



# Open data, closed government: Unpacking data.gov.sg by Hallam Stevens

## Abstract

In 2011, Singapore created data.gov.sg as an open, online repository for government data. This essay examines this Web portal, the data it contains, and some of the applications that have been built using it and aims to understand the role that data.gov.sg plays within the context of Singapore's continued political and economic development. Although such portals and the data they contain are often presented as offering transformative modes of governance and democratic participation, analysis of data.gov.sg shows how the data portal can act to reinforce and entrench existing modes of governance.

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## Introduction

### *Big data beyond the West*

In 2011, the Singapore government created data.gov.sg. Allowing access to government-produced data from a variety of sources, the Web site aimed to “create economic and social value for Singapore through the use of public data in analysis, research and application development.” [1] The site was established by the Ministry of Finance to provide a means through which government-created data could be shared with the public and used to create new services for Singaporeans. Data.gov.sg was conceived as part of the 2010 “eGov2015” masterplan with the broader aim of creating a “collaborative government” that “connects with our people” (Government Technology Agency of Singapore (GovTech), 2011). Although developed largely through the Ministry of Finance and the InfoComm Development Authority, the data on the site draws together data from over 70 government agencies. According to the site itself, data.gov.sg contains a large number of datasets and includes demographic, education, environmental, traffic, crime, economic, geographic/GIS, health, and other kinds of data.

This essay aims to understand the role that data.gov.sg plays within the context of Singapore's continued political and economic development. While the portal is linked to Singapore's

aspirations for techno-economic progress, especially its desire to become a “smart city,” this essay will also examine how imperatives for “data sharing” reinforce existing modes of governance.

Singapore is, of course, not the only state (or city) to implement such “open data” policies; this is now a worldwide trend that includes nations in the global south (*e.g.*, data.gov.in). Much of the popular and business literature on “big data” and “open data” pre-supposes, implicitly or explicitly, that the effects of data and its use will be more or less uniform across the globe (*e.g.*, Mayer-Schönberger and Cukier, 2013; Manyika, *et al.*, 2011). Much scholarly literature too — focusing on Western liberal democracies — has taken for granted the connections between data, openness and democracy (*e.g.*, Castells, 2009; Yu and Robinson, 2012; Baack, 2015). Davies’ (2010) account of data.gov.uk, for example, tracks the multiple ways in which increases in public availability of information generates increasing democratic participation. Critiques of “open data” and “open government” initiatives have focused largely on the practical failures of technologies and systems to live up to expectations (Hansson, *et al.*, 2015) and the potential barriers to public participation and engagement (Gurstein, 2011; Kitchin, 2014, 2013; Andrejevic, 2014). There has been far less emphasis on the importance of the *contexts* in which data are extracted, embedded and used.

There are now a handful of studies that examine the effects of big data in non-western contexts. Arora (2016), for example, has examined the potential effects of data on the global south and, in this issue, she looks more closely at emerging big data regimes in China and India. This scholarship suggests that the valence and impact of big data is likely to be significantly different in these different social and political contexts. By focusing on another jurisdiction outside the West, this paper aims to underscore the fact that there is no necessary or causal link between datafication and democratization. Rather, such a linkage depends heavily on existing political and social structures. Indeed, the findings here suggest ways in which data, rather than promoting transformation, can actually work to entrench existing political and social values. Rather than assuming that “big data” is “global data,” we need to turn our attention to these local particularities to understand what role big data is playing in these different contexts. This is an attempt to do that within one particular data jurisdiction.

## **Background**

Singapore is a city-state founded in 1965 after achieving independence from Great Britain. The nation experienced dramatic economic growth, rising to become one of the “Asian Tiger” economies in the 1990s; it is now one of the world’s wealthiest countries per capita. Singapore is notable for its small land area (720 square kilometers, having grown from 580 square kilometers since 1965 via land reclamation), its consequent lack of natural resources, its rapid industrialization and urbanization and its efficient deployment of urban infrastructure (including an extensive highway network, Changi International Airport, and an expanding rapid transit system). Singapore is also well known for its high-achieving educational system, its lack of corruption and favorable business environment [2].

Singapore’s remarkable growth and development has been achieved within a context of tight political control. The People’s Action Party — initially under the leadership of Lee Kuan Yew — has ruled the nation for its entire independent history. Although opposition parties contest free general elections, in practice the scope of their operations is limited. Political assembly and political speech remain tightly controlled, including online (Frater, 2013). Although the government has implemented a number of innovative mechanisms for “grassroots” participation in political processes, some observers, including within Singapore, perceive its decision-making to be “paternalist” (*e.g.*, Tan, 2014; Chong, 2015). For instance, the government is perceived to use “eminent domain” and similar schemes to compulsorily purchase or re-acquire property for redevelopment without extensive community consultation. This has been a source of increasing discontent within Singapore (Chong and Chua, 2014).

Singapore also faces an increasing number of social, political and economic challenges. First and foremost, the government needs to ensure that the nation continues to grow economically

and that its people remain prosperous. Second, Singapore faces population challenges: it has an aging population and a low birth rate, yet it must also maintain the delicate multi-cultural balance between its three primary “races” (Chinese, Malays, Indians) [3]. In addition to this, Singaporeans have resisted calls for immigration-driven population growth, fearing increased overcrowding of the island (Hodal, 2013). Third, wealth and income inequality have become increasingly sources of tension. Although Singapore touts its meritocratic education system and public service, the fairness of this system has come under increasing popular scrutiny (Low, 2013; Prakash, 2013). A recent book by Teo (2018), for example, has sparked public and political debate about the extent to which the Singapore education system reproduces patterns of wealth and privilege.

## ***Methods***

This essay will employ several linked methods: close reading and analysis of the data.gov.sg Web portal, data analysis of data extracted from data.gov.sg and close reading and analysis of apps developed using data made available through data.gov.sg. As such, this paper employs both quantitative and qualitative methods and represents an attempt to combine approaches from the humanities with approaches from within “data science” itself (see Blok and Pederson, 2014).

The findings are divided into three parts. In the first part, analysis of the Web portal will draw on the notion of the “walkthrough” as applied to a Web site. As developed by Light, *et al.* (2018), the “walkthrough” is a “way of engaging directly with an app’s interface to examine its technological mechanism and embedded cultural references to understanding how it guides users and shapes their experiences” [4]. Although Light, *et al.*’s method is tailored specifically for apps, their approach to thinking about “vision,” “operating model” and “governance” is particularly relevant to a Web portal such as data.gov.sg. In particular, the “walkthrough” provides a ready framework for considering the “affordances” of technologies such as Web portals as spaces that request, demand, allow, encourage, discourage and refuse particular forms of usage (Davis and Chouinard, 2017).

The second part turns attention to the data contained within the portal. Programs in the “R” programming language were used to mine data from data.gov.sg and perform data analysis to understand the main features of the data. This is an attempt to deploy methods of data analysis to better understand data itself. I also attempt here to read the data “against the grain,” (Stoler, 2009) paying attention to omissions in the data sets in order to suggest what continues to be concealed beneath “open data” rhetoric.

In the third section of the findings, examines the apps developed for and using the data on the portal. Here the walkthrough method outlined by Light, *et al.* (2018) is explicitly deployed in analyzing some of the apps made available through data.gov.sg. By understanding these apps within the social and political context of Singapore, I aim to show how the ways in which data are used are constrained by the forms and structures within which they are presented.



## **Findings**

### ***Reading a Web portal***

#### **Gateways**

[Figure 1](#) shows the original and some more recent (2016) versions of the “gateway” or entry page to the data.gov.sg portal. All these versions share several important features. First, the search bar is displayed prominently, either in the middle of the page or in a way that is colored to stand out starkly from the background. This draws a user into actually searching for data; Figure 1b even suggests potential searches: “transport” or “pollutant.” Like an online library catalogue or a search engine page, it is clear that the main function of the page is to “search.”

The *volume* of data is also immediately drawn to the users' attention. "Browse 11992 datasets" the early version boasts, while listing some examples of the newest datasets below; later versions display colorful pie, line and bar charts showing "Singapore at a glance" (including "Singapore residents by ethnic group," "domestic exports by area" and "Gross Domestic Product") [5].

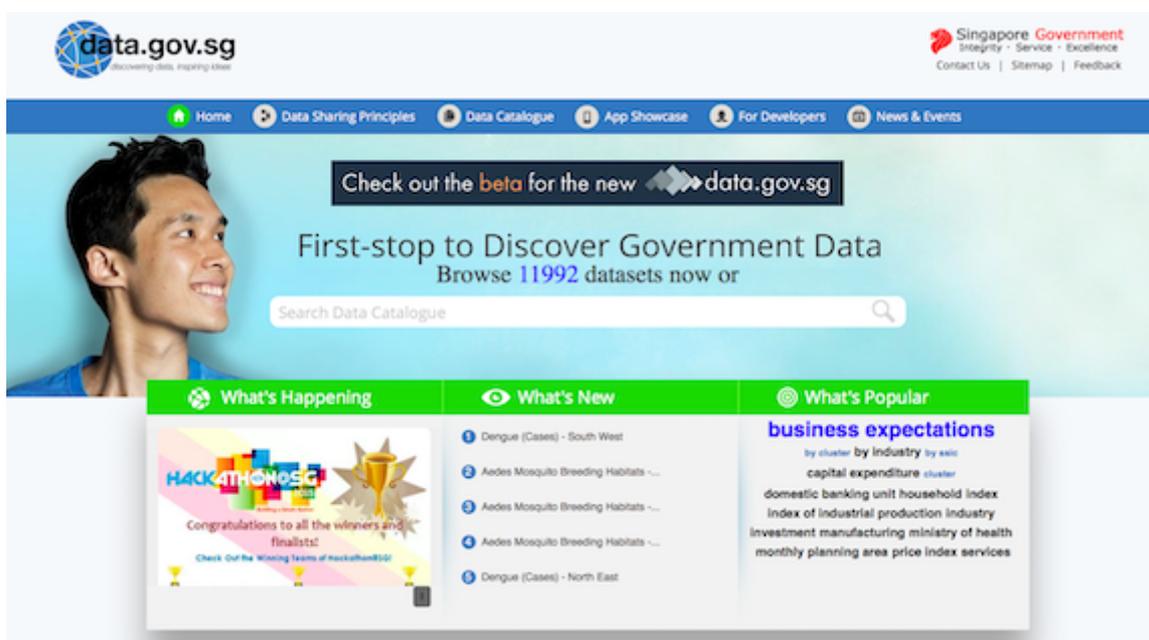


Figure 1a.



Figure 1b.



Figure 1c.

**Figure 1:** Versions of the “gateway” or entry page to the data.gov.sg portal.

Second, amongst the kinds of the images that are displayed here, maps of various kinds are particularly prominent. Indeed, Figure 1b is entirely composed of some kind of “datafied” map of the Singapore island (captioned with “When are the best times to hit the gym?”). Other maps show dengue “clusters” (areas with high densities of dengue fever diagnosis) and the location of particular kinds of schools. Alongside prominent images of the Singapore skyline and cityscape, these maps suggest the integration of data *with and into* the city itself: data is overlaid onto maps of the city and the surrounding territory, suggesting that data is being generated by or emerging from particular places or sensors spread over these spaces.

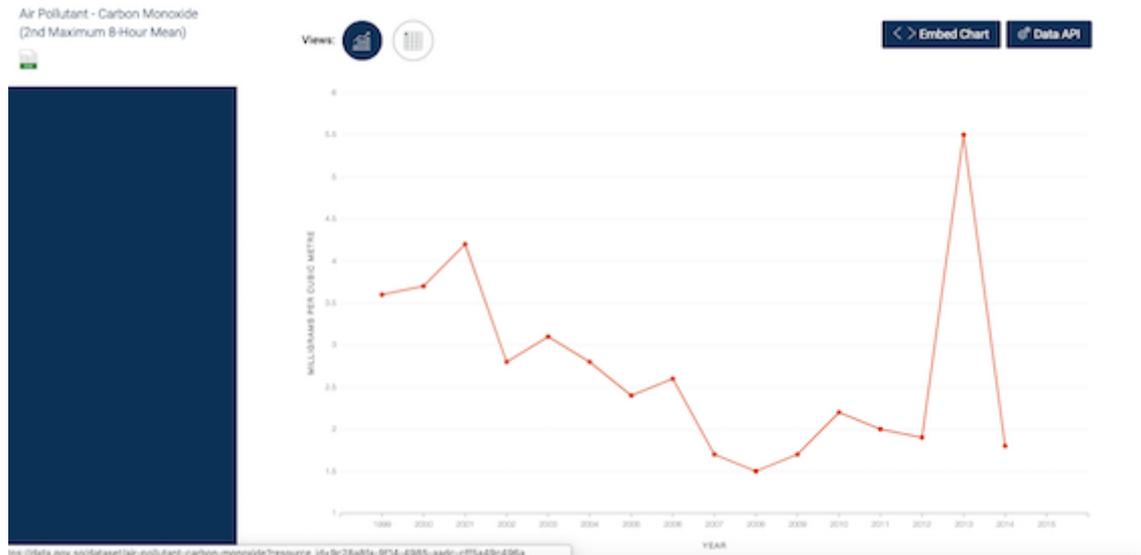
Third, other elements of the portal front page are designed to appeal to programmers and software developers. The earliest version of the page displays, for example, the results of a hackathon, while a later version entices users to enter the “Developer portal” and “Build something cool with our APIs.” This is reinforced by the overall “techie” aesthetic, featuring chic data visualizations and infographics.

Together, these three aspects of the front page of the portal already reveal much about the aspirations of data.gov.sg. Most importantly, the Web site is very much embedded within the developmental priorities of the state, particularly the discourse of the “smart city.” Economic and financial data and population statistics are given prominence — this aligns precisely with Singaporean government concerns about continued economic growth and population management. The prominence of maps and the city itself suggest that data will be deployed within the city to enhance urban life. Moreover, it will effectively respond to the concerns of city dwellers: education, transportation, health and even “when to hit the gym.” However, the realization of such benefits also relies on attracting particular kinds of users to actually utilize the data to “build something cool,” that is, to connect data to the city and its residents in valuable ways.

### Data presentation

What if the user actually performs a search on data.gov.sg and retrieves some data? How is it displayed to users? What does it look like? And what can be done with it? [Figure 2](#) shows the

result returned if the user actually takes up the suggestion to search for “pollutants”: several results are returned for different substances such as carbon monoxide, ozone, nitrogen dioxide, lead, etc. The data can be viewed directly in two ways: as a line graph (as in Figure 2) or as a table. Additionally, the data can be downloaded as a CSV file or embedded into another Web site as a chart graphic. Clicking on the “Data API” button also gives instructions on how to import the data into an app or Web site using Javascript or Python.



**Figure 2:** Carbon monoxide over time, from the data.gov.sg portal.

Subsequent sections will give more details about the kinds and density of data included on data.gov.sg. The focus here is on the way in which data is presented. Upon immediate click through, the data is presented in an accessible and easily digestible form: simple tables and simple line or bar charts. The data display pages are also intended to be gateways for more sophisticated uses — either via exporting the data or by using an API to access it as part of an app or other piece of software. Most of the datasets, however, seem far too small for such exports to be worthwhile — data could simply be copied and pasted from the Web page itself. These tools, then, are no doubt meant to impress the would-be developer while remaining largely impractical for most purposes.

The other notable aspect of these data are their *cleanliness*. The tables and line graphs rarely seem to have missing data points or gaps or other kinds of anomalies. Most data scientists spend most of their time *cleaning* data into coherent and usable formats (Leonelli, 2014; Edwards, 2010). None of that is visible here. The data are presented as well-ordered quanta of facts about Singapore. There is a sense of completeness, and consequent authority, in the presentation of the data.

### Data sharing principles

There are several other elements of the portal as a whole, including a developer’s section (discussed further below) and a blog. However, one other prominent aspect of the Web site deserves particular analysis. Namely, the set of “data sharing principles for the Singapore Government” that underlie the collection and use of data at data.gov.sg:

1. Data shall be made easily accessible  
Data shared publicly shall be shared on data.gov.sg or OneMap. For data that requires

registration for access (*e.g.*, APIs or chargeable datasets), a sample of the dataset should be made available prior to registration.

2. Data shall be made available for co-creation

All data shared publicly should adopt data.gov.sg's Terms of Use or ensure that the current Terms of Use allow for co-creation.

3. Data shall be released in a timely manner

All data should be made available as quickly as possible. Information on the frequency of data updates shall be provided in the metadata.

4. Data shall be shared in machine-readable format

Unless it is not available, all data shall be published in machine-readable format (*e.g.*, XLS, CSV).

5. Data shall be as raw as possible

Data should be shared in as granular a form as possible but without compromising on data confidentiality or privacy. [6]

Although these principles seem reasonable enough, they are sufficiently vague that they do little to specify that any particular data produced by the state will be shared, when it will be shared, or how much will be shared. It is not clear which data "shall be released in a timely manner" or what the "all data" of principle (3) refers to. The emphasis of the Principles on "co-creation" and "ease of use" (including "machine readability") suggests that the underlying aim here is that developers will be able to work with the data to make something valuable (presumably an app or piece of software). In other words, the principles of sharing here are underwritten primarily by economic concerns rather than notions of democracy, representation or transparency.

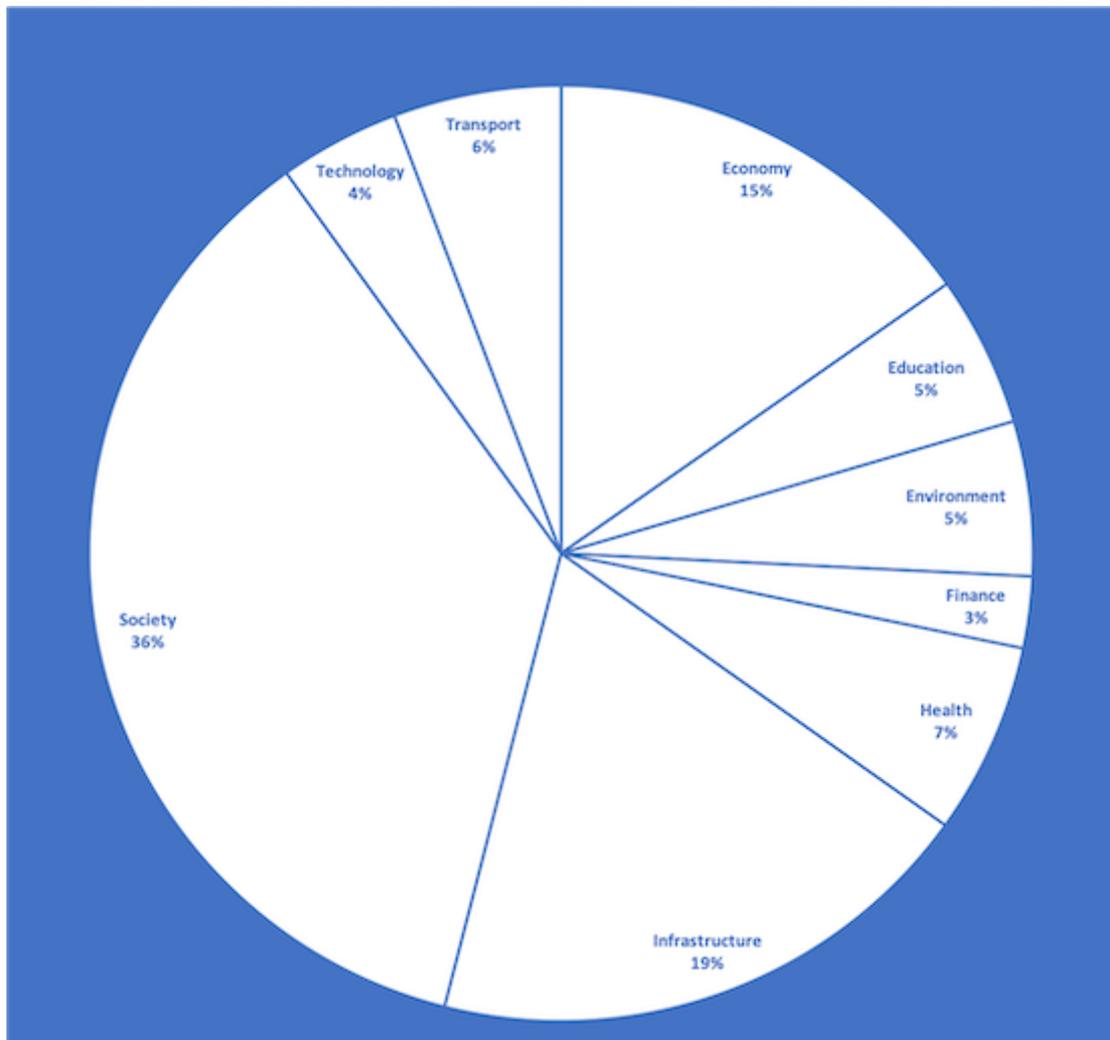
Data are supposed to be presented as "raw as possible" and in as granular a form as possible. However, as critical data studies scholars have shown, "there is no such thing as raw data" (Gitelman, 2013). As a consequence, without further specifying the "level of granularity" and the "level of rawness," this remains a rather empty principle.

### ***Extracting the data***

I now turn from the presentation of the data and the form of the Web site to the data itself. As should be clear from the previous section, data.gov.sg presents itself as a massive data repository that contains rich data about a variety of subjects. Here, I examine what the datasets actually contain: how much information, about what range of topics, and with what levels of density?

### **Overall**

The datasets on the portal are divided into nine categories on the Web site itself: Economy, Education, Environment, Finance, Health, Infrastructure, Society, Technology and Transport. The total number of datasets in each category is shown in [Figure 3](#).



**Figure 3:** Datasets, data.gov.sg portal.

Note: Larger version available [here](#).

This suggests that data is fairly evenly spread between categories but with particular concentration of datasets related to the economy and to infrastructure and with “society” forming a kind of catchall category for datasets that don’t fit into the other categories.

Also examined was the stated sources of the data from within the various ministries and statutory boards of the government. [Table 1](#) shows the top 25 sources of data:

| <b>Table 1: Sources of data.</b>                          |                               |
|-----------------------------------------------------------|-------------------------------|
| <b>Data source</b>                                        | <b>Percentage of datasets</b> |
| Ministry of Trade and Industry — Department of Statistics | 34.67%                        |
| Urban Redevelopment Authority                             | 10.69%                        |
| National Environment Agency                               | 4.81%                         |

|                                                                  |       |
|------------------------------------------------------------------|-------|
| Land Transport Authority                                         | 4.54% |
| Ministry of Health                                               | 3.47% |
| Ministry of Manpower                                             | 3.27% |
| Infocomm Media Development Authority                             | 3.14% |
| Housing Development Board                                        | 3.07% |
| Ministry of Education                                            | 2.61% |
| Ministry of Home Affairs — Immigration and Checkpoints Authority | 2.61% |
| Singapore Land Authority                                         | 2.20% |
| Inland Revenue Authority of Singapore                            | 1.87% |
| Health Promotion Board                                           | 1.80% |
| Central Provident Fund Board                                     | 1.54% |
| Singapore Tourism Board                                          | 1.40% |
| Ministry of Home Affairs — Singapore Police Force                | 1.27% |
| Energy Market Authority                                          | 1.14% |
| Early Childhood Development Agency                               | 0.94% |
| People's Association                                             | 0.94% |
| Ministry of Social and Family Development                        | 0.80% |

This table shows that majority of the datasets come from a small number of agencies, with a long tail of other institutions (61 in total) contributing small amounts of data. This distribution of datasets is consonant with a heavy emphasis on topics related to economic and financial indicators, land usage and population statistics.

### Data size

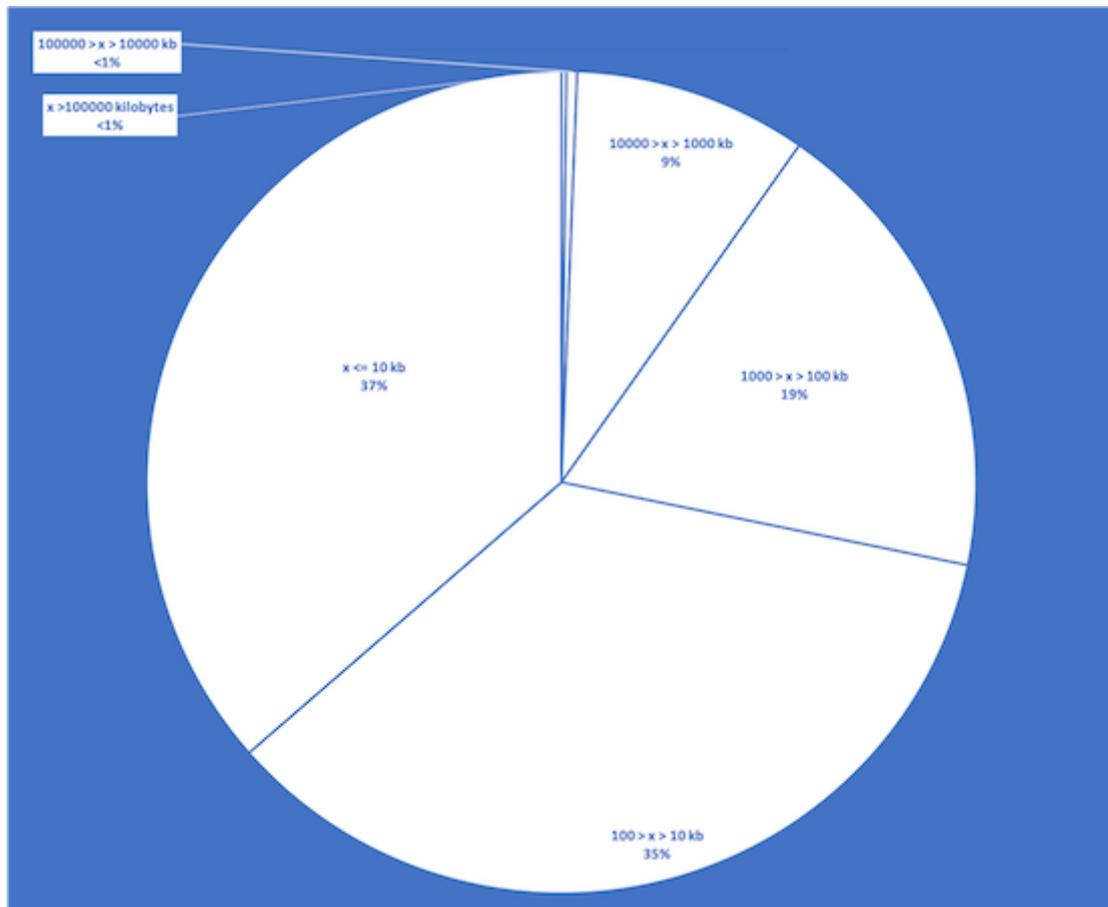
The overall size of the datasets and the distribution across size was also analyzed. The 10 largest datasets are show in [Table 2](#) and the 10 smallest in [Table 3](#):

| <b>Table 2: Largest datasets (kilobytes).</b> |                         |
|-----------------------------------------------|-------------------------|
| <b>Dataset description</b>                    | <b>Size (kilobytes)</b> |
| ACRA-information-on-corporate entities        | 778240                  |
| SLA cadastral land parcel                     | 175198                  |
| Development register map                      | 101853                  |

|                            |       |
|----------------------------|-------|
| URA no of dwelling units   | 86327 |
| MP08 land use              | 63380 |
| Resale flat prices         | 60958 |
| National map line          | 41758 |
| Master plan 2014 building  | 20488 |
| Ura-parking-lot            | 11845 |
| Master plan 2014 rail line | 9287  |

| <b>Table 3: Smallest datasets (kilobytes).</b> |                         |
|------------------------------------------------|-------------------------|
| <b>Dataset description</b>                     | <b>Size (kilobytes)</b> |
| Air pollutant — particular matter PM2.5        | 2                       |
| Air pollutant — Sulphur dioxide                | 2                       |
| Climate change and energy — green vehicles     | 2                       |
| Enrolment — MOE kindergartens                  | 2                       |
| Full-retirement-sum                            | 2                       |
| Number of Passion card members, annual         | 2                       |
| Number of polyclinics                          | 2                       |
| SDCP monument text                             | 2                       |
| SDCP park name                                 | 2                       |
| Street-lighting-facilities                     | 2                       |

The largest datasets are almost all related to geographic and land use information while the smallest datasets cover a variety of fields. Although this imbalance may be partially attributable to differences in the sizes of various file types, the preponderance of geographic data suggests the intensity of land use planning (including zoning, occupancy data, land prices, land usage data, land tax revenue data, etc.). All this is a central concern within the land-limited city-state that exercises tight control over land use. [Figure 4](#) shows the distribution of the size of datasets suggesting that data.gov.sg contains very few large datasets and is mostly comprised of relatively small datasets (less than 100 kilobytes).



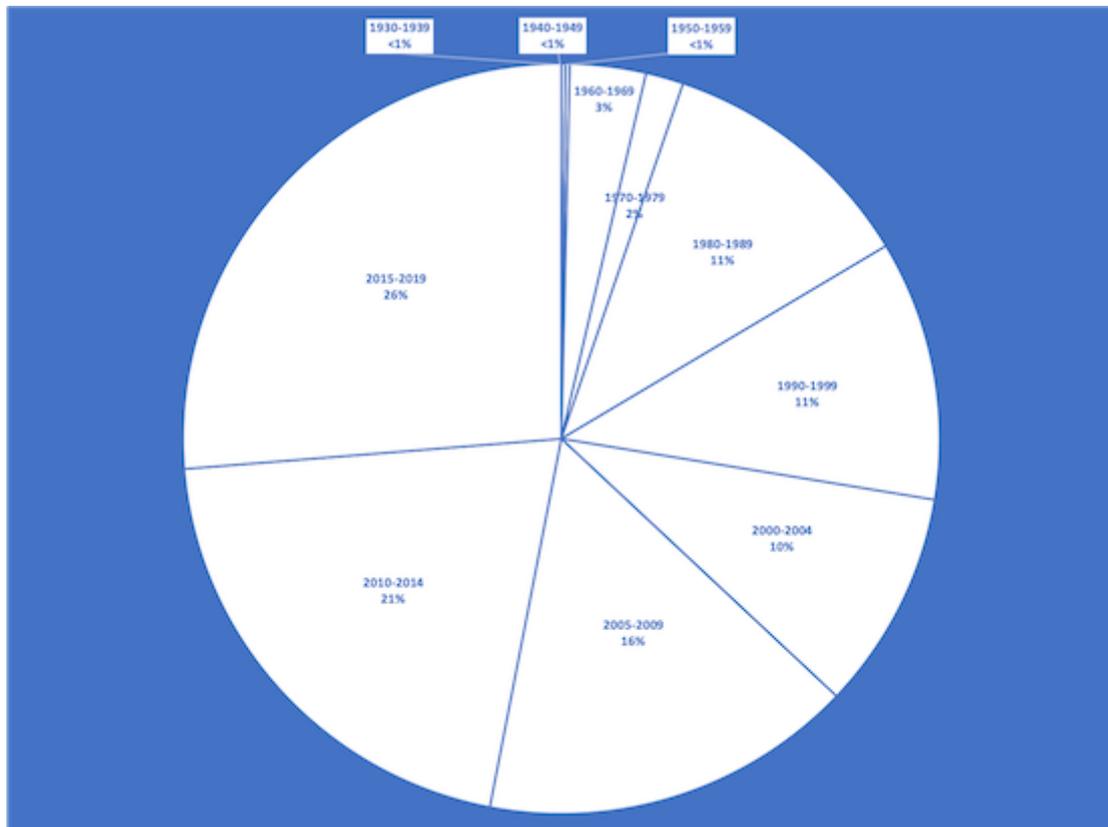
**Figure 4:** Summary of dataset size, data.gov.sg portal.

Note: Larger version available [here](#).

This distribution indicates that any interpretation of the volume of data overall needs to be very carefully interpreted since most of the data points are concentrated within a few key areas.

### Time-series data

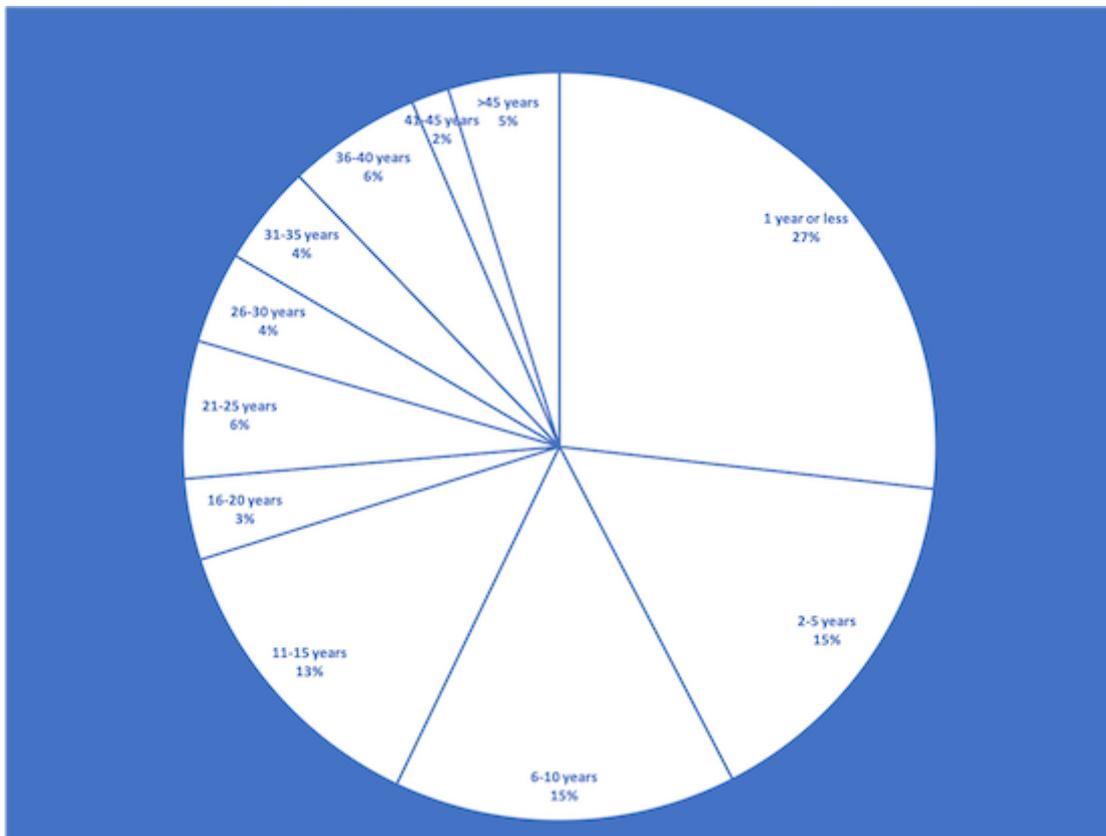
Many of the datasets in data.gov.sg are time-series datasets. As such, we examined how far in time such datasets extended (*i.e.*, the earliest data point), the overall time period covered, and the frequency with which data was reported within such datasets. [Figure 5](#) shows a breakdown of the years in which datasets commence:



**Figure 5:** Temporal distribution of datapoints in datasets, data.gov.sg portal.

Note: Larger version available [here](#).

The datasets are clearly skewed towards very recent data: over one quarter of the data only dates to 2015 or after and almost three-quarters of the data is more recent than 2000. Moreover, as shown in [Figure 6](#), most of the time series data have only been recorded for relatively short time periods.

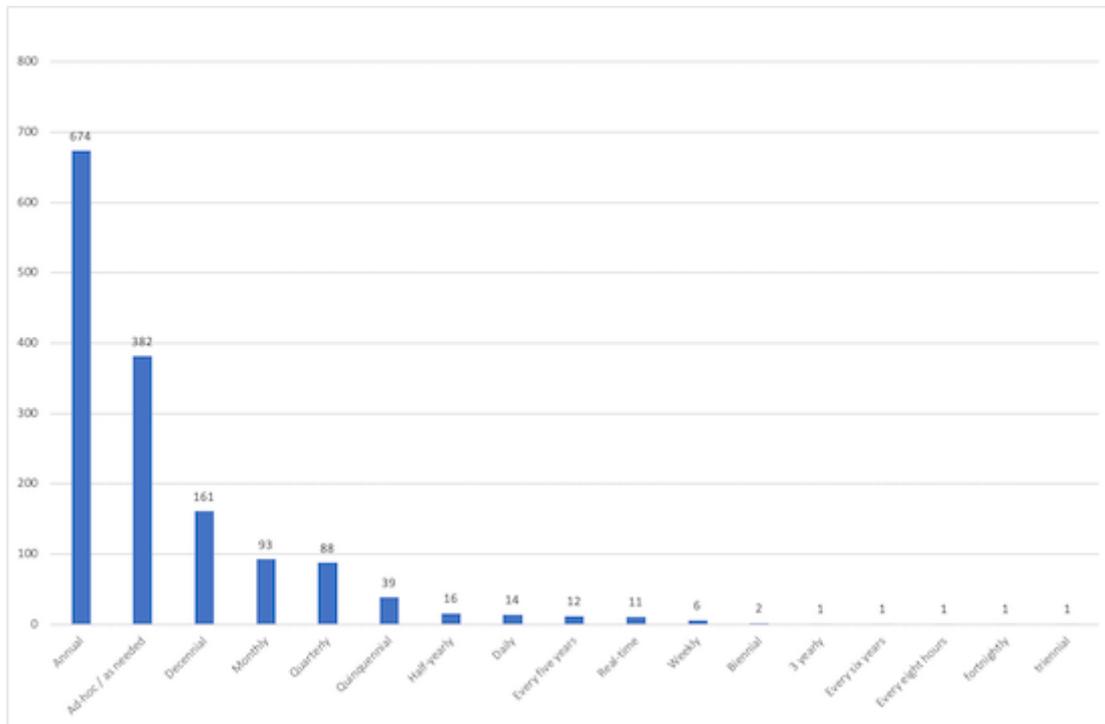


**Figure 6:** Temporal span in datasets, data.gov.sg portal.

Note: Larger version available [here](#).

Over one quarter of the dataset span one year or less and significantly more than half (57 percent) span ten years or less. Although Singapore is a young nation and no doubt much data is not available in digital form, this analysis suggests that there is still a significant amount of government data that has not been made available through data.gov.sg.

Frequency analysis suggests similarly that some datasets may not be completely available. [Figure 7](#) shows the frequency at which data is reported within data.gov.sg datasets.



**Figure 7:** Time-series data, data.gov.sg portal.

Note: Larger version available [here](#).

The vast majority of the data is either reported annually (45 percent) or in an *ad hoc* fashion (25 percent). There are very few datasets that provide fine-grained data (less than monthly). Despite the fact that large amounts of data may be present overall, the “density” of this data is lacking.

**Keywords**

Finally, to gain a sense of the coverage of the data, we also performed a keyword analysis of the descriptions of the datasets that were included in metadata. The most frequent keywords for the entire dataset are “number,” “Singapore,” “public,” “health,” “private,” “practice,” “active,” and “age.” More revealing here, however, are the keywords broken down according to the nine categories around which data.gov.sg is organized. These are shown in [Table 4](#):

| Table 4: Keywords by category. |                                                                                          |
|--------------------------------|------------------------------------------------------------------------------------------|
| Category                       | Top 10 keywords                                                                          |
| Economy                        | Data, survey, services, prices, Singapore, sector, number, investment, labour, refers    |
| Education                      | Students, courses, figures, school, course, schools, Singapore, year, offered, enrolment |
| Environment                    | Waste, climate, Changi, recorded, station, total, year, number, air                      |
| Finance                        | Year, tax, income, figures, financial,                                                   |

|                |                                                                                                        |
|----------------|--------------------------------------------------------------------------------------------------------|
|                | duty, assessment, amount, number                                                                       |
| Health         | Number, Singapore, health, services, data, public, onwards, years, population, private                 |
| Infrastructure | Indicative, area, polygon, Singapore, data, boundary, land, annotation, dataset, number                |
| Society        | Population, household, survey, conducted, resident, general, consensus, GHS, mid-decade, mini-census   |
| Technology     | Infocomm, statistics, survey, Singapore, subscriptions, data, research, expenditures, total, broadband |
| Transport      | Vehicles, registered, road, roads, Singapore, period, report, bus, exempted                            |

For “economy,” most of the data appearing on the Web site has been collected through a variety of surveys, including surveys of various sectors of the economy. These include business expectations surveys, labour market surveys, labour force surveys, surveys of the financial structure and operations of companies, surveys of foreign equity, investment, debt and financial derivatives, and surveys of Singaporean investment abroad. In the “education” section, the data reflects the reporting of results of students in the national examinations (such as the Primary School Leaving Examination and the GCE level examination) as well as data on available education courses and enrolment figures for kindergartens, primary schools, secondary schools, and tertiary institutions.

For the “environment,” much of the data relates to the ABC (“Active, Beautiful, Clean”) Waters Programme, a government initiative to improve the cleanliness of Singapore’s waterways. In addition, information is available about Singapore’s “Cash-for-Trash” programme (for recycling), air quality measures, energy consumption levels, food establishment licenses, historical weather conditions and solid waste management. In “finance” the majority of the data consists of tax rate and tax collection data, “Baby Bonus Scheme” data and information about duties, exchange rates and goods and services taxes.

“In health” the data reports the rates of diseases, claims under public insurance schemes (Medishield and Eldersield), clinic and hospital attendance rates, the location of healthcare institutions, lists of healthcare providers and information about the location of Zika virus clusters. “Infrastructure” data identifies the locations of properties and their boundaries in Singapore, vacancy and stocking rates of properties, data related to the urban Master Plan and the Special and Detailed Control Plans (parks, water bodies, housing, building height data) and household survey information.

“Social” data includes common population measures such as birth, death, age, employment, marriage and divorce rates, as well as household income and expenditure data, recreation data and infringement and detention data. The “technology” category is focused on 3G mobile services, household electricity consumption, broadband and mobile data usage, computer accessibility and research and development expenditures. “Transport” data captures the distribution of vehicles, vehicle parking availability, road and air accident reports, public transport fare structures, rail, road and cycling infrastructure data, and rail, road and air ridership data.

Collectively, the analysis of the types, sources and keywords pertaining to the data suggests a significant emphasis on matters of economic concern to the Singapore government. Particularly prominent here are economic and financial and economic indicators (including business and tax information), demographic data (including birth rates, health, and education) and land usage data. This, of course, may reflect the types of data that the Singapore government is collecting, but it may also reflect the types of data that they have made a priority to share with the public.

### What is not there?

It is always a difficult task to analyze what is *not* present. One way of approaching this would be to conduct a detailed comparison between data.gov.sg and other open government portals; this is not within the scope of the present study. Nevertheless, it is clear that there are some significant gaps in both the types and depth of the data available.

For example, public transport data contains information about the average trip distance (yearly intervals) and average daily ridership (yearly intervals, broken down by subway, light rail, bus and taxi). However, smartcard systems deployed in Singapore allow the collection of much more detailed geographic and time-based data about public transport ridership. There is little doubt that such information is collected since Singapore public transport uses a smartcard system; however, only very broad-level data (yearly averages) are made available through data.gov.sg [7]. Likewise, island-wide electricity consumption is reported geographically, but only at the level of broad areas on the island and only provided as a monthly average [8]. Again, it is very likely that more detailed and specific data is collected, but it is not made available here.

Data about the activities of para-government organizations is also limited. JTC Corporation, for instance, is a state-owned organization and one of the government's major real-estate developers and owners. Data.gov.sg contains a total of six datasets related to JTC dating back to 2017 and containing a total of only 145 data points. Again, this information is presented at a high level of aggregation rather than in "raw" or detailed form.

### *Apps*

Since the data.gov.sg site is partially aimed towards engaging app developers and programmers, the site also includes both tools for developers and examples of the apps that have been built using data.gov.sg data. Indeed, a prominent link at the top of the main page leads to the "Developer Guide" ([data.gov.sg/developer/](https://data.gov.sg/developer/)). In this section I examine what kinds of apps are featured on the site, what kinds of apps are presented as key examples using the provided "developer tools," and then finally turn to an analysis of some specific apps linked to data.gov.sg. The development of such apps is explicitly encouraged by the portal itself. Indeed, such "co-value creation" opportunities are one of the *raisons d'être* for the site.

### Showcase apps

Until 2016, data.gov.sg linked to an "application showcase" listing apps that had been developed using government data. Some of these were developed "in house" while others were submitted by citizens, non-government organizations, community organizations or businesses. Some such applications were encouraged by holding competitions, hackathons and the awarding prizes for such app development [9].

In October 2015, the site listed 148 apps divided into 12 categories: Business and Economy (6); Education (14); Energy and Environment (23); Finance (4); Health (17); Housing and Urban Planning (11); Justice, Safety and Security (3); Population and Household (1); Science and Information Technology (0); Society and Community (24); Tourism and Recreation (9); Transportation & Storage/Others (37).

Again, the topics represented here align closely with everyday political, social and economic concerns of Singaporeans or with explicit concerns of the state. For example, many of the "energy and environment" applications are concerned with tracking of the PSI (small particulates, a standard measure of air pollution) — the issue of air quality rose to prominence in

2015 after slash-and-burn agriculture in nearby Indonesian islands caused weeks of heavy air pollution. Many of the apps categorized under “transportation” are related to traffic conditions, parking and public transport. Under “education,” apps that assist with comparing and picking schools feature prominently.

More explicitly aligned with state concerns are apps listed under “health” (encouraging healthy eating, health monitoring, exercise), “justice, safety and security” (encouraging the in-app reporting of crimes via smartphones), and “tourism and recreation” (promoting tourism via maps and listings of tourist attractions).

### The developer site

Before turning to a more detailed analysis of a selection of apps from data.gov.sg, it is worth examining the “developer” part of the Web site in more detail. This suggests the kinds of apps that data.gov.sg *hopes* will be developed and the types of tools they imagine will be used.

The develop site uses two types of API (application programming interfaces) — these are programming “hooks” that developers can easily latch onto to integrate data from the site into their applications. CKAN (Comprehensive Knowledge Archive Network) APIs provide statistical and tabular data, while other APIs on the site provide access to real-time data (for a very small number of datasets).

The data and the tools are made available under the “Singapore Open Data License” (<https://data.gov.sg/open-data-licence>) and attempt to conform to international standards with respect to making data as open and usable as possible (CKAN, for example, is an *de facto* international standard for open data platforms developed by Open Knowledge International (see <https://okfn.org/projects/ckan/>)).

A listing of the “examples” here is again instructive for understanding the types of applications that are imagined:

- IPOS applications API — for downloading patents, designs, and trademarks;
- Carpark availability — retrieved every minute;
- Realtime weather readings — one-minute intervals from weather stations;
- Ultraviolet index — 7 AM to 7 PM, averaged per hour;
- Traffic images — live traffic images along expressways and at the international checkpoints to Malaysia;
- Taxi availability — location coordinates of all available taxis;
- PM2.5 — particulate matter regional hourly values;
- Pollutant Standards Index — 24-hour value, three-hour value, and pollutant concentration sub-index;
- Weather forecast — for next two hours, 24 hours, and two days.

The selection of these few datasets for special treatment is once again suggestive of state priorities. In particular, most of these datasets are broadly focused on monitoring and expediting the flows of people around the island and monitoring the atmospheric environment of the city. These align closely with the ideals of a “smart city,” a carefully monitored urban space dominated by careful control over the flows of people and the environment (Kitchin, 2015). Indeed, Singapore’s vision of the smart city involves precise monitoring of traffic and public transport according to immediate and local demands as well as improved environmental monitoring of the urban environment (see <https://www.smartnation.sg/>). The kinds of apps that data.gov.sg hopes to produce very much match these ideals.

### Cats, schools and an aging society

Finally, I want to turn here to a closer analysis of three specific applications that are listed on data.gov.sg. Turning again to the “walkthrough” method of Light, *et al.* (2018) allows a mapping of the affordances of such software by attending to their “vision,” “operating model” and “governance.”

In 2012, the Singapore Cat Welfare Society developed an app, “Cat Community” that allowed citizens to report the locations of “stray” cats. This app interfaced with data.gov.sg’s OneMap platform, creating a map overlay of cats all over the city (the Cat Welfare Society was one of the first groups outside the government to make use of the OneMap platform). Although data.gov.sg described these as “stray” cats, such animals are more widely known as “community cats” in Singapore — because cats are not allowed to be kept inside government-developed housing estates (Housing Development Board flats), many people take care of cats who live in their neighborhoods, feeding them, neutering them and providing veterinary care when necessary.

The “Cat Community” app allows users to upload the locations of cats accompanied by text, pictures and videos. This “animal monitoring” (Esri Singapore, 2014) would allow the Cat Welfare Society to identify places where more feeding of cats is needed and to better organize people to help (Singapore Land Authority, 2012). However, “animal monitoring” also went hand in hand with monitoring of citizens: the app was also designed to allow the reporting of “cat abuse” — injured or neglected cats that appear to have been deliberately harmed.

For suspected cases of “cat abuse,” the Cat Welfare Society Web site advises, “take photos or videos of the perpetrator ... report to the AVA, Police, and SPCA ... .” Where the perpetrator of abuse remains unidentified, the Web site suggests: “organize a citizen patrol” (<https://www.catwelfare.org/get-help/>). Although the goal is a noble one, the “Cat Community” app becomes a mode through which such surveillance and policing of citizens, by citizens can be enacted (see Dennis, 2008; Kasra, 2017). This can be usefully framed in terms of thinking about app “governance” — “Cat Community” affords and enables particular modalities of use. As Light, *et al.* note, this may “expand from simply managing user activities to enforcing norms and values” [10]. Here the app seems precisely to encourage the reproduction of broader cultural and political norms through the app itself.

In May 2017, data.gov.sg released an app called “Schoolpicker.sg.” (<http://schoolpicker.sg>). As the name suggests, the aim of the Web-based platform was to allow parents to select between the 182 primary schools and 154 secondary schools across the island. “It can be challenging to sieve out the schools that offer the right mix of CCAs [co-curricular activities] and special programmes for you.” The app begins by asking users a series of questions about their requirements: school level, address and preferred activities and programmes (ranging from “athletics” to “rockwall climbing” to “sepak takraw”). The result is a “shortlist” of schools displayed on a map, highlighted according to the distance from one’s home. Through its map-based interface, Schoolpicker promotes a “vision” that mobilizes a “tech-savvy” user (either a student or parent) and emphasizes the ease and convenience of picking schools. The Google Maps-like interface promotes a consumerist approach to primary and secondary education.

The significance of this app can only be understood within the context of Singapore’s highly successful, but also highly competitive, education system. Success in the “Primary School Leaving Exam” can lead not only a place in the better secondary schools, but also entry into more advanced educational “streams.” Those streams, in turn, lead to places in Junior Colleges and, ultimately, Singapore’s universities. This “meritocratic” system has come under increasing scrutiny in recent years with many commenters suggesting that the system reproduces wealth, privilege and class (Low, 2013). Amidst these anxieties and tensions, Schoolpicker.sg can be seen as an attempt to limit fears about unequal educational opportunities. By placing information and the ability to “select” appropriate schools seemingly in the hands of the user, the app suggests increased control over educational choices. It also emphasizes co-curricular activities over traditional school subjects (math, English, chemistry etc.), downplaying “academic achievement” as component of school choice (some secondary schools will actually be unavailable to some students because of low scores in the Primary School Leaving Exam).

A final app to be discussed here, “ElderlyCare” is designed to allow elderly Singapore citizens to use their smart devices to call for help in an emergency. The app sends “predefined emergency SMS-es” and activates a loud alarm. However, the alert does not flow to a doctor, hospital or nurse, but rather to a “next-of-kin” or “caretaker.” Such a model of care for the aged is consonant with a Confucian social model in which children take primary responsibility for

caring for their parents [11]. Here, we can consider the “operating model” of the app as critically important to establishing and understanding its meaning. Who the app intends to connect to who (relatives within families) reveals its “underlying political and economic interests” [12].

However, the family-based social support system is under increasing strain in Singapore. The national health care system, while providing some “safety net” protection for the elderly and indigent, relies heavily on private insurance and personal savings [13]. In many cases, this places significant financial burdens on families. This is an increasing source of anxiety and political tension within a rapidly aging society [14]. Such an app, then, takes a particular position within this social and political debate, affording particular kinds of uses that encourage *families* to take responsibility.

All three of these apps relate to issues of concern to the population — cars, schools and how to care for aging relatives. Their specific form, however, suggests how these technologies hew closely to prevailing social, political and economic norms. Rather than using data and data-based technologies to challenge the system, such apps reproduce existing modes of governance (self-policing, meritocracy and family-based aged care).

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## Discussion

In this section, I want to consider the reasons for Singapore’s embrace of “big data” and the meaning of data.gov.sg in the Singapore context. Big data, open data and government data are often touted as critical resources for fostering representation and participatory forms of democracy in the twenty-first century (see, for example, Open Knowledge International, “Why Open Data?” <https://okfn.org/opendata/why-open-data/>). Data.gov.sg certainly adopts the rhetoric of both “big data” and “open data.” The promises of large volumes of data (“over 12000 datasets”!), the “open” terms of use, its Singapore Open Data License, the data-sharing principle, developer-friendly presentation of the Web site all suggest “openness.” At least in presentation, the portal replicates emerging international standards (*e.g.*, CKAN) with respect to data sharing and data openness.

However, some of the data presented here suggests that the data actually made available on data.gov.sg does not necessarily match up to these ideals. Analysis of data.gov.sg makes clear that although the Web site contains a large number of datasets, the majority of these are quite small in size (that is, contain quite a small number of data points). Moreover, the majority of datasets contain only recent data and also remain quite “sparse,” showing only yearly or monthly averages (and in some cases it is obvious that more detailed data is collected). The data is also skewed heavily towards particular topics and particular sources (that is, particular ministries and agencies within the government).

In addition to the scope and the kinds of data available, the use of the data is also constrained. Most publicly available datasets however are controlled by some “terms of use.” Apart from standard legal disclaimers, data.gov.sg’s includes the proviso that data taken from the site must not be used for any purpose that is “misleading” to the public. “Misleading” is a term open to wide interpretation. Although no such cases of “misuse” have arisen, such a broad restriction on use may have a chilling effect on the types of uses to which Singapore’s government data may be put. This is particularly true in a nation where the state often uses the court system (usually via libel laws) to silence alternative voices (*Economist*, 2017).

Given such limitations, what is the broader purpose of data.gov.sg? Clearly, the government has invested significant resources in this endeavor. Why? One possibility here is that the Web site is designed as a *presentation* of the openness and transparency of Singapore’s government. By following international norms standards with respect to “open data,” the Web site generates a performance of accountability and transparency. Such a performance might be understood as a response to both internal and external criticism of the government. This is certainly consonant

with pronouncements of the ruling political party, who have promised increased accountability and transparency in government [15].

However, these factors are not sufficient to account for the deep investments in data that data.gov.sg represents. Rather, what the analysis of the Web site here suggests is that “open government data” in Singapore is deeply tied to economic objectives and imperatives. This is at once apparent from the kinds of data that can be found on the portal and its organization and presentation. “Open data,” on data.gov.sg is linked not just to openness and transparency, but to value creation, business development, and economic growth. This too, fits squarely, within the rhetoric of “big data” that promises that “openness” of data leads to creativity, innovation and wealth (*e.g.*, Deloitte, 2012).

More specifically, Singapore hopes that data.gov.sg will foster economic growth in at least two ways. First, apps that are developed may become valuable in and of themselves, leading to new startups, new business opportunities and furthering Singapore’s information and communication technology industries. Second, encouraging people to work with data serves an educational purpose, creating young “knowledge workers.” For example, in 2014, data.gov.sg was at the center of an event called “Young Rewired State” which gave participants (aged 18 under) a chance to learn to program using data.gov.sg data, while being hosted at Google and mentored by Google employees; the Web site has also co-sponsored “Data in the City Ideas Challenge,” “Visualization Challenge,” “Code Xtreme Apps,” “Smart Nation API CoLab” and “Geohackathon” events [16].

Such programmes are aligned with Singapore’s broader development goals, especially its desire to become a “smart nation.” On the Web site itself we find a quote from Prime Minister Lee Hsien Loong (28 May 2014): “We are venturing into new industries, new technologies; globalisation is progressing, people talk about big data. We are part of that. We want to be a smart city, a smart nation” (<https://data.gov.sg/about> 2018). Data, including open data, are a part of Singapore’s plan to foster technology innovation and prepare its workforce for the coming decades. Within the Singapore political and social context, however, the consequence of the promotion of data and data openness are significantly distinct from other data jurisdictions. The valences and affordances of open data in Singapore can be understood in terms of the meanings of “sharing,” “transparency,” and “democracy” within the context of data.gov.sg.

### *The meanings of sharing*

There is a seductiveness to the idea of “sharing” and “transparency” that is hard to argue against (who is against sharing?). Nevertheless, sharing should not be held as a universal good. Levy and Johns (2016) have written about how sharing can be “weaponized” in various contexts: when industry lobbyists in the United States began to insert “data sharing” riders into Environmental Protection Agency legislation, the agency was mandated to share data that they could not possibly share (proprietary data, non-anonymous data). Calls for “openness” resulted in the hamstringing of environmental protections (Levy and Johns, 2016). As Arora (2016) reminds us, “just because databases are ‘open,’ they do not necessarily result in open practices.”

For data.gov.sg, “sharing” is deeply embedded within Singapore’s economic vision for the future. “Sharing” becomes a mode through which knowledge workers can be trained, data can become apps and value can be created. This is reflected in both the prevalence of economic and financial data, the ways in which data.gov.sg presents itself to the public, and the kinds of apps that have been created. “Sharing” becomes a means of encouraging the mobilization of citizens and businesses to produce and consume. Sharing is a “good” because it is associated with potential economic development and growth.

### *The meanings of transparency*

Data.gov.sg is embedded in an aesthetic of transparency — attractive graphics allow the user to “see the data for themselves.” However, such “transparency” works in two directions — citizens are able to “see” government data, but much of this data is collected from the citizens themselves. Ultimately, data.gov.sg is revealing the government’s gaze on the citizens

themselves. The rhetorical emphasis on the volume of the data and the number of datasets emphasizes the scope of the government's view. In this sense, the Web site also serves to remind citizens of the all-seeing power of the state.

The problem of who or what is made visible through data.gov.sg emerges also in its apps. Apps such as "Cat Community" foster notions of self-policing, and community surveillance. It is significant here that this is an app produced not by the government itself, but rather by a community organization. This suggests that possibilities for imagining what to do with data are already heavily constrained by existing ways of thinking and doing within society. Data becomes utilized in ways that reinforce, rather than challenge, existing modes of behavior. In particular, what is "made visible" through these datasets and their uses is heavily dependent on local circumstances.

### *The meanings of democracy*

"Open data" promises new modes of representation for citizens and new ways of tackling social and urban problems. However, data.gov.sg appears to entrench existing modes of thinking and doing. The kinds of data available on the portal implicitly supports existing social and political structures. Transport data, for example, focuses almost entirely on trains, buses and especially cars. Little or no data is available about alternative modes of transportation (bicycles, for example) [17].

Likewise, apps such as "Elderly Care" and "School Picker" do not offer novel modes of aged care or education. Rather, they act to reinforce existing ideals and serve to legitimate existing modes and patterns of behavior. While appearing to empower citizens (the elderly or students) through connectivity and choice, these apps actually function on the continued dependence of these groups on existing social and political institutions and structures (families, schools). This serves to further embed — via information technologies — values that already are widely held in Singapore.

Moreover, these apps offer deeply *technocratic* responses to existing social and political problems. They belong to an imagined future in which information technologies — especially data — will solve social problems. Again, this is consonant with Singapore's broader plans for economic development. Data, here, conforms with, rather than challenges, existing forms of governance.

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## **Conclusion**

Through analysis of the presentation or appearance of the web site itself, through analysis of the data on the site, and through "walkthrough" analysis of apps created with the data, this paper has sought to demonstrate precisely how data.gov.sg embeds and reinforces existing social and political values. Although well-intended in all sorts of ways, the site seems likely to further undergird and entrench, rather, than transform social values, political structures and institutional frameworks. At the very least, data.gov.sg promotes a vision of a sanitized, hyper-networked, clean and modern digital state, contributing to the branding of Singapore as a "smart city" and "smart nation."

These findings have both local significance and broader theoretical importance. Locally, it suggests that data.gov.sg — if it is to fulfil its own goals of creating economic value and innovation — must do more to include more and different kinds of data (from more varied sources, for example), to increase the density of data, to encourage different forms of usage, and to engage with different social groups. There is no doubt that data can have powerful social and political effects. But data.gov.sg (and other similar Web sites) cannot just put data out there and hope for the best: "sharing data" will not prove to be some sort of magic bullet for solving economic, political or social problems. Innovative uses of data will require not just access to

data but more attention to who and what are represented, the contexts within which it can be used and who can work with the data.

More broadly, the argument here suggests the importance of the social and political context for understanding the effects of “big data” and “open data.” The embeddedness of data portals within particular social and political circumstances make their effects far from neutral or universal. Web sites such as data.gov.sg afford particular types of usages and support particular types of goals because they belong to a particular context. As the notions of “open data” spreads to other jurisdictions (especially outside the west), it is increasingly clear that the valences of “big data” and “open data” are far from fixed. Understanding their meaning will require deeper understanding of what data are being shared and why, how it is being shared, who it is being used by, and what such usages mean within local circumstances. 

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## Notes

1. <http://data.gov.sg/about/>.

2. For a detailed history of Singapore to 2005 see Turnbull (2009). For statistics on Singapore’s growth, see <https://www.singstat.gov.sg/modules/infographics/economy>.

3. I use the term “races” here rather than “ethnicities” since it is the term used by the Singapore state.

4. Light, *et al.*, 2018, p. 882.

5. The total number of datasets is stated differently in different places and at different times. The initial announcements of data.gov.sg referred to 5,000 datasets; later figures were given as high as 12,000. As of October 2018, however, searching for “all datasets” on the site returns 1,498 datasets. A “dataset list” returns 1,987 entries. This study examined the 1,497 datasets available in mid-2018.

6. These principles are not given as much prominence on current versions of the Web site. However, they can be found archived at <https://web.archive.org/web/20140210003619/http://data.gov.sg/common/dsp.aspx>.

7. Some concession to both privacy and proprietary information must be made here. At some level of granularity with public transport data, tracking of individuals may be possible. Public

transport in Singapore was operated privately under government tender, although since 2016 this corporation wholly owned by the government. Despite these complexities, a greater density of public transport data could be made available.

8. <https://data.gov.sg/dataset/average-monthly-household-electricity-consumption-by-ura-planning-area-and-dwelling-type-2011>.

9. Advertisements for such events can be found in archived versions of the Web site. See, for instance, <https://web.archive.org/web/20140612115310/http://data.gov.sg/>.

10. Light, *et al.*, 2018, p. 891.

11. A similar model can be found within some of Singapore's "smart city" and "smart home" initiatives. The "elderly monitoring system," for instance, "lets you monitor your elderly relatives through sensors placed in the flat, and alert caregivers via text messages" (<https://www.hdb.gov.sg/cs/infoweb/about-us/our-role/smart-and-sustainable-living/smart-hdb-town-page/hdb-smart-home-exhibition>).

12. Light, *et al.*, 2018, p. 890.

13. Smith, 2015, p. 48.

14. In 2018, for instance, the government introduced range of new measures for expanding funding for aged care, partly in response to social concerns (Ng, 2018; Khor, 2018).

15. For example, in 2016, Prime Minister Lee Hsien Loong called for accountability in his swearing in speech: <http://www.straitstimes.com/singapore/pm-sets-out-core-principles-for-singapore-political-system>.

16. Advertisements for these events can now be seen in the archived versions of the Web site. For example: <https://web.archive.org/web/20140612115310/http://data.gov.sg/>.

17. In fact, the portal contains one dataset pertaining to bicycles, showing the location of Land Transport Authority-maintained bicycle racks. There are 26 datasets related to cars.

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