempted estimations of the numbers of new businesses operating within it. However, one estimate for Spain in 2011 found that the sector consisted of 150 companies, employing around 4,000 people and generating €330-500 million per annum.

There is evidence that the stimulation of the infomediary sector has increased the number of new businesses. The proliferation of new businesses in recent years is evidenced by a World Bank report which discusses the United States GovLab (an index capturing the top US based companies providing services using open data). Survey-based results show that of the top 500 companies in the US overall, two-thirds were founded within the previous five years, indicating most businesses in this sector are new. The report also cites specific examples of businesses developed based on open data. For example Waze, a business acquired by Google for a reported $1.3 billion in 2013, is a GPS-based navigational application for smartphones with GPS support and Climate Corp, an application acquired by Monsanto for $930 million in 2013, aggregates US Government data to help farmers improve operational efficiency, crop yields and overall profits.

It is noted by Greun et al that open data enables companies also to enhance existing products and services and/or deliver them more efficiently. This can stimulate further investment, GVA and jobs.

As an example of how data can support the more efficient delivery of business services/products, the transportation sector uses open transport and related data to optimise fleet management and operations. This can enable the best routes to be found based on speed, route, size of load, traffic and other datasets available. The resultant increased operational

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53 As defined by Proyecto Aporta, in its 2011 publication ‘Characterization Study of the Infomediary Sector’. Prepared by the Ministry of Territorial Policy and Public Administration, the State Secretariat of Telecommunications and Information Society and of the National Observatory of Telecommunications and of the Information Society (ONTSI), of the Ministry of Industry, Tourism and Trade, Madrid.


efficiency from this will lead to a reduction in transport and distribution costs and greater revenue generating opportunities due to better use of employee time. McKinsey estimates that globally there is the potential to increase output by between $720 billion and $920 billion per year due to open transportation data.\textsuperscript{56}

Whether it relates to new or existing businesses, the delivery of new or improved products and services through the use of open data has the potential to generate increased profit.\textsuperscript{57} This, in turn, can result in the generation of additional GVA which also has wider economic impacts.

While the literature points to a range of positive economic impacts that may arise from the opening of data, some of the positive impacts may be offset, to some extent, by negative impacts (or, disbenefits). This is particularly likely to be the case when considering the impacts realised from open data across different firms. While some may benefit, this may be at the expense of other firms within the same sector or broader economy. This is likely be arise as digitisation, due to the opening and sharing of data, changes the nature of businesses and jobs.\textsuperscript{58}

The term “creative destruction” is often used to explain the impact of technological change, in particular the impact of new-technology-based firms, in ‘traditional’ markets. Technological change, brought about by data, digitisation or other factors, can often result in traditional businesses either needing to adapt to the changes (and incurring costs in doing so), or potentially closing down, with resultant job losses.\textsuperscript{59}

There are examples of this creative destruction occurring as the result of increased use of data and the digitisation this facilitates. For example, a paper by Berger et al.\textsuperscript{60} examines the impact on the conventional taxi market as a result of Uber. At a simplistic level, Uber provides citizens with a platform that matches individuals with self-employed taxi drivers, and facilitates payment via the platform, with the drivers taking a share of the profit generated for Uber from each ride. The results from the study show that the hourly earnings of conventional wage-employed taxi drivers declined after the introduction of Uber – an economic cost for those employed in the conventional taxi market. However, Berger et al. also found there was an observed shift towards self-employment in the market, reflecting how the market adjusted to this new taxi provision platform.

Further evidence suggests that even in the face of creative destruction, new jobs are likely to appear as technological applications develop and other sectors expand as costs fall and income and wealth increase, although it may take some time for this to materialise.\textsuperscript{61}

Citizens’ use of open data enables them to become better informed in government matters and in their own decision-making. This can lead to further impacts for the government including enabling greater transparency, accountability and strengthened public debate. In doing so, it may also enhance citizens’ happiness.

For example, Verhulst and Young consider case studies on how opening up data improves transparency of governments functions, as well as looking at how open data can empower citizens in their decision making (leading to cost savings). Case studies, such as Brazil’s Open Budget Transparency Portal and Tanzania’s Shule and Education Open Data Dashboard, demonstrate that open data is improving governments around the world in terms of greater accountability, tackling corruption and making the functions and responsibilities of government more transparent to citizens.

Further, Granickas references the fact that seven of the top ten countries on the Web Index, which measures the effects of open government data on transparency and accountability, are shown to be the least corrupt on Transparency International’s Corruption Perception Index. Although only a correlation, this supports the notion that open data can play an important role in improving government transparency and accountability.

Open government data also has the opportunity to improve citizens’ quality of life, by enabling them to make more informed decisions about their own spending habits and life decisions. Residents and visitors can use open data to make more informed decisions and better choices in many aspects of their lives including finance, healthcare, education, and transportation. This can “enhance the quality of their lives”.

Capgemini describes better decision making as one of the “main benefits”.

The vision for Dubai data is to improve the lives of citizens, residents and visitors, through many channels. These include helping residents to plan their family experiences and spend more time together; and enabling visitors to have a seamless stress-free stay by integrating city traffic and event calendars which can help them to travel to events without delay.

In the context of citizens, we consider only open data. It is assumed, due to the nature of the shared data, this would unlikely be made available to citizens.


With more transparent budget this is now hailed as one of the country’s primary anti-corruption tools. A portal that provides the public with important information on schools such as exam pass rates which encourages citizens to engage with the education system and demand greater accountability.


However, open data cannot on its own deliver these impacts. Yu and Robinson state “a government can provide open data on politically neutral topics even as it remains deeply opaque and unaccountable”. This is directly related to governments being selective in what data they choose to open, not publishing all that is eligible. However, the vision for the Dubai Open Data strategy is that all data not deemed to be confidential, sensitive or secret will be open. This, in combination with the ambition to have 100 per cent of all data open or shared by 2021, is illustrative of Dubai’s intent.


Smart Dubai Office. Available at: http://www.smartdubai.ae/dubai_data.php
There are already various examples from across sectors of how citizens in other countries have benefited from the opening and sharing of data. Some of these examples are set out below:

— Cucos\textsuperscript{75} notes three examples of platforms available in Canada, Moldova and Italy that have led to more informed consumer decisions in education. On these platforms, parents can access information on school performance, teacher absence, use of IT and other factors to support their decision making about where to send their children to school. We note that similar information is already made available in Dubai. Cucos argues this information leads to happier citizens and that there will be a wider societal impact as schools are encouraged to improve performance which could then increase educational attainment.

— An example from the transport sector is presented by Manyika et al\textsuperscript{76}. In Minnesota, Google Transit installed transponders on city buses. This enabled individuals to locate the buses in real time which, in turn, increased ridership by 12 per cent and reduced congestion in the city (as less people chose to drove).

Enabling public participation and engagement is a key impact for citizens from the opening of data. The expanding use of new technologies, along with open data, are enablers of citizen self-empowerment and participation.\textsuperscript{77}


4.2.4 The relationship between types of data and the generation of economic and social impact

As detailed above, there are numerous examples across a wide range of sectors of how the use of open and shared data can generate different forms of economic and social impacts. However, there is evidence to suggest that the extent to which these impacts can be generated varies across different ‘types’ of data made available for use.

A study conducted for the UK Department of Business Innovation and Skills created a data intensity matrix comparing the extent to which the data is used or re-used to create value. This is shown in Figure 5. According to this study, the data types that generate the most economic value from use and re-use include geospatial, environment and meteorological information and economic and business information data.

Figure 5: Value generation potential of data across economic sectors

In Dubai, as 100 per cent of government is to be open and shared by 2021, all available data will be released (regardless of its potential to create value). However, lessons can be learned regarding how different types of data create value in order to inform the prioritisation of the opening of datasets over the period up to 2021.

The extent to which different types of data create value for a city or country is to some extent dependent on its economic make-up and the consumer and business behaviour within that context. For example, if agriculture is a small aspect of a city’s/ country’s economy, the importance of data relating to agriculture is much lower. Therefore, for Dubai, data that relates to the sectors that contribute most to the economy (such as tourism and logistics) are likely to be of the most importance.
4.3 Barriers to realising the full potential of open and shared data

While there is clearly significant potential to realise economic and social impacts from the opening and sharing of data, there are a range of barriers (or dependencies) that may inhibit this. In the literature we have reviewed, a number of legislative, economic and accessibility barriers to achieving the impacts of open / shared data have been identified.78

Legislative barriers

Ubaldi79 discusses the policy challenges that may represent barriers. These include disclosure policies, which limit data transparency, and copyrights, which may reduce clarity of ownership of datasets. In Dubai, however, it is clearly mandated that the Government as a whole, not individual Entities, own all of the government data. Furthermore, the draft Open Data Licence in place clearly lays out copyright rules and requirements that apply to all users of data.80

A report by Deloitte81 discusses the importance of potential barriers from ineffective licensing agreements. It notes that “licensing conditions play an important role in facilitating (or preventing) the full exploitation of the value of public sector information”. We understand that the emerging Dubai Open Data Licence has built on best practice and lessons from around the world to try and minimise any inefficiencies.

The quantity and quality of data available

The quantity of data that is available for use and re-use clearly impacts on the extent to which economic impacts can be realised. Furthermore, the quality of this data is of importance.

Data that is made available must have particular characteristics to enable its use and re-use. In line with OECD recommendations, to be valuable data needs to be:82

— Accessible – that is, data must be made available in disaggregated forms and in an electronic format. The format in which the data are made available should be convenient and modifiable and should be machine-readable (for example, pdfs are not always machine-readable).
— Discoverable – this means the data should be findable via a data catalogue, information asset register or other sorts of cataloguing.
— Timely – rapid disclosure is required, for example, by builders of certain apps that rely upon using the very latest data.
— Linked – this allows for more sophisticated user queries.
— Available for re-use without discrimination.

80 Draft open data licence summary. Provided by the Smart Dubai Office.
Recent literature on the subject suggests there are some challenges globally in meeting these requirements, despite their importance.

For example, in its 2013 report, Capgemini found that 96 per cent of countries do not regularly update their datasets (and so do not provide timely data). Furthermore, it found that 60 per cent of countries’ open data portals lacked enhanced search capabilities. These capabilities enable users to interact with, and navigate, the data more efficiently and derive the most value.

To help overcome some of these common pitfalls, the Dubai Data Manual (described in Appendix 2) sets out how these widely accepted principles will be adhered to in Dubai in order to help to ensure maximum value can be derived from its open and shared data.

To further ensure these standards are met by all stakeholders, the DDE is running training courses and workshops for all the Government Entities so they can be fully informed on what is required of their data.

**Economic barriers**

The economic barriers to realising the maximum potential impacts are widely referenced in the literature we reviewed.

There is evidence that charging can significantly impact the usage of data and, therefore, the potential value realisation. Ubaldi builds on this, reporting that economic analysis shows when information is provided free of charge, or at marginal cost, then individuals, developers and private enterprises are more likely to take the raw data and create added-value products they can market. Charging for datasets is likely to be a particularly significant barrier for SMEs and individuals who face financial constraints, potentially acting as a barrier for entrepreneurship.

A Finnish study considered the impact of reducing such barriers to create added-value products and enterprise growth. The study found that businesses who re-use geographical data in countries where data was available freely grew 15 per cent more than their counterparts in countries who price the data to recover production costs. Even though moving to a lower price model would potentially reduce revenue generation per use, it has been shown that with significantly lower costs per use, revenue can in fact increase due to increase demand and take-up. An example is that in Austria an entity supplying geographic information lowered its prices by 97 per cent and its revenue increased by 46 per cent overall due to a huge, 7,000 per cent, growth in demand.

In the context of Dubai, the current stance to ensure all raw underlying data is made available free of charge will help to ensure these economic barriers are reduced. However, we note that in some circumstances, where the costs to collection are beyond normal

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86 That is, the cost of producing data per unit.
operations, a fee may be charged by the DDE to recover such additional costs\(^9\). This may impact on demand for these data sets and act as a potential barrier to use.

In addition, the Government of Dubai intends to be an active player in the market for value-added data services that are created using open data. The Dubai Data Policy sets out a framework to ensure that this is done in a way which ensures a level-playing field between the government and private sector competitors. Clearly, the effectiveness with which this policy is implemented – and, crucially, is perceived by the private sector – will be critical (see Box 1 below for further theoretical discussion regarding the economic barriers).

On the one hand, if managed well this governmental intervention could help demonstrate the business case for investment in open data services, and stimulate and accelerate the development of the wider market. On the other hand, there is a downside if such intervention crowds out private sector investment.

**BOX 1: THE DUBAI GOVERNMENT AS A VALUE-ADDED SERVICE PROVIDER**

It is envisaged that Dubai Government Entities will develop value-added services based upon open data and sell these for commercial gain. The Draft Policy states there are a number of principles that must be met for these value-added services to be sold. These include:

- Such value-added services must be in the public interest, furthering the goals of the Smart Dubai initiative.
- They will only be made available to users via the electronic platform.
- It must foster the wider re-use of open data and not use shared data (i.e. all underlying data supporting the value-added service must be freely available to potential competitors as open data).
- The value-added services must be made available to all users on a fair, reasonable and non-discriminatory basis.
- The fees charged must be above costs ensuring the full costs are recovered, including a reasonable return on investment, to enable the private sector to compete on a fair basis.
- There must be scope for complaints and redress mechanisms to third parties who believe that a value-added data service is failing to abide by the abovementioned principles.

The Government Entities will have first-mover advantage in regards to these value-added services. First-mover advantage refers the benefits of being the first provider of a good or service. Theory states that those who enter the market first benefit from learning, network effects, size and access. However, as stated during stakeholder consultations, the ambition in Dubai is for the Government Entities to lead by example and prove there is a business case for such services to encourage private sector players to enter the market.

The pricing mechanism (i.e. ensuring Government Entities charge above cost) should also ensure there are potential profits to entice private sector entry. Economic theory shows the potential for profits will attract new firms, increasing the supply of the product available on the market (and thereby lowering the price in the longer term). However, this is subject to no barriers to entry being present. Barriers to entry are the existence of obstacles that prevent new competitors from easily entering an industry or area of business. Such barriers could include, for example, access to the underlying data (which

\(^9\) This may occur in “exceptional circumstances” (as per the Draft Dubai Data Policy).
BOX 1: THE DUBAI GOVERNMENT AS A VALUE-ADDED SERVICE PROVIDER

The Draft Policy ensures for). It could also include switching barriers (for consumers switching from the government value-added service to a private sector equivalent) or customer loyalty for using government services rather than private sector services.

There is also a risk that the Government Entities investment into value-added services may crowd out private sector spending. Crowding out refers to the economic theory that public sector spending, or provision of services, drives down or even eliminates private sector spending and provision of that service. The concept is recognised as a potential issue by Osborne and Raper91 and Deloitte92 who both note that a balance needs to be struck between providing easy-to-access data and not stifling private sector innovation.

Source: KPMG summary based on literature review undertaken as part of this study. 2017.

Access barriers

Access barriers relate to the format and reliability of data, the reluctance to use data, and the lack of skills and understanding that will reduce the realisable value from the data.93

The Dubai Government has put in place a range of measures to help to ensure that access barriers will not pose a threat to the realisation of potential economic and social impacts from open data. For example, the Dubai Data Manual has a framework to ensure that the open data is timely, easy to access, understandable and of high quality. Stakeholder engagement and marketing activity to promote Dubai open and shared data and the Smart Dubai Platform should also help to encourage use. And efforts are underway, for example through training and workshops, to ensure that users have the skills to be able to utilise the data in a value generating way.

92 Deloitte, 2014, ‘Driving economic and social growth: Designing an open data strategy for Public Sector organizations,
5 High level estimates of the potential economic impact of open and shared data in Dubai

This section provides an overview of the potential economic value that could be achieved through the opening and sharing of data in Dubai. The estimates derived are ex-ante in nature in that they have been developed ahead of the full implementation of the Dubai Data initiative and the opening and sharing of data via the Smart Dubai Platform.

The estimates are based on benchmarks of the economic impacts from other jurisdictions, drawing upon existing studies to provide insight into the extent of potential impacts that could be achieved in Dubai when all data is opened or shared in 2021.

Estimates have been undertaken in relation to GVA. GVA is defined by the OECD\textsuperscript{94} as “the value of output less the value of intermediate consumption; it is a measure of the contribution to GDP made by an individual producer, industry or sector”. In contrast, GDP, is the sum of GVA across all industries plus taxes on products minus subsidies on products and services.\textsuperscript{95}

5.1 Estimates of the economic impact of open and shared data from other jurisdictions

In order to understand the economic impact of open and shared data at an economy wide level, we conducted a literature review to gather evidence from relevant studies that quantified the impact of open data.

We identified a number of studies that sought to quantify, to the extent possible, the economic and social impacts enabled by open/ shared data. In particular, we identified six frequently cited studies that we considered best quantified the economic impact of open data:

— A research paper by Manyika et al published by the McKinsey Global Institute in 2013 titled ‘Open data: Unlocking innovation and performance with liquid information’\textsuperscript{96} assesses the total economic impact, direct and indirect, of both open government and private sector data on a global scale, with particular estimates for the United States and Europe cited. The estimates are based on seven broad sectors.

— Capgemini Consulting’s 2015 study titled ‘Creating value through Open Data, European Commission’\textsuperscript{97} considers the value of the market for open data across the EU. It considers the value added to GDP, number of jobs created, cost savings to the public sector, efficiency and productivity gains. It is based on a 2006 study undertaken by


\textsuperscript{97} Capgemini Consulting, 2015, ‘Creating value through Open Data, European commission’
Dekker et al.\textsuperscript{98} which estimates, based on survey data, the value of open data across 10 broad industry sectors, across the EU. It does not consider open private sector data.

— A 2014 study by Gruen et al from Lateral Economics in Australia titled ‘Open for Business: How Open Data Can Help Achieve the G20 Growth Target’\textsuperscript{99} quantifies the return on investment for open data in Australia using an economic growth model approach. The study considers only public sector open data. This approach provides a range of estimates based on different accessibility assumptions and relies on country or city specific data on total factor productivity and stock of data held. This study also uses the McKinsey study (as above) to provide an estimate for the Australian open data market for both government and private sector data.

— Deloitte’s 2013 study for the Department for Business, Innovation and Skills titled ‘Market Assessment of Public Sector Information’\textsuperscript{100} considers the impact of open government data (excluding open private sector data) for the UK economy, estimating wider indirect and induced impacts.

— DotEcon’s 2006 study for the UK’s Office of Fair Trading titled ‘The commercial use of public information (CUPI)’\textsuperscript{101} focuses on the economic value of public sector information in the UK and also considers possible consumer detriment existing within the market.

— A study in 2011 by Vickery titled ‘Review of recent studies on PSI re-use and related market developments’,\textsuperscript{102} estimates the market for open data for the EU27 based on studies of geospatial data in the Netherlands, Australia and New Zealand. A key assumption of this study is that half of the value derived from all open data is based on geospatial data.

A full description of these studies can be found in Appendix 3 where we discuss the studies’ methodology, results, and the relevance to Dubai and limitations to using the estimates within each of these studies as a benchmark to derive economic impact estimates for open and shared data in Dubai.

We note that each of these studies estimates the economic impacts from open data at a country, region or global level. Ideally, to derive estimates for Dubai we would use benchmarks based on estimates derived for other comparable cities. However, our literature review identified no publicly available studies quantifying the economic impact at the city level.\textsuperscript{103}

The following section describes how we have undertaken the ex-ante estimates of the economic impacts of open data for Dubai.

\textsuperscript{98} Dekker, M., Polman, F., te Velde, R and de Vries, M. 2006. ‘Measuring European Public Sector Information Resources (MEPSIR)’. A report for the EU Commission
\textsuperscript{100} Department for Business, Innovation and Skills. 2013. ‘Market Assessment of Public Sector Information’. A report by Deloitte.
\textsuperscript{101} DotEcon. 2006. 'The commercial use of public information (CUPI)'. A report for the Office of Fair Trading
\textsuperscript{102} Vickery, G. 2011. ‘Review of recent studies on PSI re-use and related market developments’
\textsuperscript{103} We undertook a benchmarking exercise regarding city-level strategies and how these impacts were measured and the results of this can be found in Section 6.3.1.
5.2 **Estimating the potential economic impacts of open data in Dubai**

5.2.1 **The approach to deriving our high level estimates**

As noted above, our estimates of the potential economic impacts of open data in Dubai are based on a benchmarking approach, drawing on evidence of the impacts from other jurisdictions.

While we identified a number of studies that sought to quantify the economic impacts of open data, for our benchmarking we drew only on those that we considered most relevant to Dubai in terms of:

— the impact being measured – for example, did it measure impact in terms of GVA, GDP or output or something else, such as consumer detriment;
— the scope of open data being assessed and if this included only public sector information;
— the timeliness of the study, i.e. whether it was undertaken recently and therefore more representative of current business and consumer behaviour; and
— the applicability of findings to Dubai considering differences in consumer and business behaviour.

In particular, as the objective of our study was to assess the economic impact of both open and shared data from government and the private sector (as envisaged under the Dubai Data Law), and to estimate the impact in terms of economic activity (GVA or GDP), our selection of benchmarks drew on studies that allowed these estimates to be derived.

Therefore, our high level estimates of the impact of open data in Dubai are based on estimation approaches using two main benchmarks and calibrating these existing estimations to Dubai. For completeness, we also derived estimates using benchmarks from the other studies noted above – the results of which are in Appendix 4. However, these are not presented as our central analysis given concerns about the relevance of these studies to the Dubai context and limitations to applying these as benchmarks for Dubai (for example, due to differences in data available, types of impact considered and timeliness).

The two benchmark figures used for our central analysis were:

1. Global estimates of the GVA impact of open data (broken down for Europe, the USA and the rest of the world) from the McKinsey study. These estimates consider seven different sectors and include both private sector and public sector data. For our central Dubai economic impact estimation using this approach we scaled the estimates to reflect only the opening of public sector data (and not private sector data), due to the initial focus of Dubai on this.

2. Estimates of the GVA impact of open data in Europe (broken down for ten industry sectors) from the Capgemini study. This study focuses only on the opening of public sector data.

In order to derive estimates of the potential impacts in Dubai, based on these benchmarks, we used two methods to calibrate the benchmarks to the economy of Dubai - calibrating using Dubai’s total GDP; and calibrating using Dubai’s GDP broken down by sector of...
economic activity. Table 3 overleaf provides further detail on how the benchmark estimates were calibrated to derive economic impact estimates for Dubai.

Table 3: Methodological approaches to derive high level estimates of the economic impact of open data in Dubai

<table>
<thead>
<tr>
<th>Paper</th>
<th>How we have adapted the approach for Dubai</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) Manyika, J., Chui, M., Growves, P., Farrell, D., Van Kuiken, S., and Almasi Doshi, E. 2013, Open data: Unlocking innovation and performance with liquid information, McKinsey Global Institute</td>
<td>The original global estimates are broken down into the impact for Europe, the USA and the Rest of World (ROW). They are also detailed by seven sectors, these include: education; transport; consumer products; electricity; oil and gas; health care; and consumer finance. The details of how this has been used and calibrated for Dubai, using both methods are detailed below. Method (a)- scaling by economy level GDP The first method involves calibrating by Dubai’s total GDP. We know that, as a proportion, Dubai’s GDP makes up 0.2% of the ROW GDP (in 2013 values). Scaling purely by GDP means that Dubai will realise 0.2% of the impacts estimated for the ROW. As the original study estimates are in terms of output, a broader measure than GDP alone, we then translated this to GVA using Dubai’s National Accounts and the level of output to GVA for the economy as a whole. The study involved looking at the value of public and private sector data and therefore had to be scaled to reflect public sector data only. It was assumed that half of the impact is attributable to public sector data and that three-quarters is still yet to be realised (i.e. a quarter is already realised as some data is already available for download). This is in line with assumptions made by Gruen et al. Method (b)- scaling by sector level GDP The second approach involves calibrating by Dubai’s GDP by sector or economic activity. Global GDP is available broken down by broad sector¹⁰⁴, these sectors include: agriculture, hunting, forestry, fishing; mining, manufacturing, utilities; construction; wholesale, retail trade, restaurants and hotels; transport, storage and communication; and other activities. The impact from each of the seven sectors was put into the relevant broad sector. In 2013 Dubai’s GDP received contributions of 0.0%, 0.1%, 0.3%, 0.6%, 0.5% and 0.2% from the respective sectors above and therefore could realise the pro-rated amount of impact, i.e. 0.3% of the impact from wholesale, retail trade, restaurants and hotels. This level of output was then scaled to reflect the GVA contribution of public sector data in the same way described above. For all estimates As the estimates related to 2013, we applied relevant growth rates observed until 2015. For future periods the average growth rate of 5.9%, average from 2006-2015, was used to increase the impact. As the estimates were calculated in United States dollars (USD) they were then converted to United Arab Emirates Dirham (AED) using the 2015 exchange rate¹⁰⁵.</td>
</tr>
<tr>
<td>(2) Capgemini, 2015, Creating value through Open Data, European Commission</td>
<td>The impact of open data was categorised by ten sectors, these included: arts, entertainment, recreation; public administration; profession services; real estate; finance and insurance; ICT; trades and transport; construction; industry; and agriculture. The impact from each of these sectors was put into the relevant broad sectors. The Capgemini estimates were presented for Europe and therefore we scaled the impacts to the ROW using the same ratio found by McKinsey. We then applied to same two methods (scaling by economy level GDP and scaling by sector level GDP) as detailed above to the Capgemini estimates to establish an estimate for Dubai. The estimates were presented in GVA terms and for public sector data solely and therefore did not require scaling in that respect. Estimates were presented in terms of direct and total impacts (direct plus indirect). This was used to estimate the same for Dubai.</td>
</tr>
</tbody>
</table>

¹⁰⁵ World Bank DataBank, Official exchange rate (LCU per US$, period average)
5.3 Results

5.3.1 Estimates of the overall potential economic impact of open data in Dubai

Our high level estimates of the potential impacts of open data in Dubai, demonstrate the economic impacts in terms of additional GVA that could be generated for the Dubai economy.

These are the annual economic impact estimates for 2021 onwards, on the assumption that, in line with the target set out by the Dubai Data Law of 2015, 100 per cent of Dubai’s Government Entity data is open or shared. And that by 2021 sufficient time will have elapsed after the opening of data for the full impacts to be realised. A full description of the assumptions used for our analysis can be found in Appendix 5.

Figure 6 overleaf, sets out our high level estimates of the potential economic impact of open data in Dubai, based on the two benchmarks used in our central analysis and using the two different calibration approaches.

While the first approach, drawing on the global benchmark figures, only allows for the estimation of the total GVA impact, the second approach, drawing on the European benchmark figures, allows the GVA estimates to be split by the direct and indirect impacts.

The direct impact is felt through efficiency savings to Government Entities and private sector businesses, as well as additional GVA generated by new and improved goods and services, drawing on open and shared data.

The indirect impacts accrue from the re-use of data, such as through the use of the new and improved goods and services. For example, a citizen using a new transport application on their mobile phone will optimise their travel which will generate time savings as well as savings in fuel consumption.

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106 We recognise there is likely to be a time lag between when data is made open or shared and any impact being realised, due to the time needed to exploit and generate value form the data, e.g. to set up a business, innovate etc. However, we consider that it may be the case that Dubai is able to realise some value quicker than seen previously in other countries given that many multinationals already use similar open datasets in other countries. Therefore, the same business model could, in theory, be applied in the Dubai context relatively quickly.
Our high level estimates suggest that the overall GVA impact from open data in Dubai could be in the range of AED 4.3 to 6.6 billion per annum. This is the equivalent of 0.8 to 1.2 percent of Dubai’s forecasted GDP for 2021.

We consider that the upper end estimates using each of the two benchmarks, based on calibrating the benchmarks to Dubai using sector level GVA, are more robust given that this approach better takes account of the existing composition of economic activity in Dubai and the extent to which data can add value by these sectors.

These estimates focus on the economic and social impact of open government data only.

- If we also consider the impact of open private sector data, assuming this is implemented and taken up by the private sector in Dubai, the global benchmark figures suggest that the impacts of opening data in Dubai could potentially double.\(^\text{107}\) When considering both the impact of private sector and public sector data opening, the total GVA impact ranges from AED 8.6 billion to 10.4 billion.

- The benchmark estimates relate to open data. We did not identify any approaches that quantified the impact of shared data overall. There are some specific examples or use cases where sharing specific types of data for particular uses can realise impacts but these were not suitable to use to quantify impacts at an aggregate level due to their limited scope.

Considering this, we believe that because of this, we are likely to underestimate the potential economic impacts from open and shared data for Dubai, which is a limitation of our analysis. We have, where possible, provided insight into where shared data has the

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\(^{107}\) We recognise that it is important the opening of private sector data is carefully planned to protect consumers, adhere to privacy and confidential laws and does not result in anti-competitive practices.
potential to generate further value based on stakeholder consultation. The monitoring framework established for ex-post monitoring (detailed in Section 6) also will capture the shared data element of impact.

5.3.2 **Estimates of the potential economic impact of open data in Dubai, by sector**

Our high level estimates set out above provide an indication of the potential overall impact at the aggregate Dubai economy level. However, how this economic value is attributed to various sectors of the economy varies depending on the extent to which open data is valuable and useful in each sector.

Figure 7 below sets out our estimates of the proportion of the total GVA impact of open data in Dubai generated by key sectors of Dubai's economy.

**Figure 7: Contribution to the potential GVA impact of open data in Dubai, by sector**

![Diagram showing the contribution of different sectors to the potential GVA impact of open data in Dubai.]


It is clear that the big value drivers of impact for Dubai are the transport, storage and communication sector; the public administration sector; wholesale, retail trade, restaurants and hotels sector; and the real estate sector. These four sectors account for approximately three-quarters of the estimated potential GVA impact of open data in Dubai.

We now set out how these four sectors can derive value from open and shared data, including examples of the ‘types’ of data used to realise this value.
Based on our estimates from the benchmarking studies, as shown in Figure 7, the transport, storage and communications sector has the potential to realise the most value from open data, with 27.8 per cent of the estimated impacts.

The potential for value realisation in this sector in Dubai comes from the opportunities to manage traffic disruption, optimise routes and logistics as well as improve capacity and manage public transport networks. The potential impact in this sector also represents, and takes account of, savings in consumer and business time.

As an example, in London, value has been derived from real time public transport information. Transport for London (TfL) data opened up its data, and this has been used to develop smartphone applications based on real time traffic information, such as tube departures, traffic disruption and annual passenger counts. Over 5,000 developers have transformed and used the available data. As at 2014, this had led to the development of 362 smartphone applications which had been downloaded nearly 4 million times. These smartphone applications are used by consumers to help save time when making their journeys, which was estimated to be worth between £15m and £58m in 2012.

In Dubai, stakeholders we engaged with indicated there are particular use cases for open data value generation based on traffic congestion and incidence data. A private sector delivery company consulted during the course of this study said improved real-time traffic data could allow it to make improvements to the underlying algorithms required to operate its delivery network. We were told this could translate into time savings, with consequent financial benefits.

Example ‘types’ of data likely to lead to value realisation in this sector include:
— Geospatial; traffic and transport information; demographics; energy, resources and utilities

Based on our estimates from the benchmarking studies, as seen in Figure 7, we estimate that the second largest value driver is public administration, which represents 23.6 per cent of the potential impact estimated, despite only contributing 7.0 per cent of Dubai’s current GDP. The potential value likely to be derived from open and shared data in this sector is largely driven by savings and value generated in government activities and policies. In the case of Dubai, this could include revenue generated as a result of value-added services, as well as the savings and efficiencies gained through the opening and sharing of data between Government Entities.

Some examples of such savings are evidenced in other cities. For example, the city of San Francisco was found to have saved over $1 million per annum from the introduction of real-transit data which resulted in 21.7 per cent fewer calls to its service line that connects

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residents, businesses and visitors to customer services for general government information, SF311. Evidence of how savings can be derived have also been observed by Bristol City Council, in the UK. After the introduction of an open data catalogue they were able to reduce their transaction costs. This was due to more service transactions, which would have been dealt with in person or over the phone, being completed online. They found that the average service transaction was 15 times less expensive if answered over the internet rather than in person or via the telephone.

During stakeholder consultation in Dubai, particular use cases to share data to save money were identified. For example, a representative from the Department of Economic Development indicated that a lot of internal resources were spent on ensuring business registration details are up to date, particularly addresses. This requires an inspector to visit the business and make any required updates. It was identified that information on business addresses were also collated by a number of other Government Entities. If this information was shared between Entities automatically, it would allow them to identify the most recently updated address reducing the need to send out inspectors so regularly. Such use cases identify, on a small scale, the extent to which cost efficiencies could be realised in Dubai.

Example ‘types’ of data likely to lead to value realisation in this sector include:

— Demographics data; health care, social care and population health data; labour market statistics; education statistics; economic and business information; social conditions

Based on the benchmarking studies, the ‘wholesale, retail trade, restaurants and hotels’ sector is of significant importance to Dubai’s economy, contributing almost a third to GDP, 31.5 per cent (as per 2015 figures). This is mainly driven by the tourist economy. Based on our estimates, this sector has the potential to realise 13.7 per cent of the potential estimated impacts of open data in Dubai, predominantly through more effective business operations, an example of which is demonstrated below.

A report by Manyika et al. details how in the UK Tesco (a UK supermarket chain) has combined meteorological data with sales records to create hour-by-hour demand models, as weather has been found to greatly influence customer activity. This modelling allowed Tesco to reduce revenue losses caused by running out of stock and reduce spoilage of excess stock by adequately forecasting demand based on the forecast weather. In addition to which, the report also suggests that further value can be gained through optimising retailers locations based on traffic patterns and the presence of other retailers in the vicinity.

During stakeholder consultation, many use cases based on data collected by the Department of Tourism and Commerce Marketing was identified as likely for value generation. For example, an opportunity to link information on where tourists stay/ visit with business

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112 Pollard, P., 2011, Opening up government data: making the case, European Public Sector Information Platform, Topic Report No. 26
registration information was identified. It was suggested that overlaying this information could provide potentially valuable information to investors and tourism-related service providers.

Example ‘types’ of data likely to lead to value realisation in this sector include:
— Economic and business information; Demographic data; Environment and meteorological information; Traffic and transport information

Based on our analysis from the benchmarking studies, we consider the real estate sector has the potential for significant value realisation from open data in Dubai. We estimate that it has the potential to contribute 9.6 per cent of the total impact of open data despite only contributing 6.4 per cent of GDP. The potential value in this sector relates to how open and shared data can be used for planning, real estate sale decisions and pricing as well as business location decisions.

In a report by Hogge for the Omidyar Network\textsuperscript{115}, the value derived in the real estate profession and through property data is illustrated by an example of the UK’s HM Land Registry (HMLR) data. This property dataset included the price paid for all properties bought and sold in the UK from January 1995 to present day. The report details that between January 2012 and March 2013 this dataset alone was downloaded nearly 78,000 times with one user, YOUhome, stating that it uses this data, combined with other proprietary sources, to “make their estate agency business more efficient, and more attractive to potential clients”. The release of this data has also coincided with the rise of proptech which is new “businesses using data and technology to innovate in the property sector”.

The Dubai Business Map, developed by the Dubai Economic Development Entity, is one example of how such value from property related data is already being derived in Dubai. The map allows all citizens and businesses to see where businesses are registered — allowing citizens and residents to make decisions about where to live and potential competitors to choose appropriate locations to buy or rent real estate. Activities, and such value-added applications, will likely become more prominent with the additional data open or shared.

Example ‘types’ of data likely to lead to value realisation in this sector include:
— Geospatial data; planning information; demographic data; economic and business information; and housing data.

\textsuperscript{115} Hogge, B. 2015. Open Data: Six Stories About Impact in the UK. Omidyar Network
6 Future monitoring and evaluation of the impact of open and shared data in Dubai

While our high level estimates of the potential economic impacts of open and shared data in Dubai provide an ex-ante assessment of the possible size of the opportunity available to Dubai, achieving this scale of impacts is by no means certain. Understanding the impacts that are actually realised as a result of opening and sharing data requires evaluation. And as the realisation of economic impacts is dependent upon a number of key inputs and activities occurring and certain outcomes arising from this, monitoring progress against each of these dependent variables is important.

In this section of the report, we detail how monitoring and evaluation can be used as a means of understanding the progress that will be made via the Dubai Data initiative to realise the economic impacts of open and shared data over time. We set out the overarching approach that can be used for monitoring and evaluation and the key principles that should be adopted. We also describe how monitoring and evaluation of open data has been undertaken in other smart cities globally.

We then go on to set out a framework that can be adopted in Dubai, based on our logic modelling of the routes to impact from the opening and sharing of data. Our framework includes the KPIs that we recommend are measured and baselined, how the data for these KPIs can be sourced, and how measuring these KPIs will allow for the future estimation of the key impacts arising from open and shared data in Dubai.

6.1 The importance of monitoring and evaluating the impact of open and shared data in Dubai

Evaluation is an important part of the policy making cycle of governments. It is a means of examining the actual implementation and impacts of an intervention to assess whether the ex-ante anticipated impacts were in fact realised. It helps to identify what works, where problems have arisen, highlights good practice, identifies unintended consequences and allows value for money of an initiative to be assessed.116 The findings from such an evaluation should be used to inform and improve future decision-making.

It is good practice that all policies and interventions be subject to comprehensive but proportionate evaluation, where practical to do so.117

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The type of evaluation undertaken should depend on the types of questions trying to be answered:

— a process evaluation assesses how the policy or intervention was delivered;
— an impact evaluation considers the difference a policy or intervention made; and
— a value for money evaluation assesses if the benefits justified the costs.

For Dubai, we were asked to develop an approach that could be used to measure and assess the social and economic impacts of open and shared data – i.e. develop a framework for an impact evaluation. As such, our proposed framework does not include the approaches and metrics required to conduct either a process or value for money evaluation.

6.2 Approaches and key principles of economic impact evaluation

Economic impact evaluation considers the extent to which a policy or intervention has made a difference, in line with the objectives of the policy or intervention.\(^ {118}\)

There are two broad approaches to undertaking an economic impact evaluation to assess the effect of a policy or intervention on key impact measures. The appropriateness of employing each depends on a number of factors including: the context and policy/intervention that is being evaluated; the timing of the evaluation; data availability; and the key insights that the evaluation is seeking to provide,

A macro-economic level assessment could be conducted, using a so called ‘top-down approach’.\(^ {119}\) This approach looks at overall changes in the economy and key economic variables, such as GVA, and seeks to understand the extent to which those economy-level changes can be attributed to the policy or intervention.\(^ {120}\) This can be done through econometric modelling with a measure of the policy or intervention as one explanatory variable, alongside a range of other variables that could also explain the changes being observed in the macroeconomic indicator. For example, if one were to use this approach to estimate the impact of open data on economy wide GVA, an econometric model might be developed with GVA as the dependent variable (the factor that we are seeking to understand the change in) and explanatory variables (the factors that might drive a change in GVA) including a measure of open data (such as the stock of data made open) plus potentially numerous other factors that might drive changes in GVA such as an economic shock, such as a recession, or changes in employment or capital investment in an economy.

In order to use this approach, there is a need to have sufficient data points on each of the variables.\(^ {121}\) Therefore, it is often best suited to evaluating impacts of a policy or intervention a number of years post-implementation. Furthermore, and perhaps most importantly, it is often difficult to establish a cause and effect relationship between the policy or intervention and changes observed in the macroeconomic impact measure. Further, this approach does not allow any insight into what inputs, activities, outputs and outcomes of the policy or

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\(^ {119}\) UK Cabinet Office. 2011. ‘Top down and bottom-up estimation’. Available at: https://data.gov.uk/sib_knowledge_box/top-down-and-bottom-unit-cost-estimation

\(^ {120}\) UK Office for National Statistics. 2010. ‘Measuring the economic impact of an intervention or investment’. Available at: https://data.gov.uk/sib_knowledge_box/top-down-and-bottom-unit-cost-estimation

\(^ {121}\) UK Office for National Statistics. 2010. ‘Measuring the economic impact of an intervention or investment’. Available at: https://data.gov.uk/sib_knowledge_box/top-down-and-bottom-unit-cost-estimation
intervention are specifically driving the end impacts observed. These factors limit the usefulness of this evaluation approach.

An alternative evaluation approach can use a so called ‘bottom-up’ approach based on a theory of change of how the inputs and activities associated with a policy or intervention ultimately lead to end impacts in the economy.¹²²

The relationships between impacts and the policy or intervention are often complex, therefore describing the relationship between an input, activity, output and resulting outcomes and impacts is key. This can be done through the use of a logic model which is a systematic and visual way of presenting the interactions between inputs, activities and impacts. Elements of this logic model can then be quantified and/or monetised to build up to an estimate of the end impacts attributable to the policy or intervention. The process to do this, and how it is applied to the Dubai data context, is detailed in Section 6.3.

This approach requires the collection of more data than an econometric modelling, top-down approach, and therefore can require greater resources to implement. It is also based on fully assessing the underlying theory of change arising from a policy or intervention and is susceptible to underestimation if not all outcomes and impacts are specified and captured within the evaluation. Despite this, it provides a greater level of granularity of the factors driving the end impacts and so provides more detailed insights into how impacts are generated and the levers to impact that can be pulled to realise more significant end impacts.

6.2.1 Key principles of an impact evaluation

Irrespective of the evaluation approach taken, there are a number of key principles of impact evaluation that should be adopted. These principles include: causality; proportionality; and timeliness.

Establishing cause and effect (causality)

Fundamentally, impact evaluation involves (a) determining whether there has been an observed change in line with the objectives, i.e. has there been an impact?; and (b) determining whether the policy was responsible (i.e. it can be attributed).¹²³

To test the extent to which the policy or intervention is responsible for the observed impact it is necessary to estimate what would have happened anyway in its absence. This is known as the counterfactual. Establishing this is not always easy, and in some cases, not possible. In the absence of this, it is important to control for all other potential influences.¹²⁴

It is also important to consider, to the extent possible, the degree to which attribution can be demonstrated based on other evidence (for example, benchmarking or views from stakeholders).¹²⁵

The availability of baseline data is also important to measure the ‘starting point’. The extent to which this can be captured should also be considered prior to a policy or intervention being launched.126

**Proportionality**

Evaluations must be proportional to the risks, scale and profile of the policy or intervention.127 This means the benefits from undertaking an evaluation at a certain scale must be considered against the costs. This is particularly important in relation to the frequency with which evaluations are undertaken.

Measuring impacts in real time or at regular frequency requires significant resources for the collection of the required data for the evaluation and for conducting the analysis. There is likely to be a trade-off between the costs and the benefits derived from such regular monitoring.128 Undertaking monitoring and measurement of impacts at a more regular frequency may enable, for example, better decision-making that tangibly affects the realised impacts of the policy or intervention. However, if these benefits do not outweigh the costs, such monitoring would not be proportionate.

The earlier an evaluation is planned in the policy development process, the more likely it is that it will be possible to consider these trade-offs and choose the most appropriate evaluation.129 And implementing a monitoring and evaluation framework alongside the launch of a policy can allow for more efficient processes, for example for data collection, to be put in place at the outset.

Proportionality is also important in relation to the availability of existing data sources. If a wide range of good quality data sources that capture the impacts already exist, the feasibility of undertaking a robust and regular impact evaluation is increased. However, if impacts are more difficult to measure and require either dedicated data collection (e.g. through surveys) or a way of estimating them from other observed changes, then this requires more resources and time. Therefore, the proportionality of the resources required to collect the data should also be considered.130

**Timeliness**

It is important to consider the most appropriate time intervals at which to conduct evaluations, particularly after the launch of a new policy or initiative.131

While early stage evaluations can provide insights into the immediate impacts of a policy, and allow adjustments to be made rapidly, where required, there are often times lags for the impacts of policy changes to be observed. Some impacts might take some time to appear, for example in terms of the timing between the opening or sharing of data and the realisation of some of the economic impacts. For example, if a potential entrepreneur identifies an

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opportunity based on a dataset, it may be some time before this can be trialled and introduced to the market and then translates into customer demand and changes in business revenues and profit levels.

Sufficient time should be allowed for the full economic impacts of a policy to be realised before an evaluation is conducted, otherwise it risks understating the overall impacts that will be achieved over time.

6.3 Establishing a monitoring and evaluation framework for Dubai to measure the impact of open and shared data

To understand the actual impacts of open and shared data that are realised in Dubai over time, we have developed an economic impact monitoring and evaluation framework that we recommend is implemented to enable a full impact assessment to be undertaken post-implementation of the Dubai Data initiative. It will allow for rigorous measurement of the economic and social impacts as a result of open and shared data in Dubai.

To develop this we have drawn on the above principles, as well as on lessons learnt from monitoring and evaluation frameworks in place (or recommended for) other smart cities.

6.3.1 Impact evaluation frameworks in place in other comparable cities to assess the impact of smart city and open data initiatives

Given that a number of other comparable cities already have initiatives in place related to open and/or shared data, to inform the development of a monitoring and evaluation framework for Dubai we looked to these cities to determine if any insights could be obtained from their experiences.

We conducted a review of how eight world cities measure the success of their smart city and smart data strategies. The eight cities considered include: New York; London; San Francisco; Copenhagen; Amsterdam; Barcelona; Hong Kong; and Singapore. These cities have all implemented smart city and data initiatives and are often seen as leading the way, presenting opportunities for Dubai to identify and implement lessons learnt.

This review was based on web research, conducted in January 2017, looking at evidence of the extent to which the cities had a clear, published strategy in place alongside clear metrics to measure the social and economic impacts being delivered by their open data initiatives or smart city strategies. We considered the extent to which a clear strategy, measurable goals, KPIs, a logic model and an impact evaluation framework exists across these eight cities for either their open data initiative or their smart city strategy. The results of this review is displayed in Figure 8, with the smart city strategies mapped on the vertical axis and open data initiatives on the horizontal axis.

As can be seen in the above matrix, few other cities have developed comprehensive monitoring and evaluation frameworks to measure the impacts of data or smart city initiatives.

San Francisco, New York and London are the only cities with published strategies regarding open and/or shared data with some goals also in place. However, San Francisco goes further than New York or London in that it also has in place a published logic model133 and associated KPIs to undertake some elements of public reporting.

San Francisco has in place a clear smart city strategy underpinned by open data (no shared data appears to be considered). The city has in place a high level logic model to map activities, the quality of the data and the impact.134

The planned activities in San Francisco focus on increasing the number and timeliness of datasets, improving their usability, supporting increased use of data in decision-making and identifying and fostering innovation in open data use.

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133 A logic model is a systematic and visual way of presenting the interactions between inputs, activities and impacts. It is described in greater detail below.

134 DataSF. 2015. ‘How to measure open data’. Available at: https://datasf.org/blog/how-to-measure-open-data/
These activities link to the desired impacts that San Francisco is aiming to achieve:

— a robust and innovative economy;
— quality-outcomes for residents, businesses and visitors using city services;
— increased engagement and empowerment; and
— excellent quality of life and work in the city.

To track its performance, San Francisco has in place an evaluation plan, along with defined KPIs. These KPIs focus on capturing the quality of the open data as well as the number of the datasets. The city recognises the impact measures are often difficult to quantify, noting the KPIs in place are predominantly process metrics. It is working to identify ways of measuring the outcomes and impacts.\(^{135}\) For example, data is collected via an annual survey and this is used on its dashboard. The survey asks basic impact questions such as “how important was open data to creating your service?” in order to assess the extent to which the impacts observed can be attributed to open data.\(^{136}\)

San Francisco recognises a key challenge to its impact evaluation information collection via surveys is poor response rates. In light of this, it also looks to capture additional evidence of economic impact via the use of case studies, focus groups and counts of apps or websites that are made using open data.

In developing the economic impact monitoring and evaluation framework for Dubai we take account of the lessons learnt by San Francisco to ensure, in so far as possible, that our recommended framework seeks to overcome these known pitfalls and draws on the key principles of a robust impact evaluation.

### 6.3.2 Our recommended economic impact evaluation framework to assess the impact of open and shared data for Dubai

As detailed in section 6.3.1 above, we were tasked with developing a recommended framework for monitoring and evaluating the economic impact of open and shared data in Dubai. Our recommended approach draws on the overarching guiding principles and possible approaches for conducting evaluations and the frameworks implemented in other cities – as detailed earlier in this section.

Given the timing for starting the monitoring and evaluation of the economic impact of open and shared data in Dubai (i.e. alongside the first releases of open data on the Smart Dubai Platform) and the need to understand and track the key drivers of the impacts being observed (i.e. the intermediate effects of different activities and inputs), it is recommended that a bottom-up approach to evaluating the economic impact of open and shared data in Dubai is adopted.\(^{137}\)


\(^{136}\) DataSF. 2015. ‘How to measure open data’. Available at: https://datasf.org/blog/how-to-measure-open-data/

\(^{137}\) A macroeconomic level, top-down evaluation approach could be used however estimating the impact, for example on GDP or GVA would be difficult to conduct at such an early stage in the implementation of the open and shared data initiative given that it relies on having sufficient data points, over time, to assess the causal link between the end impact and the data. Even if such an evaluation were conducted in 2021, there would likely still be too few data points for a robust econometric analysis to be conducted. Furthermore, developing the detailed evaluation approach at this stage is difficult as identifying the most relevant specification and all relevant explanatory variables will require testing and modification and this can only be done using the relevant monitoring data.
As was implemented in San Francisco, a logic model is helpful in framing what needs to be captured and measured as part of the monitoring framework for this evaluation approach.

A logic model is a systematic and visual way of presenting the interactions between inputs, activities and impacts. The logic model has five key stages:

1. Inputs – these are the resources required to develop, and to deliver on an ongoing basis, the Dubai Data initiative. They also include other resources used to create value from data, for example costs to businesses of innovating with the data.

2. Activities - those activities required to convert the inputs into something ‘usable’ or ‘valuable’. For example, downloading the data.

3. Outputs – the potential direct results of the activities in the short-term.

4. Outcomes – what might be achieved in the medium-term. This includes both intended and possible unintended consequences.

5. Impacts – the end results that may come about. These should be in line with the intended impacts of the Dubai Data initiative.

The visualisation of the logic model demonstrates the flow of inputs through to impacts and the channels through which they are realised. They also allow for an assessment of the different roles of stakeholders, and how they contribute to the end impacts.

We present the logic model developed for Dubai overleaf. This has been developed based on our review of the literature regarding the impacts of open and shared data, the benchmark estimates derived for the potential economic impact in Dubai and through stakeholder consultation with Dubai Government Entities.

As it can be seen, this captures the key economic and social impacts as per the evaluation question (in yellow). These are the impacts that need to be measured as part of the impact evaluation. This logic model should be read from right (starting with inputs) to left (the vision).
Figure 9: Logic model for Dubai, the impact of open and shared data

The monitoring and evaluation framework we have developed aims to allow the quantification, where possible, of the impacts arising from open and shared data in Dubai. We recommend that this quantification is based on the measurement of KPIs.

The KPIs have been developed to provide a metric for measuring each input, activity, output and outcome in the logic model that feed into the end impact that we are looking to evaluate. To quantify each of these end impacts a number of the KPIs are used. This is detailed, for each area of impact, in section 6.3.3. We also set out in Appendix 6 the full logic model, with KPIs overlaid for each input, activity, output and outcome.

As explained in section 6.2, one of the guiding principles for evaluation is proportionality – that is ensuring the burden (cost) of conducting the evaluation does not outweigh the benefits the evaluation delivers (for example, in terms of enhanced future policy making).

With this in mind, it may not be appropriate for Dubai to conduct a detailed evaluation aiming to quantify each end impact, and to monitor a KPI for every input, activity, output and outcome in the logic model. Instead, the DDE may wish to focus on understanding the impact of only one or two end impacts identified in the logic model and ensure that it conducts a rigorous and robust monitoring and evaluation of these rather than adopt a higher level approach covering more end impacts.

We set out below our thoughts on a deployment approach, specifically the importance of monitoring and evaluating each potential end impact we have identified. The DDE may choose to develop its own prioritisation, however, in line with its key objectives.

— GVA impact of open and shared data: Assessing the contribution to economic activity in an economy (measured in this case in terms of GVA), is normally a key objective of an evaluation. The majority of the outcomes and outputs of the opening and sharing of data make a contribution toward GVA in some way or other. Given that our high level estimates relate to the potential GVA impact, and as this is a key metric that external parties, including other smart cities, would expect Dubai to be able to report as an outcome of any economic impact evaluation, it is recommended that the GVA impact is quantitatively assessed within any future evaluation that Dubai conducts.

Furthermore, the monitoring of the KPIs that are required for the quantification of the GVA impact can draw on economic and financial data already collected by the DSC, although this will need to be combined with some additional information regarding open and shared data use that will need to be gathered.

— Impact on the fiscal position for Dubai Government as a result of open and shared data (i.e. change in government surplus): This forms a significant driver of the economic impacts of shared data in particular and is quantified as part of GVA. Therefore, it does not necessarily need to be measured and reported individually, although via the GVA impact quantification, these figures will be available.

— Impact on employment due to open and shared data: While job creation is often an important objective of government policies, our understanding is that this is not a primary direct objective of the Dubai Data initiative. We have developed an approach to estimating, using a bottom-up approach, the impact on employment, in terms of Full Time Equivalent (FTE) employees. As this can draw on some data already collected by the DSC, and would require new business level data to be collected from the same sources
as the GVA impact analysis requires, the additional burden of measuring this impact may not be significant.

— Impact on innovation and investment due to open and shared data: These impacts are often reported in evaluations although there is no single metric for measuring innovation levels, particularly in monetary terms. Therefore, lesser weight could be placed on monitoring and evaluating performance in this area, particularly as to the extent to which the investment and innovation leads to changes in businesses’ revenues, costs or profits the end effect of this will be an impact on GVA and so is picked up in the GVA impact measure.

— Impact on happiness and well-being due to open and shared data: Given that a key objective of the Dubai Government is to become “the happiest city” it will be important to measure happiness levels overall, although lesser weight could possibly be placed on monitoring and evaluating how much this is driven by open and shared data alone. Indeed, attributing changes in happiness to open and shared data will be difficult and could likely only be done qualitatively.

— Impact on trust in government due to open and shared data: This relates to the trust citizens and the private sector have in the Government, including trust in Dubai Data. Evaluating this impact would generally have been based on a qualitative assessment of perceptions. As these impacts are unlikely to be able to be monetised or robustly measured, this may be an impact of open and shared data that the DDE chooses not to expend significant time and resource in monitoring and evaluating.

We now discuss each of these impacts, and the KPIs that can be used to measure them, in turn. This includes recommendations for deploying the framework, including sources of information and suggested frequency of data gathering. Together, these form the impact evaluation framework that can be implemented by DDE.

Appendix 7 specifies in greater detail the relevant equations and data inputs.

6.3.3 Quantifying GVA and Dubai Government surplus

GVA, as defined in Section 5, is the value of output less the value of intermediate consumption. It includes both direct GVA, indirect GVA and induced GVA. It is one of the highest priority impacts to be monetised from the logic model.

There are two approaches to estimate GVA contributed by the private sector – the income approach and the production approach:

The income approach is \( \text{GVA} = \text{Operating Profit (before tax)} + \text{Employee Costs} + \text{Depreciation} + \text{Amortisation} \).

The production approach is \( \text{GVA} = \text{Turnover (sales)} - \text{cost of goods and services bought in (excl. employee costs)} \).

For the purposes of these estimates, we recommend using the production approach given existing data collected in Dubai. This will require extrapolation of revenue estimates (provided by businesses to the DSC via their annual economic service), the cost of goods

\[^{138}\text{As defined in Section 5, this identifies the wider economic activity generated by the direct GVA. This is via the associated supply chains (indirect GVA) and the further economic activity when employees spend a proportion of their wage in the Dubai economy (induced GVA).}\]
and services bought in and the proportion of these figures attributable to their use of open and/or shared data. The burden of collecting information using this approach is reduced given relevant data is already captured on a monthly basis by the DSC.

Figure 10 overleaf provides an overview of how GVA arising from the open and shared data is measured. This illustrates that the data inputs to the GVA estimates should be sourced from three different types of stakeholders:

— the Dubai Government;
— new businesses created as a result of the open and shared data; and
— existing businesses who use the open and shared data.

The estimates for additional GVA are broken down into these three categories, with the sum of these equalling the total impact.

As can be seen, all estimates of the additional GVA rely first on the direct GVA – that is, economic activity as a direct result of the open and shared data.

Estimating the indirect and induced impacts relies on relevant industry level economic multipliers. Industry multipliers account for the further economic activity that results from the direct economic activity. For example, through the use and re-use of data and the creation of new businesses, economic impact is also indirectly generated through employment and spend of these new businesses through the supply chain. The Dubai input-output tables, from which these multipliers are derived, are expected to available from the DSC in June 2017.  

Where possible, all of these estimates should be broken down by sector in order to better understand which sectors are driving the realisation of economic impacts from open and shared data. Sector level analysis of the GVA impacts also allows for more robust estimates to be derived. Further details on the application of this can be found in Appendix 7.

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139 As confirmed with DSC during stakeholder consultation. The relevant input-output tables are currently under construction/being reviewed internally by the DSC.
To estimate the direct GVA due to Government’s, existing businesses’ and new businesses’ use of open (and for Government, shared) data, Figure 11 and Figure 12 detail the KPIs required.
Figure 11: Measuring direct GVA, due to Government’s use of open and shared data


Figure 12: Measuring direct GVA, due to private sector’s use of open and shared data

The above approach to estimate direct GVA is based, to the extent possible, on information that is already collected by the DSC and Department of Economic Development. Some additional information will be required, particularly in relation to how the data relates to open and/or shared data:

— For the private sector, financial data is already collected from a sample of companies via the DSC’s annual economic survey. This could be the source for the information required for this KPI. However, it is recommended that a further question be built into future surveys to enable attribution to open and shared data to be established. It is recommended that this be built into the DSC survey going forward, if deemed appropriate by all stakeholders.

— For the private sector, information on the number of businesses (by industry and by size) to be used to scale up across the industry (using information on the total number of businesses by sector) is available from the Department of Economic Development. This will need to be combined with information from the DSC economic survey regarding the extent to which businesses use open data, to allow attribution.

— For all estimates, the relevant industry output-to-GVA ratios can be sourced from the DSC.

Table 4 provides greater detail on the information and data required to undertake this estimation for additional GVA generated by the use of open and shared data. Further detail on the underlying equations can be found in Appendix 7.
### Table 4: Information required to measure GVA arising from open and shared data

<table>
<thead>
<tr>
<th>KPI</th>
<th>Description</th>
<th>Source</th>
<th>Baseline</th>
<th>Regularity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct GVA – due to Government (i.e. Government surplus)</td>
<td>Change in revenues through business licenses and taxation</td>
<td>Change in the additional payments made by the private sector to government due to additional activity or new activity generated by open and shared data, as well as any reductions in existing activities. This will involve applying a proportion of license fees and tax revenues attributable to open and shared data (proxied by the proportion of business activity attributable to open and shared data). Revenues should be reported in monetary terms (i.e. AED).</td>
<td>This KPI can be derived from the financial information submitted by a sample of businesses to the DSC as part of their annual economic survey. As part of the DSC survey, respondents should be asked the extent to which their business uses open data. This will be a self-reported measure and the question should be clear and explicit in its definition of ‘use of’ and ‘open data’. It is recommended this survey question is tested by the DDE prior to launch as part of the DSC survey. This proportion will be used as a proxy to measure the extent to which any change in payments to government made by the private sector are attributable to open data. This proportion should then be applied to the value of license fees and taxes paid by the private sector, by sector. This will be collected from Government Entities. Further details on this are described in Appendix 7.</td>
<td>Baseline is 0.</td>
</tr>
<tr>
<td></td>
<td>Government Entities’ cost savings from more efficient operations (due to improved policies or efficiency gains)</td>
<td>The resulting cost savings from more efficient government operations as a result of the use of open/ shared data – this may be the result of better policy decisions, new and improved services and a greater understanding of the needs and demands of other Entities, the private sectors and residents/ visitors. Cost savings should be reported in monetary terms (i.e. AED).</td>
<td>This KPI will be derived via a survey launched to Government Entities. The survey should ask directly for an estimate of the cost impact of the Entities’ use of open/ shared data, by type of data. This will be a self-reported measure and the question should be clear and explicit in its definition of ‘open/ shared data’ and examples of cost savings to provide further context. It is recommended this survey question is tested by the DDE prior to launch as part of the DSC survey. It should also be ensured that transition costs are accounted for in the estimates, i.e. the costs of changing the policy or service before any efficiency gains are realised.</td>
<td>Baseline is 0.</td>
</tr>
<tr>
<td></td>
<td>Government Entities cost savings: IT</td>
<td>Any cost saving arising as a result of consolidation of ICT infrastructure across all Government Entities.</td>
<td>Based on our understanding from stakeholder consultation, an ICT subcommittee is currently collecting information on the cost of ICT infrastructure.</td>
<td>Current spend on ICT infrastructure across all Entities.</td>
</tr>
<tr>
<td>Link to logic model</td>
<td>KPI</td>
<td>Description</td>
<td>Source</td>
<td>Baseline</td>
</tr>
<tr>
<td>--------------------</td>
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<td>-------------</td>
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<tr>
<td>infrastructure consolidation</td>
<td>Cost savings should be reported in monetary terms (i.e. AED)</td>
<td>across all Government Entities. An estimate of the expected reduction in this, due to the use of the Smart Dubai platform, should be undertaken based on the information collected.</td>
<td></td>
<td>the ICT sub-committee.</td>
</tr>
<tr>
<td>Change in revenues from value-added services</td>
<td>This captures the additional revenues to government as a result of the sale of value-added services. Revenues should be reported in monetary terms (i.e. AED).</td>
<td>This KPI will be derived via a survey launched to Government Entities. The survey should ask for an estimate of the additional revenues realised due to value-added services. This could also be gathered directly from Government Entities by the DDE, via its responsibility in relation to selling value-added data/services, as per the policy framework.</td>
<td>Government Entities’ current revenues from the sale of value-added services on an ad-hoc basis.</td>
<td>Annual, or as frequently as surveyed or collected.</td>
</tr>
<tr>
<td>Government Entities spending on value-added services (i.e. costs)</td>
<td>This captures the internal resources spent on developing the value-added services based on data sold (alongside revenues captured above). Spending should be reported in monetary terms (i.e. AED).</td>
<td>This KPI captures the resources required to develop the value-added services (as above). As above, this information could be gathered from a survey launched to Government Entities. Alternatively, it could be gathered based on financial records for Government Entities (whether this is gathered by DDE or submitted by Government Entities on an annual basis). The resources should include any capital expenditure and operating expenditure.</td>
<td>Government Entities’ current costs for the development of value-added services on an ad-hoc basis.</td>
<td>Annual, or as frequently reported.</td>
</tr>
<tr>
<td>Government Entities resources to prepare the raw data and extend/enrich the data offer (i.e. costs)</td>
<td>This captures the resources used by Government Entities to collect, clean and publish open and shared data. The cost of resources should be reported in monetary terms (i.e. AED), including staff related costs.</td>
<td>This information should be gathered based on financial records for Government Entities (whether this is gathered by DDE or submitted by Government Entities on an annual basis). The resources should include any capital expenditure and operating expenditure, including staff related costs.</td>
<td>The information would need to be compiled by Government Entities and reported as a 2017 baseline figure. We know there are currently 180 data team members from 31 Entities.</td>
<td>Annual, or as frequently reported.</td>
</tr>
<tr>
<td>Link to logic model</td>
<td>KPI</td>
<td>Description</td>
<td>Source</td>
<td>Baseline</td>
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<td>--------------------</td>
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</tr>
<tr>
<td></td>
<td>Smart Dubai Platform resources (i.e. costs)</td>
<td>This captures the resources to operate the Smart Dubai platform. The cost of resources should be reported in monetary terms (i.e. AED).</td>
<td>We understand there will be resources incurred separately by the Government and Du. Data on both of these should be collected to ensure all resource inputs are accounted for. This should consider any capital expenditure and operating expenditure.</td>
<td>We know the Smart Dubai Platform will cost Dubai Government AED 120 million over the next 5 years. Up-to-date figures will need to be compiled by Du and DDE.</td>
</tr>
<tr>
<td></td>
<td>DDE budget</td>
<td>This captures the input resources of the DDE to monitor compliance, assist with the Government Entities with the implementation of the Dubai Data initiative and any other day-to-day activities. This should consider any capital expenditure and operating expenditure. The budget should be reported in monetary terms (i.e. AED).</td>
<td>This should be captured based on internal financial information.</td>
<td>DDE budget for 2017 is AED 30 million.</td>
</tr>
</tbody>
</table>

**Direct GVA – due to private sector**

| Revenue realised by businesses | This captures changes in business revenues realised by businesses annually. Revenue should be reported in monetary terms (i.e. AED). | This KPI can be derived from the financial information submitted by a sample of businesses to the DSC as part of its annual economic survey. As part of the DSC survey, respondents should be asked the extent to which their business uses open data (see KPI below). Businesses already submit information on their revenue and this will be used for the estimation. This information should be segmented by size of business and industry. | Revenue from previous years can be used as baseline (see KPI below). | Annual, in line with DSC data collection. |

<p>| Proportion of revenue attributable to | This captures revenue attribution and the extent to which business revenue (or a change in business revenue) relates to open and shared data. | The DSC undertaken an annual economic survey where revenue information is submitted. It is recommended that an additional question is added to this survey to ask businesses the extent to which their baseline to be collected next fiscal year. | Annual, in line with DSC data collection. |</p>
<table>
<thead>
<tr>
<th>KPI</th>
<th>Description</th>
<th>Source</th>
</tr>
</thead>
</table>
| open and shared data | This should be reported as a proportion (%) which can be applied to revenues. | business model is reliant on, or attributable to, open data. This will then be used as evidence regarding attribution.  
This will be a self-reported measure and the question should be clear and explicit in its definition of ‘use of’ and ‘open data’. It is recommended that the relevant survey questions are tested by the DDE prior to launching as part of the DSC survey. |
| Number of existing businesses operating in the industry using open/ shared data | This is the number of existing businesses using open/ shared data operating in the industry and is used in the calculations to scale the revenues (as calculated above).  
This should be reported as an absolute number of businesses. | Department of Economic Development data on existing business registration.  
Information gathered on attribution captured from an additional question in the DSC annual economic survey (as above) will also be required here.  
Baseline to be collected once attribution established.  
Annual, in line with DSC data collection. |
| Number of new businesses operating in the industry using open/ shared data | This is the number of new businesses using open/ shared data operating in the industry and is used in the calculations to scale the revenues (as calculated above).  
This should be reported as an absolute number of businesses. | Department of Economic Development data on new business registration.  
Information gathered on attribution captured from an additional question in the DSC annual economic survey (as above) will also be required here.  
Baseline to be collected once attribution established.  
Annual, in line with DSC data collection. |

6.3.4 Measuring the change in employment in Dubai due to open and shared data

As shown in the logic model, there could potentially be an impact on the number and types of jobs as a result of open and shared data use, both in the public and private sector.

How this is considered and estimated is shown below in Figure 13.

**Figure 13: Measuring the change in Dubai jobs (measured in FTE), due to open and shared data**

This impact can be quantified if information is gathered from companies and Government Entities on the extent to which jobs can be attributed to open and shared data. The following table details the information required to undertake this quantification.

### Table 5: Information required to estimate the change in employment in Dubai due to open and shared data (measured in FTE)

<table>
<thead>
<tr>
<th>Link to logic model</th>
<th>KPI</th>
<th>Description</th>
<th>Source</th>
<th>Baseline</th>
<th>Regularity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Change in public sector employment due to open and shared data</td>
<td>Change in public sector employment due to open and shared data</td>
<td>This captures the change in public sector employment as a result of using Dubai open/ shared data. In the first year, this should be an absolute number (Full Time Equivalent, FTE) to ensure a baseline is gathered. Thereafter, either the change in, or the absolute number, can be collected.</td>
<td>This KPI would require Government Entities to self-report the number of employees and proportion of these employees’ jobs reliant on open/ shared data and the Dubai Data initiative. This will be self-reported, so the descriptions of open/ shared data, and the extent to which jobs rely on it, should be explicit. It is recommended these survey questions are tested prior to launch. This could be gathered via a survey launched to Government Entities.</td>
<td>There is no baseline data on attribution (i.e. proportion of jobs currently reliant on open/ shared data) currently available.</td>
<td>Annual.</td>
</tr>
<tr>
<td>Change in private sector employment due to open and shared data</td>
<td>Change in private sector employment due to open and shared data</td>
<td>This KPI captures the number of employees across the private sector whose job uses Dubai open data to some extent. In the first year, this should be an absolute number (FTE) to ensure a baseline is gathered. Thereafter, either the change in, or the absolute number, can be collected.</td>
<td>Data on number of employees per business is already submitted by a sample of businesses to the DSC as part of its annual economic survey. It is proposed an additional question to ascertain the extent to which these employees’ jobs rely on, or are linked with, open data be added. This is similarly a self-reported measure and the question should be clear and explicit in its definition of ‘use of’ and ‘open data’. It is recommended these survey questions are tested prior to launch.</td>
<td>There is no baseline data on attribution (i.e. proportion of jobs currently reliant on open/ shared data) currently available.</td>
<td>Annual – in line with DSC economic survey.</td>
</tr>
</tbody>
</table>

6.3.5 Monitoring and evaluating other economic and social impacts from open and shared data in Dubai.

Innovation and investment impacts of open and shared data

Additional innovation and investment, as a result of open and shared data is one of the potential impacts identified in our logic model. To the extent to which this innovation and investment results in a change in economic activity (for example revenue growth from new or improved products and services) the end impact of the change in innovation and investment activity will be captured within the GVA impact evaluation approach.

However, there are a number of direct measures of innovation and investment that could be quantified separately if the DDE wishes. These include the change in investment spending (capital expenditure – capex); the change in the number of patents linked to use of open data; and the number of innovations in terms of the number of new products and services developed as a result of open/ shared data. These metrics will provide an indication of the scale of change in innovation and investment activity, arising from the opening of data.

Figure 14: Innovation and investment due to open and shared data

[Diagram showing the relationship between change in innovation & investment due to open data and other metrics such as change in investment due to open data, change in patents due to open data, and new products & services due to open data.]


The following table describes the information required to measure these KPIs to track innovation and investment.
<table>
<thead>
<tr>
<th>Link to logic model</th>
<th>KPI</th>
<th>Description</th>
<th>Source</th>
<th>Baseline</th>
<th>Regularity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Business expansion: Change in investment due to open data</td>
<td>This captures changes in investment levels by businesses due to open data used for business expansion. It could be the result of innovation by the private sector as a result of aggregation, enriching and enabling data. This will not necessarily reflect total investment but will be an indication of the level of investment and the change in this over time. This should be reported in monetary terms (i.e. AED).</td>
<td>Information regarding investment is submitted by a sample of businesses to the DSC annually via the economic survey. An additional question regarding the extent to which this investment uses, or is based on, open data could be added. However, this will not capture investment being undertaken by entrepreneurs or individuals that may not take place within a registered business. As this is self-reported, a description of open/ shared data, and the extent to which the investment can be attributed to it should be explicit. (It is recommended this the survey question is tested prior to launch.) Alternatively, an independent survey to users of the data could be launched by the DDE to understand the extent to which investment is being driven by the download/ use of the data.</td>
<td>The first phase of data collection will be treated as the baseline. Thereafter, the change should be measured.</td>
<td>Annual.</td>
<td></td>
</tr>
<tr>
<td>Business expansion: Change in patents due to open data</td>
<td>This captures the change in the number of patents lodged/ applied for annually linked to the use of open data. This is not used for total measurement of innovation, but is an indicator of progress. This should be reported in absolute number of patents linked to the use of open data</td>
<td>The DSC economic survey asks a sample of businesses whether they hold any patents. An additional question regarding the extent to which these patent rely on, or relate to, open data could be added.</td>
<td>There is no baseline currently available as attribution of any existing patents to the use of open data is not possible based on current information available from the DSC economic survey. The first phase of data collection will be treated as the baseline. Thereafter, the change should be measured.</td>
<td>Annual.</td>
<td></td>
</tr>
<tr>
<td>Business expansion: New products &amp; services due to open data</td>
<td>This captures the new products or services developed by the private sector based on open data. This is not used for total measurement of innovation, but will be useful as an indicator of progress. This is an absolute number of products/ services linked to the use of open data.</td>
<td>This would need to be derived based on an additional question asked in the DSC survey to understand the extent to which new products/ services are being developed based on open data. Similar self-reported cautions as above.</td>
<td>The first phase of data collection will be treated as the baseline. Thereafter, the change should be measured.</td>
<td>Annual.</td>
<td></td>
</tr>
</tbody>
</table>

Happiness and well-being impact of open and shared data

The vision of the Smart Dubai initiative is to make Dubai “the happiest city in the world”, therefore this is deemed an important indicator of the Smart Dubai initiative.

A number of international agencies, such as the OECD\textsuperscript{140}, as well as national statistics agencies (for example, the UK Office of National Statistics\textsuperscript{141}), have measures in place to assess well-being, quality of life and/ or happiness. These indices generally contain a range of metrics, for example the ONS accounts for personal well-being by measuring levels of satisfaction with life, degrees of happiness and levels of anxiety. Each of these is assessed based on individual responses to survey questions, given on a scale of one to 10.

Dubai already has in place a Happiness Meter to measure the happiness of Dubai’s citizens, residents and visitors especially when they interact with Dubai Government services, on a scale of happiness from one to three.\textsuperscript{142}

For this framework, rather than drawing on metrics from international agencies, we suggest drawing on Dubai’s existing measure of happiness, given that this would be a more proportionate evaluation approach. We suggest happiness could be measured at two levels: a Government Entity website or service centre. On the website, the meter can be implemented on an application level or transactional level. This should allow the meter to be implemented on services or transactions that use, or are based on, open and shared data.

Therefore, to measure the impact of open and shared data on happiness and well-being, the following approach could be applied:

**Figure 15: Change in happiness and well-being due to open and shared data**

![Figure 15: Change in happiness and well-being due to open and shared data](https://example.com/figure15)


There are also a number of other qualitative KPIs that the DDE can track to understand the extent to which users are engaging with government services that use/ are based on open and shared data that may contribute to a change in happiness or well-being. Although this will not allow an aggregate measure, they will provide insight on how the change in happiness is being achieved. These have been briefly summarised in Table 7.

\textsuperscript{140} OECD Better Life Index. Available at: [http://www.oecdbetterlifeindex.org/](http://www.oecdbetterlifeindex.org/)


\textsuperscript{142} Smart Dubai. 2017. ‘Happiness Portal’. Available at: [https://happinessportal.dubai.ae/en/Pages/AboutUs.aspx](https://happinessportal.dubai.ae/en/Pages/AboutUs.aspx)
Table 7: Possible indicators to provide insight on how the change in happiness and well-being due to open and shared data is achieved

<table>
<thead>
<tr>
<th>Link to logic model</th>
<th>KPI</th>
<th>Description</th>
<th>Source</th>
<th>Baseline</th>
<th>Regularity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residents and Visitors can use Personal Dashboards and new/ improved products to make better choices.</td>
<td>Use of smartphone applications</td>
<td>The number of users downloading and using apps or services that use, or are based on, open/ shared data. This should be reported in terms of the number of unique users.</td>
<td>This information could be gathered based on a survey to citizens or residents asking them to provide information regarding their app use. Alternatively, this could be gathered from the designers/ owners of apps (where possible).</td>
<td>No baseline data currently available.</td>
<td>Annual, or as frequently as surveyed.</td>
</tr>
<tr>
<td>Improved policies, regulations or initiatives enabled by open/ shared data, by type of data</td>
<td>Tailored individual services enabled by open/ shared data, by type of data</td>
<td>The extent to which government services have been tailored to the individual. This should be reported as a qualitative and self-reported measure by Government Entities (e.g. to a great extent, to some extent etc.).</td>
<td>This KPI would need to be derived based on a survey launched to Government Entities by the DDE. The survey would need to ask Entities to estimate the extent to which they have been able to tailor services due to open and shared data.</td>
<td>No baseline data currently available.</td>
<td>Annual, or as frequently as surveyed.</td>
</tr>
<tr>
<td>Improved policies, regulations or initiatives enabled by open/ shared data, by type of data</td>
<td>Improved policies, regulations or initiatives enabled by open/ shared data, by type of data</td>
<td>This refers to the extent to which Government Entities have been able to improve their policies, regulations or initiatives as a result of the open and shared data. For example, by enabling early intervention for child services or reducing duplication of similar efforts to collect data. This should be reported as a qualitative and self-reported measure by Government Entities (e.g. to a great extent, to some extent etc.).</td>
<td>This KPI would need to be derived based on a survey launched to Government Entities by the DDE. The survey would need to ask Entities to estimate the extent to which they have been able to improve their policies, regulations or initiatives due to open/ shared data.</td>
<td>No baseline data currently available.</td>
<td>Annual, or as frequently as surveyed.</td>
</tr>
<tr>
<td>New policies, regulation or initiatives linked to, or based on, the use of open and shared data</td>
<td>New policies, regulation or initiatives linked to, or based on, the use of open and shared data</td>
<td>This refers to the extent to which open and shared data has enabled new policies, regulations or initiatives to develop. This should be reported as a qualitative and self-reported measure by Government Entities (e.g. to a great extent, to some extent etc.).</td>
<td>This KPI would need to be derived based on a survey launched to Government Entities by the DDE. The survey would need to ask Entities to estimate the extent to which they have been able to introduce new policies, regulations or initiatives due to open/ shared data.</td>
<td>No baseline data currently available.</td>
<td>Annual, or as frequently as surveyed.</td>
</tr>
</tbody>
</table>

Change in the level of trust in government as a result of open and shared data

Enhancing trust in government is another one of the key aims of the Smart Dubai initiative. We consider this in two parts:

1. Trust and transparency in government. This will be considered based on the number of datasets opened up by government, as well as self-reported perception of government transparency and levels of trust by data users.

2. Trust in Dubai data. This will be measured by self-reported perception by users.

In general trust and transparency in government is assessed by indices, for example the World Bank’s CPIA measure of transparency, accountability and corruption.\(^1\) However, such measures account for overall levels of trust in government, and don’t account for open or shared data in particular.

For the impact framework for Dubai, we suggest trust could be tracked by allowing users to self-report their views on Dubai data and how it impacts on their trust. This would need to be based on additional pop up survey pages on the Smart Dubai Platform or for government services based on open/ shared data, to enable insights into the users’ perception of trust in government. The user would need to self-report their opinion on their level of trust, the transparency of government and the reliability of the data. This could be reported consistently with the happiness indicator (i.e. a scale of one to three).

These indicators could be collated for relevant Government Entity services using open and shared data. This is shown in Figure 16.

**Figure 16: Change in the level of trust in Government as a result of open and shared data**

![Diagram](https://via.placeholder.com/150)


Similar to the measure of happiness, there are a number of other qualitative KPIs that the DDE could track to understand the extent to which users are engaging with government services using open and shared data that may impact on their perception of trust. The following table details some KPIs that can be used to measure this level of engagement to provide insight on how changes in perception of trust may come about.

---
### Table 8: Possible indicators to provide insight on how the change in the level of perceived trust in government as a result of open and shared data is achieved

<table>
<thead>
<tr>
<th>Link to logic model</th>
<th>KPI</th>
<th>Description</th>
<th>Source</th>
<th>Baseline</th>
<th>Regularity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residents and visitors engage with Government data</td>
<td>Level of engagement: Citizen interactions with government</td>
<td>This considers the extent to which open and shared data has changed citizens or residents interaction with Government Entities. This could be either in reducing the need for interaction (e.g. reducing processes or duplication), or by increasing the level of engagement (e.g. greater data availability enables a greater level of personalized and tailored services). This should be reported as a change in the level of interaction measured in terms of number of interactions and/or time spent on interactions year-on-year, with Government.</td>
<td>Information on any changes in the level of engagement would need to be gathered from a survey launched to citizens or residents. This could be issued as a discrete survey or as a popup on Government Entity websites/ government services. The survey would need to ask to what extent the citizens’ interaction with Government Entities have changed as a result of open data and services supported by open/ shared data measured in terms of number of interactions and/or time spent on interactions.</td>
<td>No baseline data currently available. Given that users will be asked to provide responses relating to the amount of change, rather than an absolute level, a baseline will not be strictly required.</td>
<td>Annual, or as frequently as surveyed.</td>
</tr>
<tr>
<td>Change in private sector interactions/ collaboration with Data/ Government due to open data</td>
<td>Level of engagement: Private sector interactions with government</td>
<td>This considers the extent to which open and shared data has changed private sector interactions with Government Entities. Similar to citizens, this could be either a reduction or an increase depending on the data type and how it is used. This should be reported as a change in the level of interaction measured in terms of number of interactions and/or time spent on interactions year-on-year, with Government.</td>
<td>As above, this would be sourced from a survey to the private sector. This could be a discrete survey or a popup on the Government Entity website/ government services. The survey would need to ask to what extent the business’ interaction with Government Entities have changed as a result of open data and services supported by open/ shared data measured in terms of number of interactions and/or time spent on interactions.</td>
<td>No baseline data currently available. Given that users will be asked to provide responses relating to the amount of change, rather than an absolute level, a baseline will not be strictly required.</td>
<td>Annual, or as frequently as surveyed.</td>
</tr>
<tr>
<td>Link to logic model</td>
<td>KPI</td>
<td>Description</td>
<td>Source</td>
<td>Baseline</td>
<td>Regularity</td>
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<td>------------</td>
</tr>
<tr>
<td>Change in intra-govt. interaction/collaboration between Dubai Government Entities due to open/shared data</td>
<td>Level of engagement: Interaction between Entities</td>
<td>This considers the extent to which open and shared data has changed interaction between Government Entities. It could reduce interaction (by reducing duplication) or increase it (by enhancing visibility of data held by different Entities). This should be reported as a change in the level of interaction or collaboration measured in terms of number of interactions and/ or time spent on interactions measured in terms of number of interactions and/ or time spent on interactions year-on-year, with government.</td>
<td>This could be sourced from a survey to Government Entities. It would need to ask to what extent the interactions between Government Entities has changed as a result of open/ shared data measured in terms of number of interactions and/ or time spent on interactions year-on-year, with government.</td>
<td>No baseline data currently available. Given that users will be asked to provide responses relating to the amount of change, rather than an absolute level, a baseline will not be strictly required.</td>
<td>Annual, or as frequently as surveyed.</td>
</tr>
<tr>
<td>Residents and Males can use Personal Dashboards and new/ improved products to make better decisions</td>
<td>Private sector/ individual satisfaction</td>
<td>This considers the satisfaction of the private sector, citizens and residents with the new or improved services, enabled by shared or open data. This should be reported as a satisfaction level, using a similar approach to the happiness meter (with three levels of satisfaction).</td>
<td>This KPI could be derived using a satisfaction meter (similar to the happiness meter). This would involve a popup survey to users, when utilising government services based on open or shared data. It would need to ask to what extent the open data or services underpinned by open data have enhanced their satisfaction with the government.</td>
<td>No baseline data currently available. Given that users will be asked to provide responses relating to the amount of change, rather than an absolute level, a baseline will not be strictly required.</td>
<td>Annual, or as frequently as surveyed.</td>
</tr>
</tbody>
</table>

6.3.6 Additional KPIs to assess the effect of open and shared data – leading indicators of impact

There are a number of additional KPIs that can be used to monitor some of the inputs and activities captured within the logic model. The tracking of these input and activity measures will provide an indication of the possible scale of end impacts that might be achieved and to identify where a greater scale of input or activity may be required.

Given that the chain to realising the end outcomes and impacts is dependent on the inputs and activities taking action – i.e. the leading impact – measurement and tracking of these are an important means of influencing the end impacts.

Furthermore, while it may take some time for the end impacts to be observed (due the chain of events activities, outputs and impacts that lead to them), it is likely to be more possible to monitor the inputs and activities in real time and the processes for tracking the metrics could, in some cases, be built in to the design of the Smart Dubai electronic platform.

The suggested additional leading indicator KPIs to monitor performance against are detailed in Table 9.
### Table 9: Additional monitoring KPIs – leading indicators of impact

<table>
<thead>
<tr>
<th>Link to logic model</th>
<th>KPI</th>
<th>Description</th>
<th>Source</th>
<th>Baseline</th>
<th>Regularity</th>
</tr>
</thead>
<tbody>
<tr>
<td>A framework to govern the publication and exchange of data</td>
<td>This relates to the provision of a clear framework that governs the publication and exchange of data. This should relate to both the public sector and private sector use of data. This will be measured qualitatively. See source for further detail.</td>
<td>This KPI can be binary in nature (i.e. the framework exists or it does not). It could also target adherence to this framework, depending on how DDE captures compliance and whether this can be applied.</td>
<td>The baseline will depend on how DDE chooses to measure the framework.</td>
<td>Annually, depending on frequency of update</td>
<td></td>
</tr>
<tr>
<td>% datasets up to standard (by star rating)</td>
<td>This KPI captures the proportion of the datasets on the Smart Dubai platform that meet a 5, 4, 3, 2, 1 star rating (total should add to 100%). This is a rating system applied by the datasets, as per the Dubai Data manual. This should also be broken down by the data owner (i.e. the Government Entity who owns the data). This will be measured as a proportion of all datasets (i.e. % meeting 5 star rating, % meeting 4 star rating etc.).</td>
<td>The information for this KPI should be sourced from Du or DDE, depending on who is responsible for recording the star rating information.</td>
<td>There is no baseline data currently available. 2017 baseline data can be gathered for the initial 41 datasets being put on the platform imminently.</td>
<td>Annually or real time</td>
<td></td>
</tr>
<tr>
<td>Change in maturity</td>
<td>This KPI captures the change in the level of data maturity of Government Entities. Level of data maturity refers to an assessment of the ability for Government Entities to collect, publish and consume data, and the governance framework around this. The unit of measurement will depend on how data is being collected by DDE.</td>
<td>Data maturity is being tracked by DDE as part of its compliance role. Information derived from this should be used to measure maturity.</td>
<td>There is no baseline data currently available. DDE’s assessment of the data maturity of each Entity should be undertaken to establish a 2017 baseline.</td>
<td>Annually</td>
<td></td>
</tr>
<tr>
<td>% of Dubai government staff completing an assessment against the Dubai Data Competency Framework</td>
<td>This captures the overall proportion of all Dubai government staff who have completed an assessment against the Dubai Data Competency Framework. Completion rate data should be measured by Entity and by role, if possible.</td>
<td>Information regarding the staff who have been assessed should be held by DDE, who is managing and delivering the training.</td>
<td>The baseline will be 0 – with no staff being assessed prior to the introduction of the framework.</td>
<td>Monthly</td>
<td></td>
</tr>
<tr>
<td>Link to logic model</td>
<td>KPI</td>
<td>Description</td>
<td>Source</td>
<td>Baseline</td>
<td>Regularity</td>
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<tr>
<td></td>
<td>% of Dubai government staff that have all the required competencies for their role</td>
<td>This captures the overall proportion of government staff who have acquired all the relevant competencies for their role. The unit of measurement will be a proportion (%).</td>
<td>As above, information regarding the staff who have been assessed should be held by DDE, who is managing and delivering the training.</td>
<td>The baseline will be 0 – with no staff being assessed prior to the introduction of the framework.</td>
<td>Monthly</td>
</tr>
<tr>
<td></td>
<td>Functionality of platform</td>
<td>This KPI captures whether the system can handle the requests and activity taking place. It should consider if there has been any downtime or if there are performance consequences. The best way to capture this should be determined by the operators of the Smart Dubai platform in line with the service level agreement in place. The unit of measurement will depend on how this is captured by Du and the performance metrics analysed.</td>
<td>If possible, the specific KPIs to track should be based on the service level agreement in place between Du (the platform operators) and the Smart Dubai Office.</td>
<td>Baseline will need to be established when the Platform launches the first datasets.</td>
<td>Monthly or in real time, depending on frequency of updates from platform provider</td>
</tr>
<tr>
<td></td>
<td>Number of datasets available</td>
<td>This KPI should consider both the absolute number and the change in the number of datasets available (in comparison to the baseline and previous periods). This should consider separately: • The number of shared datasets available, by Government Entity • The number of open datasets available, by type of data • The number of value added datasets available, by type of data This should be reported in absolute numbers.</td>
<td>Information on the number of datasets available can be reported by the platform operators/ Du.</td>
<td>Baseline for the electronic platform is 0, with no datasets currently available. Baseline information regarding datasets already open/ shared (not on the platform) would have to be collated from Government Entities.</td>
<td>Monthly or in real time (but few updates, ~50/month)</td>
</tr>
<tr>
<td>Link to logic model</td>
<td>KPI</td>
<td>Description</td>
<td>Source</td>
<td>Baseline</td>
<td>Regularity</td>
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</tr>
<tr>
<td><img src="image1.png" alt="Image" /></td>
<td>Public awareness</td>
<td>This KPI captures public awareness of the electronic platform. This should consider all users, including Government Entities, citizens/residents and private companies. Tracking public awareness, particularly related to, or following, market engagement activities, could be a useful measure to evaluate the success of such activities. This should be reported as a qualitative and self-reported measure (e.g. to a great extent, to some extent etc.).</td>
<td>This could be gathered from ad hoc surveys to citizens, residents, the private sector and other Government Entities. Baseline will need to be established when the Platform launches the first datasets.</td>
<td>Annually. Greater regularity of monitoring, particularly in the early phases, would likely be beneficial.</td>
<td></td>
</tr>
<tr>
<td><img src="image2.png" alt="Image" /></td>
<td>Level of online activity</td>
<td>This KPI would measure the level of online activity around the Smart Dubai platform and searches for the platform/particular datasets (i.e. ‘hits’). This should be measured in absolute terms and the change seen in activity.</td>
<td>Du or the DDE will be able to track hits on the website. Additional socially generated data regarding online searches could also be used.</td>
<td>There is no baseline data currently available. Baseline data could be collected on the current use of the DSC website and related data to ascertain the additionality from the new platform and data initiative.</td>
<td>Quarterly - this will enable DDE to track any changes in awareness</td>
</tr>
<tr>
<td><img src="image3.png" alt="Image" /></td>
<td>Compliance with Dubai Data law and policy framework</td>
<td>This KPI considers the level of compliance by Government Entities. How this is measured and the frequency of monitoring will be dependent on DDE’s approach to monitoring compliance. The unit of measurement will also depend on DDE’s approach.</td>
<td>This will need to be consistent with DDE’s approach to monitoring and recording compliance. There is no baseline data currently available.</td>
<td>Annually</td>
<td></td>
</tr>
<tr>
<td><img src="image4.png" alt="Image" /></td>
<td>External requests for new data</td>
<td>This KPI measures the number of external requests received for new data, and the proportion of these met.</td>
<td>Information on the number of these requests should be submitted by the Government Entity who owns the dataset, A 2017 baseline would need to be collected from each Government Entity (if aggregate)</td>
<td>Annually or real time if tracked on platform</td>
<td></td>
</tr>
<tr>
<td>Link to logic model</td>
<td>KPI</td>
<td>Description</td>
<td>Source</td>
<td>Baseline</td>
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<tr>
<td></td>
<td></td>
<td>This should include data requests from other Government Entities, private companies and citizens/residents. The unit of measurement will be the absolute number of external requests for new data.</td>
<td>by shared datasets, by open datasets. Alternatively, if all requests are made via the platform, this would be the source of information.</td>
<td>information available.</td>
<td>Annually or real time if tracked on platform</td>
</tr>
<tr>
<td>External requests for improved data</td>
<td></td>
<td>This KPI measures the number of external requests for improved data, and the proportion of these met. This should include requests from other Government Entities, private companies and citizens/residents. The unit of measurement will be the absolute number of external requests for improved data. Information on the number of these requests should be submitted by the Government Entity who owns the dataset, by shared datasets, by open datasets.</td>
<td>Information on the number of these requests should be submitted by the Government Entity who owns the dataset, by shared datasets, by open datasets. Alternatively, if all requests are made via the platform, this would be the source of information.</td>
<td>A 2017 baseline would need to be collected from each Government Entity (if aggregate information available).</td>
<td>Annually or real time if tracked on platform</td>
</tr>
<tr>
<td>Number of datasets viewed</td>
<td></td>
<td>This KPI relates to the number of datasets that are viewed. Although this does not indicate the actual use of the data, it will still provide an indication of how often it is accessed. This information should be collected in absolute numbers.</td>
<td>This should be collected from the platform.</td>
<td>There is no baseline data currently available. A 2017 baseline would need to be collected from each Government Entity (if aggregate information available).</td>
<td>Real time</td>
</tr>
<tr>
<td>Number of datasets downloaded</td>
<td></td>
<td>This KPI relates to the number of datasets that are bought and/or downloaded. Although this does not indicate the actual use of the data, it will still provide an indication of how often it is downloaded.</td>
<td>This should be collected from the platform.</td>
<td>There is no baseline data currently available. A 2017 baseline would need to be collected from each Government Entity (if aggregate information available).</td>
<td>Real time</td>
</tr>
<tr>
<td>Link to logic model</td>
<td>KPI</td>
<td>Description</td>
<td>Source</td>
<td>Baseline</td>
<td>Regularity</td>
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</tr>
<tr>
<td></td>
<td></td>
<td>This information should be collected in absolute numbers.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dubai datasets shared with Dubai Government Entities</td>
<td>Shared data permissions</td>
<td>This KPI aims to capture the number of requests for access to shared data. This should capture both the number of requests as well as the number of requests granted.</td>
<td>This should be submitted by Government Entities to the DDE. Alternatively, if requests for shared data are made via the platform, this could be provided by the platform providers/ Du.</td>
<td>Government Entities currently share data on an ad-hoc basis. The extent to which this occurs is the baseline and will need to be collected from Government Entities.</td>
<td>Real time if tracked on the Smart Dubai platform</td>
</tr>
<tr>
<td><strong>POTENTIAL OUTPUTS</strong></td>
<td>Use of datasets</td>
<td>This considers how datasets are used (i.e. the purpose). To evaluate the usefulness of datasets, there are two elements to consider: (1) Qualitative usefulness – i.e. is it helpful for a particular purpose. (2) Practical usefulness – i.e. is the data as described, clean, dense enough etc. This would be a qualitative and self-reported measure of usefulness (e.g. very useful, quite useful etc.).</td>
<td>A short popup survey to users when downloading data could be implemented as part of the platform. This could ask how the user intends to use the data. This will enable some real time monitoring of the use of dataset. It is important to note, this is only an ex-ante view. To understand how the data has actually been used would require follow-up surveying of users downloading the data.</td>
<td>There is no baseline data currently available. A 2017 baseline would need to be collected from each Government Entity (if aggregate information available) or established at the launch of data on the platform.</td>
<td>Ex ante measure could be measured in real time. Ex-post would be annual, or as frequently as surveyed</td>
</tr>
</tbody>
</table>

7 Concluding remarks

Dubai has embarked on an ambitious initiative to open or share 100 per cent of public sector data by 2021. The Smart Dubai Office and Dubai Data Establishment is successfully driving this forward, with the launch of the Smart Dubai electronic platform and the release of the first open data sets on this platform due imminently.

As our high level estimates show, the opening and sharing of data in Dubai presents an important opportunity to realise significant economic impacts. Our estimates, based on benchmarks from other jurisdictions, suggest that the additional Gross Value Added generated could be in the region of AED 4.3 billion to AED 6.6 billion per annum from 2021: approximately 0.8 to 1.2 per cent of the forecast for the whole economy.

However, these high level estimates only provide an ex-ante assessment of the potential size of opportunity from opening and sharing data. Achieving this scale of impacts is by no means certain and will require inputs and activities from the Government and from other public and private sector players in the Dubai economy to realise them.

Therefore, in order to understand the impacts that are actually being realised in Dubai once data becomes open and is shared via the electronic platform, we have designed a monitoring and evaluation approach for Dubai that we recommend is implemented. This will allow the Dubai Data Establishment to track progress and to understand the key levers that it needs to pull to enhance the scale of outcomes and impacts that are achieved.

Through the Dubai Data initiative, Dubai has the opportunity to be amongst the leading cities globally in terms of the use of open and shared data to help it achieve its aim of becoming the smartest and best connected city.

Our research suggests that even some of the most advanced cities globally in terms of their smart city and data initiatives have not yet published detailed monitoring and evaluation plans or reported on the actual impacts being realised. Therefore, Dubai has the opportunity to set a new paradigm for other cities to emulate.
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Appendix 2 The legal and policy framework for the Dubai Data initiative

This appendix provides further detail regarding the legal and policy framework for the Dubai Data initiative.

The Dubai Data Law of 2015

The Dubai Data Law of 2015 was the first step to implement the vision for open and shared data in Dubai.

The Law assigns competent entity responsibilities to the DDE, with a compliance role for Government Entities who are the Data Providers. See Figure 17 for a summary of the duties.

Figure 17: Duties for DDE and Government Entities

![Figure 17: Duties for DDE and Government Entities](image)

Source: Smart Dubai. 2017. ‘Dubai Data 101’. Provided by the Smart Dubai Office.

Further information on the Law and requirements placed on Government Entities and the DDE is described in Box 2.

BOX 2: THE DUBAI DATA LAW

Law No. (26) of 2015 regulates the ‘Data Dissemination and Exchange in the Emirate of Dubai’ enabling the open data vision.

The Law specifies in Article 4 that the objective of the law is to enable the fulfilment of the Emirate’s vision of turning Dubai into a Smart City. It further specifies that Dubai will optimise the use of data, enhance transparency and increase the efficiency of services.

Article 3 establishes the scope of the Law as applying to all Federal and local Government Entities. It also includes “persons who produce, own, disseminate, or exchange any Data relating to the Emirate, and who are determined by the Competent Entity whether they are individuals, establishments, or companies in the Emirate […]”. In relation to Data Providers other than the federal and local Government Entities (i.e. the private sector), Article 12 of the Law states that they must abide by dissemination and exchange policies. Although the Law provides for and covers private sector entities, it must be noted that in reality, all work to date has covered only Government
BOX 2: THE DUBAI DATA LAW

Entities. Further work to collaborate and determine the scope of data to be open and shared by the private sector will commence later in 2017.

In relation to the ownership of Dubai Data, the Law states that it is deemed as an asset owned by the government (Article 15).

The Law covers the classification of open versus shared data, stating this classification will be in accordance with the Dubai Data Manual. Local Government Entities are required to classify their data and develop a plan for dissemination, including modifying their infrastructure.

It specifies the competent entity, considered to be the DDE per the relevant legislation, is responsible for (in summary):

— the supervision of the implementation of the law and propose the legislation and policies required;
— keeping abreast of international academic and regulatory best practices;
— determining Data Providers (i.e. the Government Entities) and coordinate with them to ensure the achievement of the objectives of the law;
— approving data classifications prepared by Data Providers;
— approving data dissemination and exchange policies, including the relevant policy and Manual;
— holding training courses and specialised workshops on data dissemination and exchange; and,
— following up on compliance by Data Providers with the policies developed, and investigate the complaints and violations finding appropriate solutions.

In regards to consumer data protection, Article 13 states Data Providers must “take all the procedures required for the protection of the confidentiality and privacy of legally protected customer Data”.


The Dubai Data Manual

The Dubai Data Manual Version 3.0 was published in November 2016, following publication of Version 1.0 in October 2015 and Version 2.0 in June 2016. Version 3.0 sets out the guidance for the Dubai Government Entities in the management of data, as mandated by the Data Law. The manual must be used as a reference by all Data Providers (i.e. Government Entities). It was developed and informed by relevant international standards and best practice. In particular, the Dubai Data Manual adopts the best practices for data governance, roadmap development and benefit realisation set out in the global open standard for Transformational Government published by OASIS (http://docs.oasis-open.org/tgf/v2.0/csprd01/TFG-v2.0-csprd01.pdf), and in the smart city version of this which has been published by the British Standards Institute and which is now being developed as an ISO standard (http://shop.bsigroup.com/en/ProductDetail/?pid=0000000000030277667).

Separate manuals are being developed for use by a wider audience including: private sector entities looking to collaborate with government; and citizens and stakeholders interested in using Dubai data.

145 In particular, the Dubai Data Manual adopts the best practices for data governance, roadmap development and benefit realisation set out in the global open standard for Transformational Government published by OASIS (http://docs.oasis-open.org/tgf/v2.0/csprd01/TFG-v2.0-csprd01.pdf), and in the smart city version of this which has been published by the British Standards Institute and which is now being developed as an ISO standard (http://shop.bsigroup.com/en/ProductDetail/?pid=0000000000030277667).
The Dubai Data Manual describes a new operating model for data across the government of Dubai, based on eight implementation principles. These principles prioritise the use and re-use of data for free and with limited restrictions, as well as prioritising the privacy of citizens and private sector entities. Table 10 below provides an overview of these principles.146

Table 10: Dubai data implementation principles for Government Entities: summary

<table>
<thead>
<tr>
<th>Strategic theme</th>
<th>Principle</th>
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<tbody>
<tr>
<td>Managing data</td>
<td>1 We will manage all our data as a collective asset, acting as stewards of that data on behalf of Dubai as a whole</td>
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<td></td>
<td>2 We will use open standards to ensure that all our data is easily discoverable, interoperable and reliable</td>
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<td></td>
<td>3 We will publish all our data openly by default - with exceptions to this requiring a compelling case linked to clear criteria</td>
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<td></td>
<td>4 We will protect the privacy of individuals, the confidentiality of Private Sector Entities and the legal rights of IPR holders</td>
</tr>
<tr>
<td>Realising the benefits</td>
<td>5 We will become a smart user of data</td>
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<td></td>
<td>6 We will nurture the market-place for re-use of our data by the Dubai private sector</td>
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<tr>
<td></td>
<td>7 We will participate in government-wide shared services and collaborative governance mechanisms for Dubai data</td>
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<tr>
<td></td>
<td>8 We will invest in change management to foster an open, data-driven and data-sharing culture across our organisation</td>
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The Dubai Data Manual includes the operating model for Dubai data, covering the set of rules, standards, forms and procedures regulating the dissemination, exchange and protection of Dubai data.

It also includes the data classification framework, which sets out the criteria to categorise whether data should be open and shared, using the following classifications:

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Further, the manual recognises there will be a phased process of change and sets out the short, medium and longer term actions Entities are required to implement. Article 21 of the Draft Policy (discussed below) stipulates that the Dubai Data Manual will be updated from time-to-time, reflecting the need to adapt to technological or policy changes.

The Draft Policy

The Data Standards Architecture for Dubai has been built around the vision for open and shared data. It includes 32 Policy Products that are required to meet the objectives of this vision. A Policy Product has been defined as “any document that has been formally adopted on a government-wide basis in order to shape, guide and deliver smart city activity. Such documents may vary in nature (from statutory documents with legal force, through mandated policies, to informal guidance and best practice) and in length”.\(^{147}\)

The Policy framework applies to all Dubai Government Entities and will be updated as the Entities become more mature in regards to their data handling procedures and processes.\(^{148}\)

The Draft Policy governs how data should be classified (i.e. open or shared, building on the data classification framework as set out in the Dubai Data Manual\(^{149}\)), obligations to publish data on the electronic platform, data use and re-uses (including open data licences) and protection of private information and intellectual property rights.


\(^{148}\) Information gathered based on KPMG engagement with stakeholders from the Smart Dubai Office and Dubai Data Establishment, as well as DLA Piper (a law firm contracted by the Dubai Data Establishment).

\(^{149}\) If shared, data should be classified as (a) confidential data; (b) sensitive data; or (c) secret data. This is covered by Chapter Five of the policy.
Article 28 governs the complaint procedure to request an investigation in relation to the application of the Dubai Data Law or policy. Following a complaint, the DDE is obligated to investigate and conclude within 60 days.

In regards to compliance and enforcement, the Draft Policy requires Government Entities to submit reports to the DDE regarding their performance against specific performance criteria (Article 27). Further, Article 30 allows for the DDE to identify breaches and issue a notice of breach. If no action is taken, a final order can be issued which states the use of data may be revoked if the Entity or data user fails to comply.

The policy also includes the approach to charging any fees for data (Article 10(e)). It stipulates that:

— open data will be free to download in its original form – although in exceptional circumstances, where the costs to collection are beyond normal operations, the DDE may agree that users should be charged a fee may to contribute to the costs of open data that could otherwise not be made available

— the Government of Dubai may – alongside other re-users of open data – create and market commercial value-added services based upon open data. This can only be done through the Smart Dubai Platform and with the agreement of the DDE, and only in circumstances where this is considered clearly in the public interest. Any such commercial data activities by the government will be subject to a ‘fair trading’ regime described in the Dubai Data Policy, to ensure that government engagement in this market helps to nurture its development and does not crowd out new entrants and private-sector competition.

The Smart Dubai Platform

The Law requires data to be shared and open on the electronic platform – the Smart Dubai Platform.\(^\text{150}\) This is being developed as a Public-Private Partnership with Du (an Emirates integrated Telecommunications Company).

There are five major streams to the electronic platform, all of which are due to be operational by June 2016:\(^\text{151}\)

1. **Data science as a service**: This is for all users including Government Entities, citizens, the private sector and entrepreneurs. This is the platform that enables the open and shared data to be used. This includes both open data that can be accessed in its raw form as well as value-added data which has an associated fee.

2. **Dashboard as a service**: This is a dashboard that allows visualisation of data at the data users’ request. This is information that has been gathered and enriched, for example the RTA combine traffic flows with accident data and then join this with mapping information. As this is value added, a charge is expected to be levied. This will also include personal dashboards, where users can centralise all of their administrative requirements (e.g. fines and fees).

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\(^\text{150}\) Information gathered based on KPMG engagement with stakeholders from the Smart Dubai Office and Dubai Data Establishment.

\(^\text{151}\) Information gathered based on KPMG engagement with stakeholders from the Smart Dubai Office and Dubai Data Establishment.
3. **Infrastructure as a service**: This is selling the use of the platform to all data users via hosting servers, websites or companies’ data. This also includes cloud infrastructure. This is recognised by the Dubai Government to be a service with significant revenue potential but is unrelated to the Dubai Data initiative.

4. **Internet of Things (IoT) as a service**: This is predominantly for Government Entities, where they have IoT sensors across the city. This service enables the Entities to plug in the data from these sensors into the platform and visualise the data from the devices as well as control them. Similarly, this is linked to the wider Smart Dubai strategy rather than the Dubai Data initiative.

5. **Enablement use cases**: This goes a step further than IoT as a service and involves Du installing the sensors and connecting their data to the platform. They can also charge project management fees for this. This is also linked to the wider Smart Dubai strategy rather than the Dubai Data initiative.

The first and second streams – data science as a service and dashboard as a service – are the focus for the Dubai Data Initiative. Consideration of the impact of services three to five is beyond the scope of this study.

As part of the streams relevant for this study, users will be required to register for the service. Although some datasets will be available for browsing only, there will be some requirement to register to download and use (for example, MYID based on Emirates ID).

The platform will also enable two-way interactions, where users can provide feedback. This will be collected through the platform and fed back to relevant stakeholders (i.e. Government Entities).
Appendix 3 High level estimates of the potential economic and social impacts: Relevant studies’ methodology, results, relevance and limitations

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<th>Methodology</th>
<th>Quantification</th>
<th>Relevance to Dubai</th>
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<tr>
<td>Manyika, J. Chui, M. Growves, P. Farrell, D. Van Kuiken, S. and Almasi Doshi, E. 2013. Open data: Unlocking innovation and performance with liquid information. McKinsey Global Institute</td>
<td>The paper assesses the total output for the global economy attributable to open data. This includes wider impacts.</td>
<td>This report estimates the annual economic output, in 2013 US dollars (USD), realised from open public and private sector data across seven sectors. The sectors are: Education; Transport; Consumer Products; Electricity; Oil and Gas; Health Care; and Consumer Finance. The methodology for each estimate is not detailed explicitly but includes looking at the different levers of change and value drivers, in each domain. The study estimates the impact of each lever to get the total estimated impact or the total domain. It is assumed that the assumptions for the estimates are consistent for all countries.</td>
<td>An estimated $3 trillion in annual economic potential could be unlocked across the seven sectors analysed. $1.1 trillion is attributable to the United States, $900 billion to Europe and $1.7 trillion to the rest of the world (ROW). Estimates are based on seven broad sectors which fit well with Dubai’s economic composition. Estimates are on a global scale and therefore not biased by any one country. The study is recent and also shows the potential impact if private sector data is also opened which is the overarching vision in Dubai.</td>
<td>Dubai is currently only focusing on opening government datasets and therefore the full impact will be an overestimate. There is lack of clarity regarding how the base estimates were obtained and therefore we cannot comment on the relevance of the approach for estimating the impact in Dubai. Estimates are in terms of output not GVA, the preferred measurement.</td>
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<td>DotEcon. 2006. The commercial use of public information (CUPI)</td>
<td>The estimates capture the direct impact of open data and are presented in terms of total surplus.</td>
<td>Based on survey results from Public Sector Information (PSI) holders (launched by the Office of Fair Trading) DotEcon developed a bottom-up methodology using the willingness to pay for PSI minus the cost of supplying it, to estimate the net consumer surplus. The willingness to pay was found by ascertaining the demand and price elasticity for PSI. The demand was assumed to be linear and, alongside the elasticity, was drawn upon</td>
<td>The estimate yielded a net value of PSI in the UK of £590 million per annum in 2005. The value currently lost, but there to release, coming from the three types of detriment were £320 million, £140 million and £360 million respectively. Together The approach is comprehensive and based on actual consumer demand, value derived and producer surplus calculations. The study is UK-based and therefore has a bias towards UK government institutions and consumer behaviour. The types of data and value would be different in the UK compared to Dubai given different</td>
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<td>UK Department for Business, innovation and Skills. 2013. Market Assessment of Public Sector Information</td>
<td>The estimates presented capture the direct, indirect and induced impacts of public sector information. The impacts are presented in terms of value from relevant literature and an assessment of substitutes.</td>
<td>from relevant literature and an assessment of substitutes. To determine the consumer surplus of free-of-charge data they implemented a 'choke price' which is the maximum anyone would pay for the currently free data. This was equal to the choke price of value-added PSI (where the public sector aggregate and sells data such as the Ordinance Survey) minus the current price of value added PSI. The producer surplus was found using revenue multiplied by the excess return on capital expenditure (actual – target) divided by 1, plus the actual expenditure. The detriment analysis involved estimating the possible loss to consumers arising from the current PSI framework and behaviour of PSI holders. This included the value lost due to unduly high prices, distortion of downstream competition and failure to exploit the value.</td>
<td>the total potential net value was estimated to be £1.10 billion per annum. Wider indirect and induced impacts have been included in the estimations which gives a more representative and total estimate. Wider indirect and induced impacts have been included in the estimations which gives a more representative and total estimate.</td>
<td>economic make-ups and behaviour. Results are in terms of total surplus, not GVA which is the preferred measure. Similar underlying data would need to be collected for Dubai to fully adopt the approach however the overall impact could be scaled for a high level estimate of total surplus. This methodology is likely to underestimate the impact as indirect impacts are not measured. The study is not recent and may not reflect significant technological advances since the analysis was conducted.</td>
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<td>The study builds on the DotEcon 2006 study, described above, reflecting growth in the market and also includes wider impacts for a more holistic estimate. The study estimates the wider indirect and induced impacts to society by taking the direct producer surplus, as calculated using the same approach as in the DotEcon study, and converting it into gross output and GVA for.</td>
<td>This methodology yielded an estimate of the value of PSI to consumers, business and the public sector of approximately £1.8 billion in 2011 prices.</td>
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The analysis is UK-biased and therefore bias towards UK government institutions and consumer behaviour. Similar underlying data would need to be...
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<tr>
<td>study by Deloitte</td>
<td>of narrow economic value, total surplus to the economy</td>
<td>each relevant industry. Using the UK Domestic Use Matrix the indirect and induced impacts were calculated by applying the relevant industry type I and type II multipliers. The average multiplier used was 3.0. For comparability this was then converted to GVA and then operating profit, to provide a comparable surplus estimate. The overall multiplier for direct to indirect surplus was 3.4, i.e. for every £1 of direct producer surplus £2.40 was generated through indirect and induced channels.</td>
<td>When including the ‘downstream’ social impacts the total value was estimated between £6.2 and £7.2 billion in 2011 prices.</td>
<td>advances from the DotEcon study with the same comprehensive approach.</td>
<td>collected for Dubai to fully adopt the approach, however the overall impact could be scaled for a high level estimate of total surplus.</td>
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Gruen, N., Houghton, J., Tooth, R. 2014. ‘Open for Business: How Open Data Can Help Achieve the G20 Growth Target’. A report by Lateral Economics and Omidyan Network (ROI approach) | The impact is measured in terms of output. | The approach uses the following parameters, and applies them to a modified Solow-Swan model as specified by Houghton and Sheehan (2009) 152:  
- expenditure on both types of data (AUD$8,919 million per annum for Government and AUD$2,450 on research);  
- growth in data creating/ collection expenditure (3%);  
- returns to data creation/ collection expenditure (20-60%);  
- increase in accessibility and use (50-100%);  
- useful life of data (average 10 years);  
- rate of depreciation (10%); and  
- discount rate to make present value (4%).  
These were applied to a modified Solow-Swan model as specified by Houghton and Sheehan (2009) which estimates the returns to research and development by the government. | The return to investment modelling estimated a return of AUD$120 billion over 20 years (Net Present Value, NPV, terms153).  
When modelling a 50% increase in accessibility, the estimates were between AUD$60 billion and AUD$180 billion, based on the range of returns of 20-60%.  
Increasing accessibility by 100% results in a mid-point estimate of AUD$240 billion over 20 years with a lower bound of AUD$120 | The ROI approach can be applied using Dubai-specific data, in terms of the expenditure and returns to output. | The ROI approach can provide a range of estimates based on different efficiencies and accessibility assumptions.  
The study is recent and therefore will be relatively reflective of current value.  
An underlying assumption is that ROI for expenditure on open data is similar to returns for research and development (R&D) expenditure.  
The study is based on a theoretical growth model which may not be reflective of what is actually realised.  
The estimates do not include wider impacts however they could be calculated using relevant multipliers.  
The results are in terms of output, not the |

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<tr>
<td>Gruen, N. Houghton, J. Tooth, R. 2014. 'Open for Business: How Open Data Can Help Achieve the G20 Growth Target'. A report by Lateral Economics and Omidyan Network (scaling McKinsey)</td>
<td>This approach, involves scaling the McKinsey 2013 estimates including looking at the impact in terms of GVA not just additional output. The estimates of McKinsey represent output and were therefore scaled in the following way to the GVA contribution to global GDP: - assuming two-thirds of the output is value-added; - one half of value-added is attributable to government open data; and - four-fifths of this is yet to be realised (one fifth has already been realised and therefore would not be additional). To create estimates for the Australian economy it was noted that McKinsey state 46% of the potential value of open data accrues to the rest of world (ROW) group which excludes US and Europe. The value attributable to Australia was based on its GDP share of the ROW group, around 4.3%. The output attributable to open data was scaled using Australian GDP, with the following assumptions applied: ] - assuming two-thirds of the output is value-added; - one half of value-added is attributable to open data; and - three-quarters of this is yet to be realised (one quarter has already been realised and therefore would not be additional).</td>
<td>billion and upper bound of AUD$360 billion. Overall the mid-point estimate is AUD$34 billion AUD per annum. Under this methodology the value of open data could increase global GDP by 1.12% over the following five years with similar findings in Australia of an increase of 1% of GDP over the following five years. The value for Australia, in terms of output would be AUD$64 billion per annum. The figures in terms of GVA were not presented.</td>
<td>See details on Manyika et al study above. The approach to scale McKinsey’s estimates to Australia, for output and GVA impacts of government data can be applied to provide an estimate for Dubai.</td>
<td>The limitation for the McKinsey paper are also resonated here due to the same underlying.</td>
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<tr>
<td>Capgemini. 2015. Creating value through Open</td>
<td>The overall estimate is presented in terms of GVA with the inclusion of For 2016, the direct market size of open data was estimated as</td>
<td>The paper looks to quantify the impact of the re-use of open data for the EU28 through the value added to GDP, number of jobs created, cost savings to the public sector, efficiency and</td>
<td>The impacts presented include direct, indirect and induced impacts</td>
<td>The study is EU focused and therefore biased towards EU Government institutions</td>
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| Data. European Commission     | direct, indirect and induced impacts.                    | The indirect time savings etc. are presented separately with more qualitative descriptions and quantification, where appropriate. The market size and value added as a percentage of GDP was estimated:  
  - The 2005 direct open data market size estimated by MEPSIR and Vickery was extrapolated to give the 2016 market size for the EU25 and scaled for the EU28 based on 2005 and 2015 GDP figures, forecast growth figures and also increasing the values in line with inflation.  
  - The indirect market size uses ratios found in other studies which form an upper and lower bound of 3.78:1 from Shakespeare study and 3.5:1 from Vickery’s study.  
  - The GDP figures were combined with DemosEurope and WISE research into the potential gain of open data by sector to give sectoral estimates.  
  - The direct and indirect market size estimates were shown over the ten sectors where value is likely to be generated. These include: arts, entertainment and recreation; public administration; professional services; real estate; finance and insurance; ICT; trades and transport; construction; industry; and agriculture.  
  Estimating the number of jobs:  
    - First, the study ascertained the number of people employed in knowledge intensive activities (that is classified as any activity productivity gains and many more. This was done for the period 2016-2020.  
    - Between 2016 and 2020 the market size is expected to increase by 36.9% to a value of €75.7 billion.  
    - The total market value for the same periods has been estimated as between €193 billion and €209 billion for 2016 and between €265 and €286 billion by 2020.  
    - Public administration is the sector that gains the most from open data with a value of €22 billion in 2020. The agriculture, arts and entertainment sector the impacts are smaller with €379 million each as it will take more time to unlock the full potential.  
    - Open data is expected to directly create a maximum of 75,000 jobs by 2016 rising to £55.3 billion for the EU28. and are in terms of GVA.  
    - The study is fairly recent and should therefore reflect current technologies and value generation streams.  
    - Estimates are displayed for ten broad sectors which fit well with Dubai’s economic composition.  
    and consumer behaviour.  
  Similar underlying data would need to be collected for Dubai to fully adopt the approach however the overall impact could be scaled for a high level estimate of GVA. |

<table>
<thead>
<tr>
<th>Study</th>
<th>Impact measured</th>
<th>Methodology</th>
<th>Quantification</th>
<th>Relevance to Dubai</th>
<th>Limitations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vickery. 2011. Review of recent studies on PSI re-use and related market developments</td>
<td>The impacts are presented in terms of output and reflects direct market size only.</td>
<td>To estimate the market size and aggregate economic impacts, the study pro-rates estimates from the Australian spatial data sector, the Netherlands geo-information sector, the New Zealand spatial information sector and gains to the EU25 economy of opening up non-personal PSI based on estimates by Pollock (2011) for the UK.</td>
<td>The direct PSI market size using the Netherlands and Australian geospatial sector for the EU27 was €27.9 billion in 2008, which would have grown to €32 billion by 2010 using 7%.</td>
<td>Useful for showcasing the value of geospatial data, which is valuable for Dubai.</td>
<td>A key assumption is that half of the value derived from all open data is based on geospatial data – based on our discussions with the DDE and other Government Entities, we consider that this</td>
</tr>
<tr>
<td>Study</td>
<td>Impact measured</td>
<td>Methodology</td>
<td>Quantification</td>
<td>Relevance to Dubai</td>
<td>Limitations</td>
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<tr>
<td></td>
<td></td>
<td>These estimates were pro-rated using national and EU27 data for GDP; computer services spending; and ICT spending by government. Where estimates relate only to the spatial/geo-service sector, it was assumed that the geospatial market is one half of the total PSI market and the other half comes from government itself. Studies put the growth rate of PSI markets of 6-18%, for this study an estimate of 7% was therefore utilised.</td>
<td>The Australian and New Zealand examples were used for the aggregate economic impacts and yielded estimates for the EU27 of €143 billion for 2008. The values for the EU27 for 2009 are estimated as between €35.3 and €47.1 billion for the upper range where a mid-point of €40 billion is used.</td>
<td>assumption does not hold for Dubai. By scaling these estimates we expect them to represent a lower limit of direct market size, not overly reflective of the potential impact and value that could be realised in Dubai.</td>
<td></td>
</tr>
</tbody>
</table>

- The Australian spatial information industry has revenues of 0.15% of GDP (direct impact) for 2006-07 and the broader accumulated impacts were estimated to be between 0.6 and 1.2% of GDP in 2008.
- The Netherlands geo-informational sector was estimated as 0.23% of GDP in 2008.
- Productivity related impacts from the use and re-use of spatial information in New Zealand was estimated as 0.6% of GDP in 2008, with the potential for an additional NZD 500 million by removing barriers.
Appendix 4 High level estimates of the potential economic and social impacts: Methodological approaches applied for central estimates and other alternatives available

This appendix details the methodological approaches used to derive high level estimates for Dubai, based on benchmarks from the studies outlined in Appendix 3. We present results for Dubai, drawing on each of the studies, including for completeness estimates using studies that we consider less relevant to Dubai.

<table>
<thead>
<tr>
<th>Paper</th>
<th>How we have adapted the approach for Dubai</th>
<th>Resulting estimates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manyika, J. Chui, M. Growves, P., Farrell, D. Van Kuiken, S. and Almasi Doshi, E. 2013. Open data: Unlocking innovation and performance with liquid information. McKinsey Global Institute</td>
<td>There are two ways in which we have scaled the estimates from this study to make them applicable for Dubai. The first method involves scaling the total output for the ‘rest of the world’ (ROW) group, which excludes the US and Europe, relative to Dubai’s GDP contribution to this group. These estimates are for 2013 (when the estimates were calculated). This method showed that in 2013 Dubai’s GDP was 0.2% of the ROW group and therefore would realise 0.2% of the impacts. The second approach is to scale in a similar way but by sector. Global GDP is available broken down by broad sector, these sectors include: agriculture, hunting, forestry, fishing; mining, manufacturing, utilities; construction; wholesale, retail trade, restaurants and hotels; transport, storage and communication; and other activities. By using these sectors and the estimates for the ROW, we can then scale Dubai’s contribution to each sector. In 2013, Dubai contributed 0.0%, 0.0%, 0.1%, 0.1%, 0.3%, 0.6% and 0.5% to the respective sectors for the ROW estimates. This aligns with pro-rated amount of impact, i.e. 0.3% of the impact from wholesale, retail trade, restaurants and hotels.</td>
<td>Private and public sector open data contribution to output The first method yields an estimated increase of output by AED 22.5 per annum by 2021 which is an estimated 4.1% of the estimated GDP of Dubai. The second approach, scaling by Dubai’s contribution in the seven sectors, yields an additional contribution to output, in 2021, of an estimated AED 27.1 billion per annum, the equivalent of 5.0% of estimated GDP.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Paper</th>
<th>How we have adapted the approach for Dubai</th>
<th>Resulting estimates</th>
</tr>
</thead>
<tbody>
<tr>
<td>DotEcon. 2006. The commercial use of public information (CUPI)</td>
<td>As these estimates were calculated in 2013 for our analysis they were increased by the relevant growth rate observed until 2015. For future periods, the average economic growth rate (i.e. GDP growth) of 5.9%, average (from 2006-2015), was used to increase the impact. Ideally, we would have used forecast economic growth rates however this was only available for the UAE, which differs significantly from Dubai growth rates. Therefore this was not used. As the estimates were calculated in United States dollars (USD) they were converted to United Arab Emirates Dirham (AED) using the 2015 exchange rate.</td>
<td></td>
</tr>
<tr>
<td>UK Department for Business, innovation and Skills. 2013. Market Assessment of Public Sector Information (a study by Deloitte)</td>
<td>Due to limitations to the underlying data available for Dubai the only way to use these estimations to quantify the impact of open and shared data in Dubai is to scale by GDP of the UK relative to Dubai. This was done using the UK to Dubai GDP ratio (using 2006 data – the year the study was conducted). The estimates in the study were in Great British Pound (GBP) and were converted to AED using the World Bank exchange rates for 2015. The estimate for 2006 was then inflated to 2021 using the average growth rate of GDP for Dubai.</td>
<td></td>
</tr>
<tr>
<td>Vickery. 2011. Review of recent studies on PSI re-use and related market developments</td>
<td>Due to limitations to the underlying data, the only way for us to use these estimations to quantify the impact of open and shared data in Dubai is to scale by GDP of the UK relative to Dubai. This was done using the UK to Dubai GDP ratio, using 2013 data. The estimates in the study were in Great British Pound (GBP) and were converted to AED using the World Bank exchange rates for 2015. The estimate for 2013 was then inflated to 2021 using the average growth rate of GDP for Dubai.</td>
<td></td>
</tr>
</tbody>
</table>

This approach yields an estimate of AED 0.4 billion per annum by 2021 in total surplus, the equivalent of 0.1% of forecast GDP.

This approach yields an estimate of AED 0.9 billion per annum by 2021 in narrow economic value, the equivalent of 0.2% of forecast GDP.

Using the estimates from the Australian spatial data study the direct impact on output is estimated to be

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157 World Bank DataBank, Official exchange rate (LCU per US$, period average)
<table>
<thead>
<tr>
<th>Paper</th>
<th>How we have adapted the approach for Dubai</th>
<th>Resulting estimates</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>The estimates were then inflated by the estimated average growth rate, to give the estimates of the impact in 2021.</td>
<td>AED 0.8 billion per annum by 2021, 0.2% of estimated GDP. When including wider impacts the estimated additional output for 2021 per annum is AED 5.7 billion, which is 1.1% of forecasted GDP.</td>
</tr>
<tr>
<td></td>
<td>Using the estimates from the Netherlands geospatial data study the direct impact on output is estimated to be AED 1.3 billion per annum by 2021, 0.2% of forecasted GDP.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Using the estimates from the New Zealand spatial data study the direct impact on output is estimated to be AED 3.3 billion per annum by 2021, 0.6% of forecasted GDP.</td>
<td></td>
</tr>
</tbody>
</table>
Appendix 5 Key assumptions of high level estimates of the potential economic and social impacts due to open and shared data

A number of assumptions were made for the purposes of developing the ex-ante estimates of the impact of open data in Dubai. These are detailed below. Based on our engagement with stakeholders in Dubai, we consider that it is likely that these assumptions will hold.

These are some of the key dependencies to realising the full economic and social value of open and shared data:

— Data made available for use and re-use will be useful, of high quality and meet the standards, as set out in the Dubai Data Manual.

— All data meeting the requirements to be open, as per the relevant policy, will be made available to other Government Entities, businesses and citizens. The DDE is working with Government Entities to provide support to catalogue and classify the data to ensure this is the case.

— The Smart Dubai Platform will be fit for purpose and meet the requirements to share and download data.

— Data will be provided at no charge for use and re-use. In line with the Policy, in exceptions where data collection means Government Entities incur additional and extraordinary costs, a fee can be charged to recover these additional costs. Literature suggests that charging at average cost (rather than marginal cost) will impact negatively on the economic impacts derived. In discussions with stakeholders, the pricing approach was discussed and, at the time of writing this report, an official decision has not been made. However, it is most likely this will be at marginal cost and our analysis assumes this pricing approach. If this assumption does not hold, it is likely the economic impacts estimated will be reduced.

— The Government’s own role as a value-added reseller of services built on open data will not impact on private-sector investment in Dubai data (i.e. there will be no crowding out).

— The estimates relate to open public sector data. The Government Entities in Dubai aim to have 100 per cent of their datasets open, where applicable, or if not, available to share with permitted users, by 2021. There is currently no detailed plan in regards to private sector data, and the extent to which this will be open and shared. Work to collaborate with the private sector to further these plans are due to commence in 2017.

— The studies we use to provide estimates for earlier years. To make these relevant to 2016, we applied relevant growth rates observed until 2015. To generate estimates for 2021 onwards we apply the average Dubai GDP growth rate of 5.9 per cent (average from 2006-2015). Ideally we would apply forecasted growth rates, however this was only available at a UAE level. Due to the significant variation between UAE and Dubai GDP, it was considered more robust to apply the average growth rates for previous years.

— As the estimates were calculated in United States dollars (USD) they were converted to United Arab Emirates Dirham (AED) using the 2015 exchange rate sourced from the World Bank.

158 Pollock, R. 2011, ‘Welfare gains from opening up public sector information in the UK’.
159 As confirmed during discussions with representatives from the Smart Dubai Office and Dubai Data Establishment.
Appendix 6 Logic model with KPIs overlaid for each input, activity, output and outcome.
Appendix 7 Our recommended economic impact framework: a technical description of the methodology to apply

This appendix provides a further description of the technical approach to measuring additional GVA and employment generated as a result of open and shared data in Dubai. It builds on Section 6.3.

**Methodology to measure additional GVA**

As shown in Section 6.3.3, additional GVA arising from open and shared data is derived via the following market participants:

— the Dubai Government;
— new businesses created as a result of open and shared data; and
— existing businesses who use open and shared data.

![Diagram](image)


The total additional GVA is made up of the direct, indirect and induced GVA.  

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Our recommended economic impact framework involves estimating the direct GVA based on KPIs, as was detailed in section 6.3. The indirect and induced GVA can then be estimated by applying the relevant sector level economic multipliers.161

**Estimating direct GVA**

**Estimating direct GVA due to the Dubai Government’s use of open/ shared data**

Our ex-ante high level estimates illustrate that potentially nearly a quarter, 23.6 per cent, of the estimated value to be realised from open and shared in Dubai data might potentially be driven by the public administration sector. Due to the scale of this impact, it is important to include the GVA impact generated through government operations linked to open/ shared data.

The first step is to estimate the additional direct GVA.

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161 The economic multipliers are GVA multipliers. The GVA multiplier is expressed as the ratio of the direct, indirect and induced GVA changes to the direct GVA change, due to a unit increase in other demand.

162 During stakeholder engagement with Dubai Government Entities, we gathered information regarding the most relevant and feasible information sources. Our suggestions have been based on the opinions expressed by these stakeholders.
in policy delivery costs resulting from the use of open/shared data), as well as costs incurred to collect and develop open and shared data;

— information from the ICT sub-committee on any cost savings from IT infrastructure due to the use of open and shared data and/or the Smart Dubai platform;

— information on any additional payments made by businesses that start-up or grow due to the availability and use of open data (for example, tax and/or fee payments and business licences); and

— information held by Government Entities’ regarding revenue generated by the sale of value added services, less the costs of collecting and developing the data for these services.

The above information can be combined to estimate the change in the government’s fiscal position (i.e. surplus) due to the use and reuse of open and shared data. To estimate this, the following formula can be applied:

\[ \text{Total Government surplus due to open and shared data} = \sum_{a=1}^{b} \text{Cost savings due to open/shared data}_a + \sum_{a=1}^{b} \text{IT cost savings due to open/shared data}_a + (\text{Revenue from value added services}) + \text{additional payments by businesses} - (\text{spending on value} - \text{added services}) - \sum_{a=1}^{b} \text{cost of collecting/developing data}_a \]

Where:

\[ \text{Additional payments by businesses} = \sum_{i=1}^{x} \sum_{y=1}^{i} \text{Proportion of business turnover attributable to open/shared data}_{i,y} \times \text{average licence fee}_{i,y} \]

The proportion of business turnover attributable to open/shared data could be collected, at the firm level, through the DSC Economic Survey, as discussed in the following section.

We recommend that this calculation is conducted at the firm level for the sample surveyed by the DSC and then scaled up to account for all businesses in the Dubai economy.

The DSC will have in place an approach to scale up the results of its firm level analysis to the industry sector and economy wide level. We would suggest that the same approach is adopted here.

This total government surplus can be converted to direct GVA using the following formula:

\[ \text{Direct GVA from Government} = \text{Total Government surplus due to open and shared data} \times \text{output} - \text{GVA ratio for public administration} \]
It should be possible to source the output-to-GVA ratio for the relevant industry for government activities from the Dubai input-output tables. Based on Standard Industry Classification (SIC), we recommend that industry code 84 “Public administration and defence; compulsory social security” is used.

**Estimating direct GVA due to existing and new businesses in Dubai’s use of open/shared data**

The additional direct GVA associated with the change in economic activity of existing and new businesses in Dubai as a result of the use of open and shared data, can be estimated based on financial information at the business level.

The DSC currently conducts an annual economic survey launched to a representative sample of businesses. The output of this survey is used to estimate quarterly GDP and GVA estimates, employment, compensation, production values, value-added and capital formations for all sectors of the economy. A full link to the survey can be found on the DSC website. Business level data, defined by sector of economic activity, can be collected from these surveys.

To estimate the direct GVA of existing and new businesses attributable to open/shared data, this information would need to be combined with an estimate of how much of the change in business activity can be attributed to open and shared data. This will require additional questions in the DSC economic survey regarding the extent to which the businesses’ costs, turnover, revenue, compensation of employees and profits are based on the use of open and shared data. We recognise that firms are unlikely to be able to provide exact figures for the attributions. However, it would be expected that they could estimate this to a reasonable degree of accuracy, particularly where open/shared data use has resulted in new products and services being developed or where it has led to greater business efficiency (with resultant cost savings).

To estimate the direct GVA for existing and new businesses, estimates need to be undertaken at a firm level, for a representative sample of businesses, and then scaled up to the industry and economy-wide level. The financial information used to estimate direct GVA from open/shared data per business is shown overleaf.

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163 It is expected that the Dubai Statistics Centre will publish updated input-output tables in June 2017.
165 https://www.dsc.gov.ae/en-us/Programs-Statistical-Surveys/Pages/Statistical-Project-details.aspx?ProjectId=40#DSC_Tab3
166 As defined by ISIC4, see: https://unstats.un.org/unsd/cr/registry/regcst.asp?Cl=27
To derive the estimates required, there are two potential approaches to estimating direct GVA (as mentioned in Section 6.3.3) - the income approach and production approach. We provide details of both in this section for completeness, however the approach to best take will depend upon the information gathered through the economic surveys.

The formula to estimate direct GVA using the income approach is:

\[
Direct\ GVA = Net\ pretax\ profit + compensation\ of\ employees + depreciation + amortisation
\]

However, to assess the impact of the open and shared data in Dubai the formula would need to be adjusted to account solely for the GVA that is associated with the use of open and shared data. The adjusted formula would be as follows:


**Direct GVA attributable to open/shared data**

\[
D_i = (\text{Net pretax profit} \\
\times \text{proportion of profit attributable to open/shared data}) \\
+ (\text{compensation of employees} \\
\times \text{proportion of employees attributable to open/shared data}) \\
+ (\text{depreciation} \\
\times \text{proportion of depreciation attributable to open/shared data}) \\
+ (\text{amortisation} \\
\times \text{proportion of amortisation attributable to open/shared data})
\]

Note: Where \( i \) is the individual firm

The formula for direct GVA using the production approach is:

\[
D = \text{Turnover (or sales)} \\
- \text{the cost of bought in goods & services (excl. employee costs)}
\]

As with the income approach, to capture the impact of open and shared data specifically, the formula is adjusted as follows:

\[
D_i = (\text{Turnover} \times \text{proportion of turnover attributable to open/shared data}) \\
- (\text{the cost of bought in goods & services (excl. employee costs)} \\
\times \text{proportion of costs attributable to open/shared data})
\]

Note: Where \( i \) is the individual firm

We would recommend that these calculations are conducted at the firm level for the sample surveyed by the DSC. Therefore, this would need to be scaled up to account for all businesses in the Dubai economy.

The DSC will have in place an approach to scale up the results of its firm level analysis to the industry sector and economy wide level. We would suggest that the same approach is adopted here.

**Estimating total additional direct GVA due to the use of open/ shared data**

The sum of the additional direct GVA generated by the Government, and the scaled up economy wide additional direct GVA from new and existing Dubai businesses (attributed to the use of open/shared data), is the total additional direct GVA generated as a result of open and shared data.
Estimating indirect and induced GVA due to the use of open/ shared data

Indirect and induced GVA are estimated based on applying economic multipliers to the estimated direct GVA for each industry and then aggregated across all industries.

**BOX 3: WHAT ARE MULTIPLIERS, AND HOW ARE THEY APPLIED?**

Indirect and induced impacts rely on relevant industry GVA multipliers. Industry GVA multipliers are expressed as the ratio of the direct and indirect GVA changes to the direct GVA change. For example, through the use and re-use of data and the creation of new businesses, economic impact is also generated through employment and indirectly through the supply chain. Therefore, the GVA industry multiplier can be used to calculate the change in GVA for the economy as a whole. It is expected that the DSC will publish updated input-output tables in June 2017. The data within these can be used to derive the required multipliers.\(^\text{168}\)

Type I GVA multipliers are used to calculate the indirect impacts and represent the ratio between direct and indirect GVA impacts. By applying these multipliers to the direct impact, it is possible to estimate the indirect impact. For example, a Type I GVA multiplier of 1.5 would imply that for every AED 1 of direct GVA there will be AED 1.5 of direct and indirect GVA. Therefore, the indirect effect alone is AED 0.5 of GVA.

Type II GVA multipliers are used to calculate the induced impacts. These represent the ratio of direct, indirect and induced impacts to the direct impact. To isolate the induced impacts the indirect impacts must be removed, this can be done by subtracting the Type I GVA multiplier from the Type II GVA multiplier. For example, a Type II GVA multiplier of 2.2 and a Type I GVA multiplier of 1.5 would imply that for every AED 1 of direct GVA there would be AED 2.2 of direct, indirect and induced GVA, AED 1.5 of indirect and direct GVA and therefore AED 0.7 of induced GVA.

Estimating indirect GVA due to the use of open/ shared data

The indirect GVA associated with the wider supply chain supporting each industry is estimated using the following formula:

\[
\text{Total indirect GVA attributable to open/ shared data}_y = \text{Total direct GVA attributable to open/ shared data}_y \times (\text{Type I GVA multiplier}_y - 1)
\]

Note: Where \( y \) is the industry.

The industry specific Type I GVA multipliers\(^\text{169}\) to use in this calculation will be sourced from the Dubai input-output tables that are currently being produced by the DSC.

\(^{168}\) As confirmed with DSC during stakeholder consultation. The relevant input-output tables are currently under construction being reviewed internally by the DSC.

\(^{169}\) Type I multipliers represent the ratio of direct plus indirect impacts to the direct impact. By applying this to the direct impact, we are able to calculate the indirect impact.
Estimating induced GVA due to the use of open/ shared data

In addition to these wider supply chain effects, the induced GVA associated with the activities of firms in each industry will need to be calculated using the following formula:

$$\text{Total induced GVA attributable to open/shared data}_y = \left[ \left( \text{Total direct GVA attributable to open/ shared data}_y \times (\text{Type II GVA multiplier}_y - 1) \right) - \left( \text{Total direct GVA attributable to open/ shared data}_y \times (\text{Type I GVA multiplier}_y - 1) \right) \right]$$

Note: Where $y$ is the industry

The industry specific Type II GVA multipliers to use in this calculation will be sourced from the Dubai input-output tables that are currently being produced by DSC.

Estimating total additional GVA due to the use of open/ shared data

To calculate the total additional GVA in the Dubai economy due to the use of open and shared data, the direct, indirect and induced impacts must be summed across each industry. This is done using the following formula:

$$\text{Total GVA attributable to open/shared data}_y = \text{Total direct GVA attributable to open/ shared data}_y + \text{Total indirect GVA attributable to open/ shared data}_y + \text{Total induced GVA attributable to open/ shared data}_y$$

Note: Where $y$ is the industry

This will then need to be aggregated for all industries to give a total additional GVA for Dubai as a result of the use and reuse of open and shared data:

$$\text{Total GVA for Dubai attributable to open/ shared data} = \sum_{y=1}^{x} \text{Total GVA attributable to open/ shared data}_y$$

Note: Where $y$ is the industry and $x$ is the number of industries in Dubai

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170 Type II multipliers represent the ratio of direct plus indirect plus induced impacts to the direct impact. Therefore, by stripping out the indirect effect from Type II multipliers, we obtain a ratio of the direct plus induced impacts to the direct impact. By applying this to the direct impact, we are able to calculate the induced impact.
In order to estimate the GVA impacts some additional questions would need to be included in the DSC Economic Survey to businesses, these are detailed in Table 11 below.

### Table 11: New questions for the economic survey

<table>
<thead>
<tr>
<th>Information to gather</th>
<th>Section of Economic Survey</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proportion of turnover attributable to open/ shared data</td>
<td>2 – Revenue and expenses</td>
</tr>
<tr>
<td>Proportion of profit attributable to open/ shared data</td>
<td>2 – Revenue and expenses</td>
</tr>
<tr>
<td>Proportion of employees attributable to open/ shared data</td>
<td>2 – Revenue and expenses</td>
</tr>
<tr>
<td>Proportion of depreciation attributable to open/ shared data</td>
<td>3 – Fixed assets</td>
</tr>
<tr>
<td>Proportion of amortisation attributable to open/ shared data</td>
<td>3 – Fixed assets</td>
</tr>
<tr>
<td>Proportion of costs attributable to open/ shared data</td>
<td>2 – Revenue and expenses</td>
</tr>
</tbody>
</table>

### Methodology to estimate the change in jobs due to open and shared data

The change in employment as a result of open/ shared data in Dubai should be measured in terms of full-time equivalents (FTEs).

#### Estimating direct change in jobs for Dubai due to the use of open/ shared data

As with GVA, the change in employment in the economy as a result of open/shared data will comprise: direct employment, indirect employment, and induced employment.

Similar to the GVA estimates, the employment impacts from open and shared data will need to be captured separately for the government and private sector.

The estimation approach is outlined in the figure below.

Estimating direct employment: change in public sector employment due to open/shared data

As a result of open/shared data provision and use, there is likely to be a resultant change in employment within Government Entities. This may be linked to employees in each Entity who are responsible for operating the platform, developing value-added services, collecting and publishing data.

To collect this information, it is recommended a data request or survey is issued to Government Entities or an initiative is launched to ensure Entities’ self-report this information to DDE on a regular basis.

The change in total direct employment within Government Entities as a result of open/shared data can be estimated as follows:

\[
\text{Total direct employment attributable to open/shared data} = \sum_{a=1}^{b} \text{employees involved in collecting/developing data}_a + \text{employees operating platform} + (\text{employees developing value added services}_a)
\]

Note: Where \(a\) is the individual Entity and \(b\) is the number of Entities

For the initial year, this employment would need to be measured in absolute numbers. Thereafter, it could be measured in terms of change from the previous period.

Estimating direct employment: change in private sector employment due to open/shared data

This captures the number of employees across the private sector whose job relies on, or uses, open data.

The total direct employment impact across the private sector (for both new and existing businesses) due to open/shared data can be estimated as follows:

\[
\text{Direct employment attributable to open/shared data}_i = \text{employment (FTE)} \times \text{proportion of employment attributable to open/shared data}
\]

Note: Where \(i\) is the individual firm

As noted above, DSC currently conducts an annual economic survey launched to a representative sample of businesses. This captures firm level employment data. This firm level total employment information can be used in conjunction with an estimate of how much of this employment is attributed to open and shared data. This will require an additional question in the DSC economic survey regarding the extent to which the businesses’ employment levels are attributed to the use of open and shared data.

Firm level estimates from the annual economic survey can be scaled up to the industry and then economy wide levels. As above, we recommend that the same scaling approach adopted by DSC is used.
Estimating indirect and induced jobs due to the use of open/shared data

As is the case with GVA, direct job creation also has indirect and induced impacts. This can be estimated using employment multipliers. Using the DSC’s input-output tables, it should be possible to derive the industry specific Type I employment multipliers\(^{171}\).

The formula for estimating the indirect impact on jobs would be:

\[
\text{Total indirect employment attributable to open/shared data}_y = \text{Total direct employment attributable to open/shared data}_y \\
\times (\text{Type I employment multiplier}_y - 1)
\]

Note: Where \(y\) is the industry

And to estimate the induced impact on jobs:

\[
\text{Total induced employment attributable to open/shared data}_y = \left[\left(\text{Total direct employment attributable to open/shared data}_y \\
\times (\text{Type II employment multiplier}_y - 1)\right) - \text{Total direct employment attributable to open/shared data}_y \\
\times (\text{Type I employment multiplier}_y - 1)\right]
\]

Note: Where \(y\) is the industry

Estimating total additional employment due to the use of open/shared data

To calculate the total additional employment in the Dubai economy due to the use of open and shared data, the direct, indirect and induced impacts must be summed across each industry. This is done using the following formula:

\[
\text{Total employment attributable to open/shared data}_y = \text{Total direct employment attributable to open/shared data}_y \\
+ \text{Total indirect employment attributable to open/shared data}_y \\
+ \text{Total induced employment attributable to open/shared data}_y
\]

Note: Where \(y\) is the industry

This will then need to be aggregated for all industries to give a total additional employment for Dubai as a result of the use and reuse of open and shared data:

\[
\text{Total employment for Dubai attributable to open/shared data} = \sum_{y=1}^{x} \text{Total employment attributable to open/ shared data}_y
\]

Note: Where \(y\) is the industry and \(x\) is the number of industries in Dubai

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\(^{171}\) Type I employment multipliers represent the ratio of direct plus indirect employment impacts to the direct employment impact. By applying this to the direct employment impact, we are able to calculate the indirect employment impact.