Data Innovation in a Smart City

E-Governance and Mobility Landscapes in Singapore

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**DATA AND
INNOVATION
IN ASIA-PACIFIC**

CONTENT

Data fuels digital change. It forms the basis for numerous new products and services and can bring about specific advantages such as personalised medicine, autonomous driving, or more efficient administration. While data may be indispensable for the generation of new knowledge and may aid rational decision-making in the spheres of politics, society, and the economy, it brings with it an element of fear stemming from issues such as vulnerable consumers, privacy concerns, and the possibility of algorithm-based decisions being executed independent of human control.

The ability to collect and process ever-increasing amounts of data is a **key to innovation and growth**. For states such as Germany with a globally networked and high-tech economy, this presents enormous opportunities – especially due to the increasing amount of non-personal data made available through industrial processes as well as public sources. However, neither Germany nor Europe is fully exploiting the innovative potential of data for the benefit of society, the economy, science, and the state. The collection and analysis of data does not have to be in conflict with the **European approach to data protection, which marks an important standard for the responsible handling of data** in the global context.

Numerous US and Chinese companies have occupied central strategic positions in the digital economy in recent years. These include cloud systems, digital payment systems, online trading, and Artificial Intelligence (AI). **Despite some notable successes, Europe and Germany still lack a comprehensive vision for the "age of data".** Nevertheless, in the spring of 2020, the European Commission launched its roadmap for digital policy – a "Data Act" to create a single European data market is planned for 2021.

Against this background, it is worth taking a **comparative look at the Asia-Pacific region** as it is generally considered the region that currently leads in both global innovation and economic growth.

Hence the Konrad Adenauer Foundation's regional programme "Political Dialogue" based in Singapore started a large-scale study in September 2019 on *Data and Innovation in Asia-Pacific*. We want to turn our gaze away from Silicon Valley to other important "data nations" in order to investigate the ambiguous and not-at-all-clear **connection between the use of digital data and the innovative capacity of economic and social systems**. However, we will not limit our analysis to technical and economic issues as the exploration of this ambiguous connection inevitably involves the fundamental political question concerning the *systemic competition* between liberal-democratic societies and authoritarian development models – in particular, that of the People's Republic of China – with regard to the manner in which data is attained and used. To put it more pointedly, the question is: in times of omnipresent data generation and its use by increasingly AI-based systems, is the ability to innovate only to be had at the price of the complete disclosure of private data to governments and corporate actors? Or can an alternative approach, one balancing both the protection of basic rights and promotion of innovation, be found?

The study was carried out in collaboration with the National University of Singapore (NUS) and was supported by the country offices of the Konrad-Adenauer-Stiftung in Asia-Pacific. We selected **Hong Kong SAR, India, Japan, the People's Republic of China, Singapore, South Korea, and Taiwan** as the contexts to be examined. We looked at the areas **of transport, finance, administration, health, and Industry 4.0** to understand how added value for society and the economy can be created through modern data use.

We aim to contribute to the discussion on how to balance data usage and data protection in order to promote innovation in this digital age.

The following questions guided us in this study:

Narratives

How do companies, state actors, and civil society understand the handling of data – especially personal data – and the ethical assessment of such use? What are the prevailing narratives in each country?

Legal Bases

What are the laws and regulations that apply to the collection, use, storage, provision, disclosure, retention, and disposal of personal and non-personal data? What is the status of the development of legislation for these matters and how do different stakeholders deal with the issues of data protection and data portability between different (private and public) systems?

Ecosystem

Data is part of a larger "innovation ecosystem". Its potential can only be realised through interaction with other innovation-promoting elements. What specific legal, technological, infrastructural, cultural, and economic aspects of a country shape the respective ecosystems and determine performance?

In Singapore, Japan, and Taiwan, the study is also supplemented by a representative population survey on data culture.

This first report begins with a case study on the Southeast Asian city-state of Singapore and focuses on the fields of transport and public administration. The report shows how the ride-hailing service "Grab" became an integral part of the city's transportation system and how it has now expanded its services to include food delivery and financial services. The report also focuses on how the state agency known as GovTech is promoting digital innovation in public service administration under the strategic vision of a Smart Nation.

We hope that the diverse pictures presented on the subject of data and innovation in Asia will provide food for thought in Germany, Europe, and Asia itself.

Dr. Peter Hefele
Director Asia and the Pacific

SUMMARY

Digital innovation is a top priority for Singapore and since 2014, the government has spearheaded a nationwide intiative to become a **"Smart Nation"**. The state is not only supporting innovation in the private sector, but also increasing the use of digital platforms in delivery of public services. This has been carried out with remarkable success: It was Singapore's agency GovTech that developed the world's first Bluetooth-based COVID-19 contact tracing app, TraceTogether. In addition, "Grab", once a startup and former competitor of the US service "Uber", is now based in Singapore and has developed into the largest ride-hailing platform app in Southeast Asia, with tremendous influence throughout the region.

This first report in the series "Data and Innovation in Asia-Pacific" looks at how the government is bringing about data-driven innovation and how data in the transport and mobility sector is used, especially by ride-hailing platforms, which have become an important pillar in the transport system.

Here are some key findings:

1. As a comprehensive government program, the **"Smart Nation Initiative"** states clear objectives for digital innovation projects, including in the areas of transport and digital public administration examined in this report. The focus is not only on building technological infrastructure and transforming processes but also specifically on open data and data analysis for policy making. Overall, there is **well-developed infrastructure, existing government capacities and a broad awareness** of the added value of data and data analysis.

2. The Government Technology Agency or GovTech is responsible for delivery of **digital public services** and oversees the digital transformation of all government services. It develops digital infrastructure for government agencies, processes government data, and develops **apps and digital services**. In the fight against COVID-19 alone, the agency had developed twelve apps and digital services by summer 2020. These include the world's first Bluetooth contact-tracing app, a chatbot for questions about COVID-19, and a daily update on case numbers and regulations via WhatsApp and Telegram.

3. Nonetheless, technological solutions in fighting a pandemic have their limits. In Singapore, too, **privacy and functionality concerns** played a role in the discussion about how the tracing app would work. The comparatively low number of downloads may be seen as an indirect "voting with your feet". In a representative survey accompanying this study, 77% of respondents agreed that data should be given to the government voluntarily.

4. The high level of government digital innovation in Singapore is also fueled by the belief that in the areas of **public infrastructure innovation** must be managed by the government due to **the lack of a profit incentive**.

5. **Regulations** for handling data are approached not just from the perspective of protection, but also with the goal of **driving data-based innovation**. The regulations on data protection, which are set out in the Personal Data Protection Act (PDPA), only apply to private individuals and private companies. Furthermore, compared to the EU's General Data Protection Regulation (GDPR), they give leeway for broader terms of collection, use and disclosure of data. These provisions do not apply to government agencies, which are instead bound by internal regulations that are not transparent to the public. When it comes to handling data, the majority of citizens trust government agencies far more than private companies.

6. On the one hand, there is a general belief that **too much privacy prevents innovation**. On the other hand, experts also pointed out that **high data protection standards can in turn lead to certain innovations**, for example in the area of cyber security to protect the data collected. During COVID-19, Singapore has been able to be agile with data innovations even during a pandemic, because of its existing capacities, such as the presence of an agency like GovTech to develop technological tools, as well as high mobile penetration and digital literacy. But ongoing concerns about the management of citizen data collected and used by government agencies are expected to increase, especially in the wake of incidents such as a 2018 breach of the health records of millions of citizens. The majority of citizens feel at the mercy of the big technology companies and more than half distrust companies when it comes to handling the data they collect.

7. In Singapore, ride-hailing platforms such as Uber developed as **disruptive players to an important part of the transport system**. While Uber has since left the region, Southeast Asian platforms continue to be in fierce competition and also prompt accelerated innovations for existing taxi companies.

8. The case study examines a specific example of private sector collaboration with universities: the Grab-NUS AI Lab. Grab does not yet have the capacity to do all its research internally, unlike more established firms like Google. While it processes the data necessary for its everyday operations internally, researchers from the National University of Singapore help to analyse data with the objective of developing innovations in the organisation's processes. Corresponding PhD programs are funded by the Economic Development Board.

9. Since the transport companies do not publicly share their treasure trove of data for reasons of competition, the **universities and public research institutions also act as trusted third parties** who can analyze the data. In this way, researchers can gain insights from which everyone can benefit without the companies having to disclose or publish their data to one another.

10. Singapore currently grants **1–2 year trial licenses for bike sharing within a regulatory sandbox**. While previous bicycle and e-scooter sharing programs have been discontinued, attempts to find viable models of bike sharing are still ongoing. In the regulatory sandbox, companies have the opportunity of obtaining a full license if they have ensured during this trial period that their business model can provide desirable services while mitigating problems like indiscriminate parking of bicycles. Licensees are obliged to **share data including the locations of unused bikes, distances traveled and times of travel** with the authorities on a weekly basis. This data is meant to optimise the national transport system. However, any concerns on the part of customers play a subordinate role here.

11. In contrast to the data minimization obligations enshrined in the EU's GDPR, ride-hailing companies usually **collect as much data as possible** and later decide how it should be analyzed. Representatives from companies suggested that even those responsible for data processing might not know the value of the data at the time of collection. In the case study of ride-hailing platforms like Grab and Gojek, data provided the basis for service diversification. For example, data that the platform has collected through its taxi services are used to establish new services such as food delivery. Discussions about data portability or the disclosure of aggregated customer data from companies for use by the general public are still ongoing.

12. In Singapore, it is sometimes **difficult for multinational companies to aggregate and analyze data from different countries** due to the different data protection and nationalisation laws in their respective locations. In contrast, the European single market for data targeted for 2021 certainly offers great advantages for companies based in Europe.

This project seeks to identify the characteristics of data innovation landscapes in Singapore, in the specific domains of e-government and transport. It is the first in a series surveying seven different Asian territories to deepen understandings of innovation and data policies, and contribute to debates which often focus on European models of data protection such as the General Data Protection Regulation (GDPR). The report is centred on Singapore's digital public services, especially the Government Technology Agency (GovTech) and innovations introduced during the COVID-19 period, as well as mobility and online ride-hailing services. Through these cases, we seek to understand how innovation is driven in the context of relationships among key stakeholders such as citizens, government agencies, firms and research institutions.

Innovations in Singapore's government are currently driven by the Smart Nation Digital Government Group (SNDGG). GovTech, which is part of the group, looks after the implementations of innovations by working with the respective agencies and groups within the government. The vision of Singapore as a smart city has been well supported and augmented by state-market dynamics, and GovTech in particular has been able to be agile in responding to the COVID-19 pandemic with data innovations. Regulations to protect the data privacy of individuals however, pertain to personal data collected by organisations while public agencies are governed by the Public Sector Governance Act. Regulations in Singapore are approached not just from the perspective of protection, but also with the goal of driving innovations. It remains to be seen whether increased public demands for more checks and greater engagement will be reflected in revisions to the Personal Data Protection Act (PDPA).

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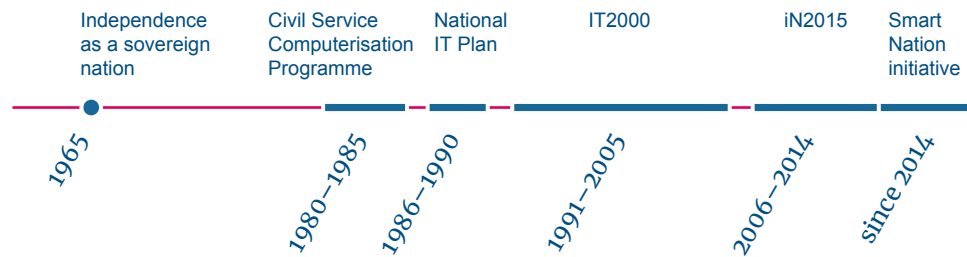
The local ride-hailing industry is directed to a large extent by private corporations that provide transport services through platform apps – in the Singapore context, the two major examples are Grab and Gojek. Innovation in this context includes changes to business practices. For example, following the increasing reluctance of investors to fund growth at all costs, these firms are compelled to expand their services beyond ride-hailing to functions like financial services and delivery. User data collected through ride-hailing services thus becomes fundamental to providing other services and marketing according to customers' needs. In Singapore, regulations in the interest of maintaining competitiveness prevent some kinds of fixed capital from being used across the different services under the same platform, although these rules are constantly being adjusted. The multinational corporations also face restrictions transferring data across national borders and multilateral agreements may need to be developed to ensure standards of data protection and maintain fair competition while facilitating business functions.

Partnerships among private firms, government agencies and research institutions are also key to innovation and planning in the transport sector. Innovation is typically guided by the agenda of either large firms or government agencies that have the resources to fund research and development. Such partnership can come in many forms, such as co-directed institutions (e.g., the Grab-NUS AI Lab), grants (e.g., the Land Transport Innovation Fund), access to application programming interfaces (APIs) and open data (e.g., DataMall).

This report will begin with an introduction to the Singapore context and the key trends and organisations in data regulation, digital government services and transport as well as perceptions of the general population. Next, it will discuss the sectors of digital public services and mobility in Singapore in turn, focusing on the cases of GovTech's technological innovations during the COVID-19 pandemic and Singapore's ride-hailing apps respectively. Finally, it concludes with a recap of the factors and players which drive innovation in Singapore, and looks ahead to how discourses around data might evolve in the future.

Since its independence as a sovereign nation in 1965, Singapore has recognised the benefits and importance of technological infrastructure and innovations. This commitment to developing Singapore as a digitally connected and competitive economy was fulfilled through a number of IT plans and blueprints: the Civil Service Computerisation Programme (1980–1985), the National IT Plan (1986–1990), IT2000 (1991–2005), iN2015 (2006–2014), and finally the Smart Nation initiative, which was launched by Singapore's Prime Minister Lee Hsien Loong on 24 November 2014.

Smart Nation is distinct from its predecessors, as other than building technological infrastructure and enabling technologies, it prioritises open data and analytics.

Independence as a sovereign nation	Civil Service Computerisation Programme	National IT Plan	IT2000	iN2015	Smart Nation initiative
1965	1980–1985	1986–1990	1991–2005	2006–2014	since 2014

Smart Nation is distinct from its predecessors, as other than building technological infrastructure and enabling technologies, it prioritises open data and analytics.

It is important to make the point here that the Smart Nation initiative is well supported and augmented by Singapore's state-market dynamics. The state has dominance over land property and urban planning facilities, which thereby provides relative flexibility and ease in the extent to which the state can shape and reshape the spatiality of the city. Market forces as well as institutions have also been configured in service of the state. Smart Nation also includes plans for a centralised geospatial platform, "Virtual Singapore", to manage and use data gathered about residents and the urban environment, ranging from information about weather and traffic patterns to human behaviour like littering (Wats & Purnell, 2016; National Research Foundation, 2018). Beyond this platform, data is also collected from sensors within public housing and from the array of digital platforms which most citizens rely on to access public services. Together, the pursuit of open data and analytics earned Singapore the reputation of undertaking 'the most extensive effort to collect data on daily living ever attempted' (Watts & Purnell, 2016).

As such, Singapore is a useful case study on Smart Government. As we illustrate in the report, it has introduced innovations and restructured public agencies to engage and develop data innovations. At the time of conducting the research in Singapore, the government has introduced a slew of innovations to cope with the COVID-19 pandemic.

In terms of transport, ride-hailing apps, once cosidered a disruptive force, have now come to be accepted as integral to the public transport network. Singapore has the second-largest online ride-hailing market in Southeast Asia and is home to the head-quarters of Grab, one of the biggest regional firms in the sector.

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Innovation and Regulatory Landscape

To better understand the innovation and regulatory landscape in Singapore, here is a list of the key stakeholders.

The **Infocomm Media Development Authority (IMDA)** is a statutory board that over-sees the regulation and development of the infocomm and media sectors in Singapore, including communications infrastructure, national digitalisation projects, and media licensing.

The **Personal Data Protection Commission (PDPC)**, serves as the main authority for data protection issues. It was established to administer and enforce the **Personal Data Protection Act (PDPA)**, which is the main data protection law in Singapore.

As the PDPA does not apply to the public sector, government agencies are instead obliged to comply with other regulations such as the **Public Sector (Governance) Act**, the government **Instruction Manual on IT Management (IM8)** and the **Official Secrets Act.**
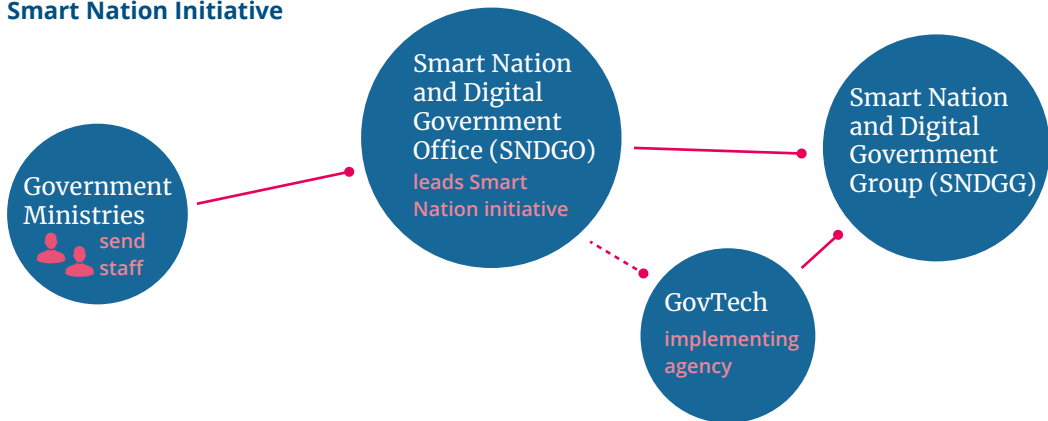
The **Data Regulatory Sandbox** allows businesses to explore and pilot data innovations in consultation with IMDA and PDPC. This initiative provides a mechanism for busi-nesses to develop innovations while ensuring compliance with PDPA. It also provides opportunities for businesses to give feedback and co-create policies with PDPC.

Digital Government Services

The **Smart Nation** initiative, launched in 2014, is a national project for digital transformation. The initiative is anchored by these Strategic National Projects:

- **National Digital Identity:** a common digital identity system across the public sector and parts of the private sector, allowing users to register for services and disclose personal information

- **Smart Urban Mobility:** efforts include trials of autonomous vehicles, hands-free ticketing technology and contactless fare payment

- **Smart Nation Sensor Platform:** based on Internet-of-Things devices in urban and residential settings

- **E-payments:** efforts to develop a national e-payment infrastructure including transfers through mobile apps and QR codes

- **Moments of Life (now rebranded as LiveSG):** a platform to deliver integrated services to citizens at key periods of life such as services targeted at young families and senior citizens

- **Core Operations Development Environment and eXchange (CODEX):** a platform for government digital services comprising common data standards and formats, software and architecture, and storage of selected data on the commercial cloud
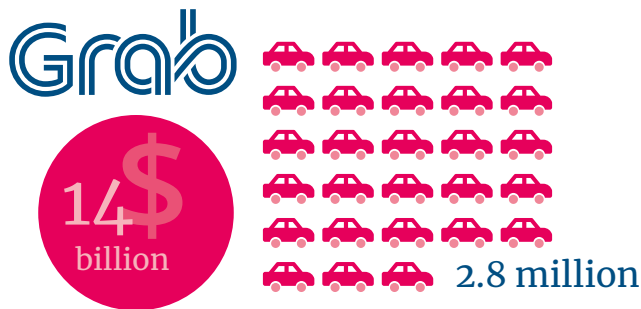
Smart Nation Initiative

The **Smart Nation and Digital Government Office (SNDGO)** leads the Smart Nation initiative, and is a unit which comprises staff from several government ministries. The Government Technology Agency or **GovTech** is SNDGO's implementing agency, which also oversees the Digital Government Transformation efforts to transform capabilities and processes throughout the government. GovTech is responsible for delivery of digital public services and develops digital infrastructure and products for public agencies.

Together, SNDGO and GovTech form the **Smart Nation and Digital Government Group (SNDGG)** so as 'to enable the Government to be more integrated and responsive' (Prime Minister's Office, 2017).

Transport in Singapore

The **Land Transport Authority** is a government agency that oversees mobility in Singapore including public transport, roads, and point-to-point travel.

Ride-hailing in Singapore has become a large industry and a key option for point-to-point transport in addition to car ownership. The ride-hailing platforms this report focuses on are apps which allow users to indicate their pick-up and destination locations, and then assign private-hire cars or taxis based on proximity to fulfil their rides.

14$ billion

2.8 million

- **Grab** is Southeast Asia's most valuable firm and the largest ride-hailing platform in Singapore, valued at over 14 billion USD and with over 2.8 million drivers. It entered the Singapore market in 2013 and shifted its headquarters from Malaysia to Singapore in 2014.

- **Gojek** is the next-biggest ride-hailing platform in Singapore and the region, valued at about 10 billion USD as of 2019 and with 1 million drivers (EDB, 2019). It is headquartered in Indonesia and only operates ride-hailing services in Singapore at the moment, but is beginning to extend its other services, such as food and delivery, outside of Indonesia.

10$ billion

1 million

- Smaller ride-hailing tech firms include **TADA**, which operates on a non-profit blockchain model, and **Ryde**, which focuses on carpooling. These have not expanded as much into services other than transport and e-payment.

- **ComfortDelGro**[1] is another multinational transport company and the largest player in the taxi industry in Singapore, and it also has a mobile ride-hailing app for its taxis. It is also the largest shareholder of **SBS Transit**, which is the largest public bus operator and also operates two of six Mass Rapid Transit lines (MRT, Singapore's rail system).

- The main public transport provider in Singapore is **SMRT Corporation**, which is owned by the government's investment holding company, Temasek Holdings. It operates four MRT lines as well as Light Rapid Transit (LRT) trains, public buses and taxis.

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1   Before ride-hailing tech firms such as Uber and Grab came to Singapore, ComfortDelGro was the largest point-to-point transport operator in Singapore.

Perceptions of Data Controllers in Singapore

As an accompaniment to the qualitative interviews and document analysis of this study, a survey was carried out from June to October 2020 in order to understand perceptions of data privacy, data controllers and regulations among the general population. This section provides an overview of relevant findings pertaining to perceptions of data controllers among the 1,020 respondents from Singapore.

Respondents tended to trust the government more than private companies to handle their data appropriately, as about 83% agreed that they trust the government's collection and use of personal data while only 46% said the same of private companies, as Figure 1 below shows.
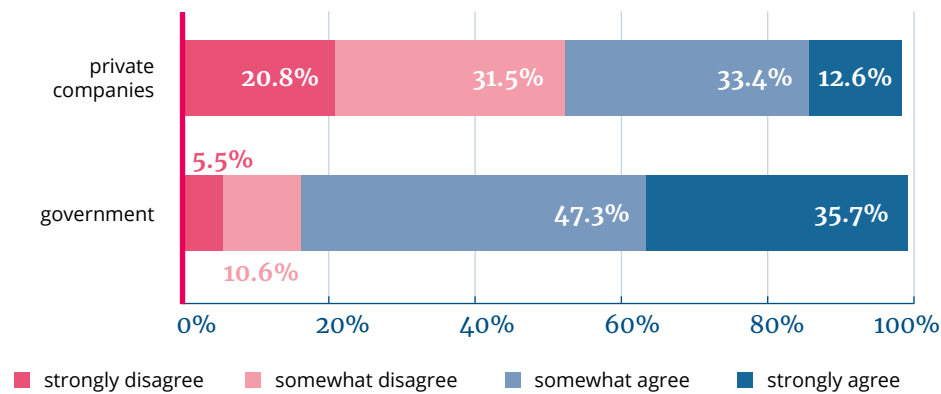
Appropriateness of Data Handling

Figure 1: "I am going to read out a few statements, please tell me if you strongly disagree, somewhat disagree, somewhat agree or strongly agree."
"I trust that my personal data is collected and used appropriately by the government."
"I trust that my personal data is collected and used appropriately by private companies."

Source: Survey by Konrad-Adenauer-Stiftung e. V. Values in percent. Missing to 100%: don't know/no answer.

When asked where the primary responsibility for ensuring data confidentiality, almost half of the respondents in Singapore were of the opinion that individuals should be mainly responsible. 32.1% thought the main responsibility should lie with the government, and the smallest group of 15.4% of respondents thought companies should be mainly responsible. Figure 2 illustrates the results below.
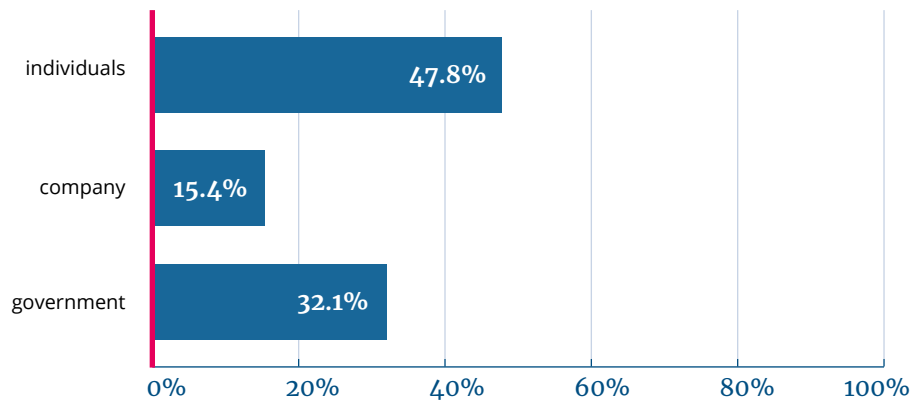
Responsibility for Data Protection

Figure 2:" In your opinion, who has the primary responsibility to ensure that personal data is kept confidential? Is it the government, the company or individuals?"

Source: Survey by Konrad-Adenauer-Stiftung e. V. Values in percent. Missing to 100%: don't know/no answer.

The study also measured the perceptions of Singaporeans towards data protection regulations in the country. Unlike the other two countries surveyed, a majority of Singaporeans consider local data protection regulations to be somewhat adequate (53.2%) or fully adequate (15.6%). The findings are reflected in Figure 3 below.
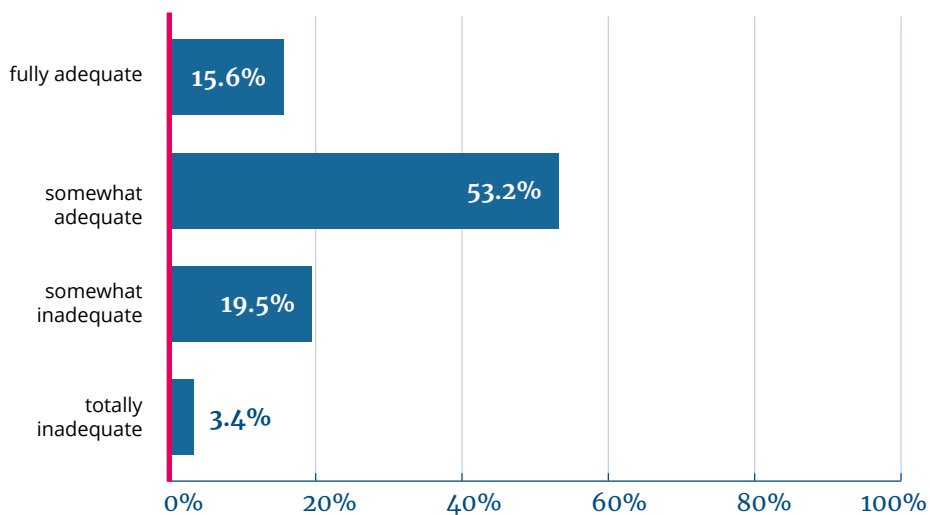
Adequacy of Data Protection Regulations

Figure 3: „Would you say that the existing regulations in Singapore for protecting your personal data privacy and security are totally inadequate, somewhat inadequate, somewhat adequate, or fully adequate?"
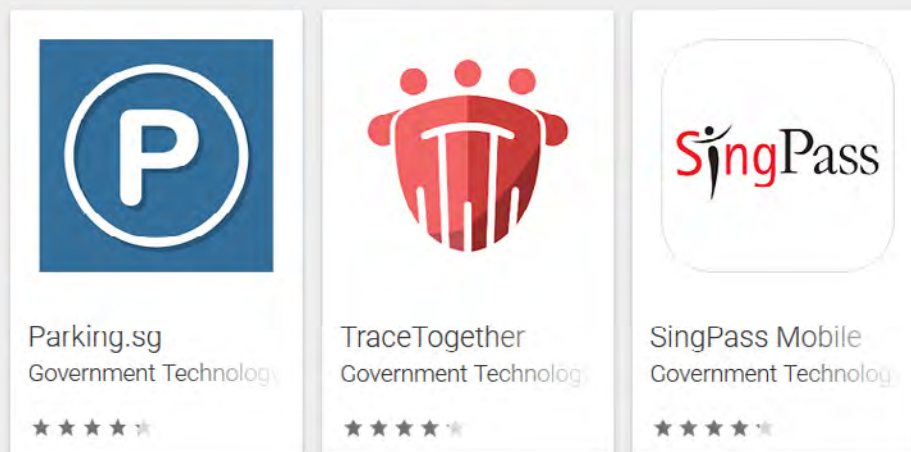
Source: Survey by Konrad-Adenauer-Stiftung e. V. Values in percent. Missing to 100%: don't know/no answer.

Case 1

Digital Public Services and COVID-19 Innovations

Outline of Stakeholders and Relationships

Innovations in Singapore's government are currently driven by the Smart Nation Digital Government Group (SNDGG), especially GovTech. **GovTech's key mandate is to support the Smart Nation initiative and deliver digital services to the public, as an implementing agency.** The agency plays a key role in digitalising various public services alongside other government agencies. As a result, most citizens who have access to these digital platforms do not need to visit public agencies in person for most services such as taxes, accessing public health records and reporting municipal issues.

Three examples of apps developed by GovTech, among them the first Bluetooth-based contact-tracing app „TraceTogether"

GovTech identifies three forms of state-community collaborations, where the "community" is referred to as "citizens and businesses": **Co-ideation, Co-development and Co-delivery**. Co-ideation involves collaborating to formulate ideas and solutions; Co-development shares technology such as data and application programming interfaces (APIs) with the public to allow citizens and businesses to develop platforms; and Co-delivery gives the public opportunities to contribute to delivery of the service (GovTech, 2019).
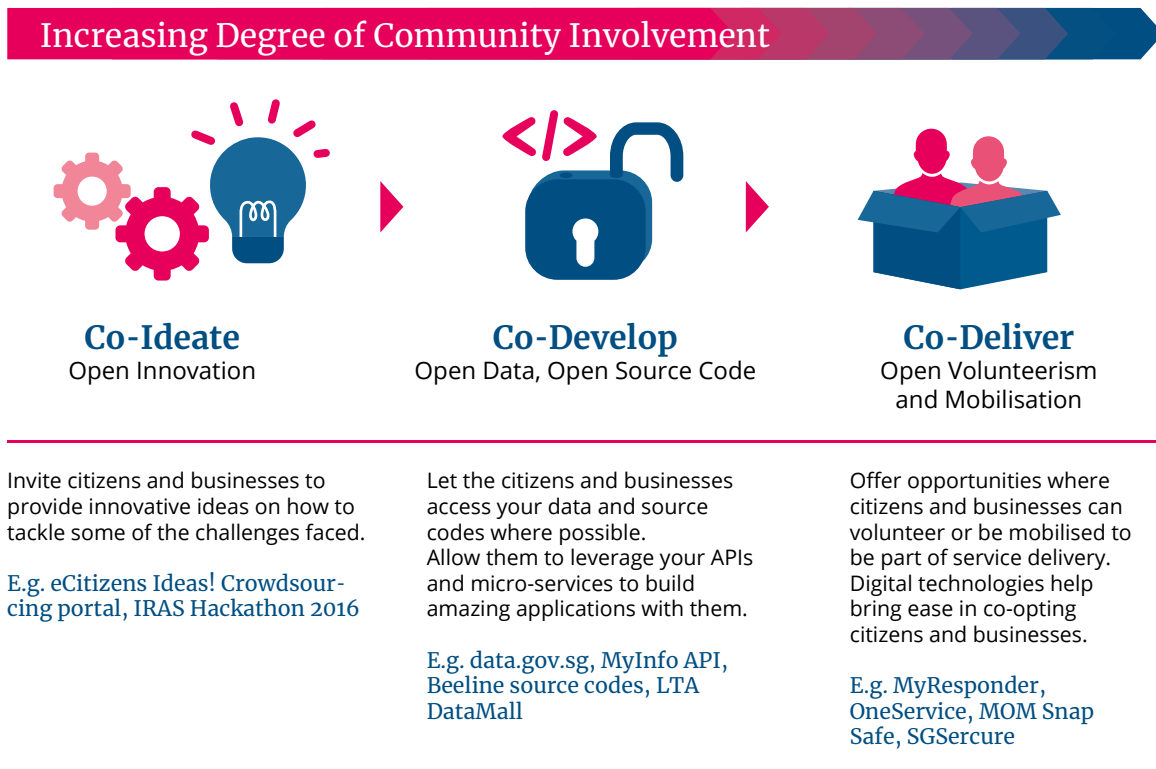
Increasing Degree of Community Involvement

Co-Ideate	Co-Develop	Co-Deliver
Open Innovation	Open Data, Open Source Code	Open Volunteerism and Mobilisation
Invite citizens and businesses to provide innovative ideas on how to tackle some of the challenges faced.	Let the citizens and businesses access your data and source codes where possible. Allow them to leverage your APIs and micro-services to build amazing applications with them.	Offer opportunities where citizens and businesses can volunteer or be mobilised to be part of service delivery. Digital technologies help bring ease in co-opting citizens and businesses.
E.g. eCitizens Ideas! Crowdsourcing portal, IRAS Hackathon 2016	E.g. data.gov.sg, MyInfo API, Beeline source codes, LTA DataMall	E.g. MyResponder, OneService, MOM Snap Safe, SGSercure

Figure 4: Three modalities of collaboration (from Govtech Ministry Family Digitalisation Guide, 2019)

Crowdsourced public services are understood as a kind of co-delivery, such as the One-Service municipal app or SGSecure internal security apps which rely on public reports from users to alert the relevant authorities to municipal issues or potential security threats. Often, the value of this kind of data is not just in the data itself but the process of collecting it, coded as "collaboration" or "community building". One example was the mobile crowdsourcing app HelpBuddy, espoused as having the potential to "bring back the kampung[2] spirit" (GovTech, 2018). HelpBuddy was an app being beta-tested to be included as a module in the broader OneService[3] municipal app, where users are matched to tasks and activities based on their interest and location.

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2 'Kampung' is a vernacular Malay term referring to a form of village or settlement, and 'kampung spirit' is used to allude to a sense of community spirit and solidarity

3 This is a smartphone application and one-stop platform that citizens can use to report issues in their municipals, without having to know which specific agency to report different issues to.

Government Digital Services in Pandemic Response

The usefulness of GovTech was evident in the way **Singapore was able to respond quickly to COVID-19 with a number of innovations, because of its existing digital and systemic capacities.** Working with the Ministry of Health, GovTech made its mark by **being the first country to introduce a Bluetooth-based app (TraceTogether) to assist with contact tracing** on 21 March 2020. Based on the TraceTogether model, other private entities such as Apple and Google, and states such as Iceland and Australia, have developed similar apps for contact tracing. GovTech has also published the open-source code based on the app to facilitate the creation of similar contact tracing systems in other countries.
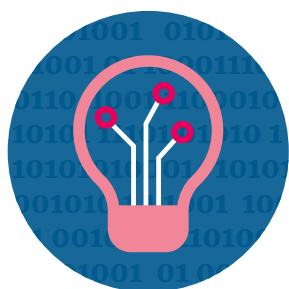
TraceTogether is not the only new tool introduced during the COVID-19 period. Other measures included **daily updates via platforms like WhatsApp, Telegram and Twitter; sites to monitor the crowd in public areas in real time; as well as the SafeEntry QR code system that logs entry and exit into public spaces such as malls.** Chen and Poorthuis (2020) broadly identify these categories of COVID-19-related technological developments used by the Singapore government:

- reporting on infections (e.g., communicating information on daily cases),

- contact tracing (e.g., TraceTogether and SafeEntry),

- and community policing (e.g., robots to track crowd density and citizen reporting of safe distancing infractions).

While these three forms of state-community collaboration are desirable to the extent that they involve citizens in the process of designing and delivering public services rather than implement purely top-down solutions, there are concerns that an over-reliance on technical responses limits potential fields of action (Ho, 2017). **There have always been particular definitive forms of acceptable civic engagement, but the involvement of digital technology may complicate this.** The boundaries of the acceptable are no longer marked only by authoritative rules, but enforced through algocratic structures – structures upholding a system of governance based on algorithms and code, which programme limits to a possible field of action (Aneesh, 2009). Specifically, there is a tendency to see the solutions to various issues, from social ills and health to environmental concerns, as matters of individualised self-monitoring and optimizing procedures. In the context of COVID-19, scholars have argued that the outbreak has exacerbated certain social stigmas and discriminatory behaviours, and media coverage which places excessive responsibility for viral spread on individual behaviour (rather than national policy) may contribute to this (Findlay and Remolina, 2020).

Data Cultures

In many debates around data privacy, the issue of a contradiction between personal privacy and collective benefit arises. This tension has been quite pronounced when examining the issues of the contact tracing app "TraceTogether". Some interviewees, particularly academics and those from government agencies, reflected that the current discourse about personal data has been driven much by concerns about individual privacy, but there may also be good that can come out of harnessing aggregated data for public benefit. For instance, by focusing only on privacy concerns, citizens may miss the opportunities and benefits that can come with more innovations.

By focusing only on privacy concerns, citizens may miss the opportunities and benefits that can come with more innovations.

The consciousness of the public about their personal data in Singapore may be summarised by three key critical inflection points.

- The first had to do with the introduction of the 'Do Not Call' registry, in response to increasing annoyance with telemarketers and banks who were calling individuals and sending them targeted marketing materials.

- The second inflection point had to do with consciousness and learning about the Personal Data Protection Act (PDPA), especially in the move to ban the collection of identity card numbers after a major attack on SingHealth data in 2018, which heightened consciousness about potential vulnerabilities associated with data held by public agencies. In this incident, personal data and records of medicines dispensed by a national healthcare provider were stolen in a cyberattack affecting 1.5 million patients, including the Prime Minister, Lee Hsien Loong.

- Singaporeans are in the midst of the third inflection point, a juncture where they are asking questions about how personal data collected by public agencies is governed and how they will be informed about the ways personal data are used.

Trust, Privacy and Functionality in the Deployment of TraceTogether

An interviewee researching smart city innovations in Singapore observed that while **Singaporeans are often assumed to have unreserved trust in the government, this may be overstated as they had found in their research that citizens often articulated the limits and conditions of their trust in specific ways.** However, Singaporean users did not necessarily express this to authorities or data controllers in ways that may be more common in Europe, such as through direct questioning or protest, more often choosing to modify the ways in which they interact with technology such as by covering up smart sensors in public housing flats. In the case of TraceTogether, this was apparent in the low rate of uptake. It was also pointed out that the narrative of high trust is one explicitly promoted by the government to attract foreign firms and research institutions to test their products in Singapore due to the relative lenience of regulatory restrictions as compared to Europe's GDPR, for example.

With the launch of the TraceTogether app and the proposed token, a more pronounced discourse regarding the conditions around adopting state-provided technologies arose. By April 2020, only about 20% of the population had downloaded the app, prompting comments that this was not enough for the tool to be effective (Yip, 2020). As of September 2020, the app is estimated to be downloaded by about 40% of the population, while the Minister-in-Charge of the Smart Nation Initiative comments that the target participation rate is at least 70% (Baharudin, 2020). A lead developer cautioned that TraceTogether was not meant to be a replacement for manual contact

tracing, but a complement such that every additional user increased the efficiency of contact tracing (Bay, 2020), rejecting the idea that the app would only be effective above a certain rate of adoption.

The adoption rate of TraceTogether aside, two intertwining concerns around privacy and functionality arose. With regard to privacy, the government was quick to emphasise that no location data was collected from the app, and that the Bluetooth data would only be accessed by the Ministry of Health (MOH) if the user tests positive for COVID-19. Citizens also discovered that early versions of the app collected more data than it claimed, although this excessive data collection was removed and a 21-day data purge was built in after feedback (Chu, 2020).

There was also dissatisfaction about the fact that the app quickly drained battery life and did not work in the background of iOS devices (Balakrishnan, 2020). In response to concerns about the functionality of the app and its reliance on smartphone ownership, a wearable token using the same Bluetooth contact tracing technology was developed. However, this stirred up some backlash, with comparisons being made to electronic tagging for probation, and an online petition rejecting the wearable devices amassing over 50,000 signatures (Low, 2020).

On 4 January 2021, more questions about the governance of TraceTogether arose when the Minister of State for Home Affairs revealed in response to a parliamentary that data from TraceTogether could be retrieved by the police for criminal investigations under the Criminal Procedure Code (CPC). It was also made known that the data had already been requested by the police for the investigation of a murder case in May 2020, although they were unable to obtain useful data (Lay, 2021). This contradicted previous assurances that ministers had made, and the GovTech website's description at the time, that the data would only be used for contact-tracing purposes (Daud, 2021). The Minister-in-charge of Smart Nation admitted that he was not aware that the CPC applied to TraceTogether until being questioned by a member of the public in October 2020, and public statements that data would only be used for contact-tracing were only amended after the debates in the first week of January 2021. This led to considerable anxiety and doubt about why the information about CPC exceptions had not been considered earlier or clarified to the public as soon as it was known, and whether such data was crucial enough to solving crimes to justify such extensive access. Eventually, the COVID-19 (Temporary Measures) (Amendment) Bill was introduced on 1 February 2021 proposing the restriction of access to TraceTogether, SafeEntry and BluePass[4] data by the police to particular serious offences only.

While these critiques may be understood as a rejection of pure technological solutionism, Sean Martin McDonald (2020) argues that such **debates around contact-tracing tech in various countries continue to focus on individual technologies which play a relatively small role in controlling viral spread, a kind of "technological theatre" which distracts from broader policy and political issues.** Even though there has been much public discourse on TraceTogether data, there has not been much scrutiny of how data collected by other e-government apps and platforms is governed. Still, this episode could prove to be a significant turning point in Singaporeans' awareness of data governance, where it has previously focused on security issues relating to data breaches and leaks.

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4   A contact-tracing app for workers in dormitories and certain industries such as construction and marine shipyards

Debates around contact-tracing tech in various countries continue to focus on individual technologies which play a relatively small role in controlling viral spread, a kind of "technological theatre" which distracts from broader policy and political issues.

Regardless, the app has demonstrated that **Singaporeans are not in fact indifferent to their privacy or unconditionally trusting of their government, and this issue displays the dynamics between privacy and functionality; personal benefit and distributed good.** Singapore has a reputation for having a high level of general trust in the government, and the quantitative study conducted as part of this project found that Singaporean respondents had a generally high level of trust in the government's collection and use of personal data – 84% agreed or strongly agreed that they trust that the government collects and uses personal data appropriately. The survey concluded in October 2020 before questions about the CPC and TraceTogether arose in parliament, but even at this time, survey respondents were not willing to disclose their data to the government unconditionally. As Figure 5 below shows, most Singaporean respondents believed that in the context of COVID-19, the government should only ask individuals to provide information voluntarily (as opposed to non-consensual data collection), with 77% indicating that they agreed or strongly agreed with the statement. However, 65% of respondents agreed or strongly agreed that they have "no choice in how much [their] personal data is collected by the government", suggesting that even though respondents may generally trust the government to handle data well, they would also like more agency in choosing what data to provide and for what purposes.
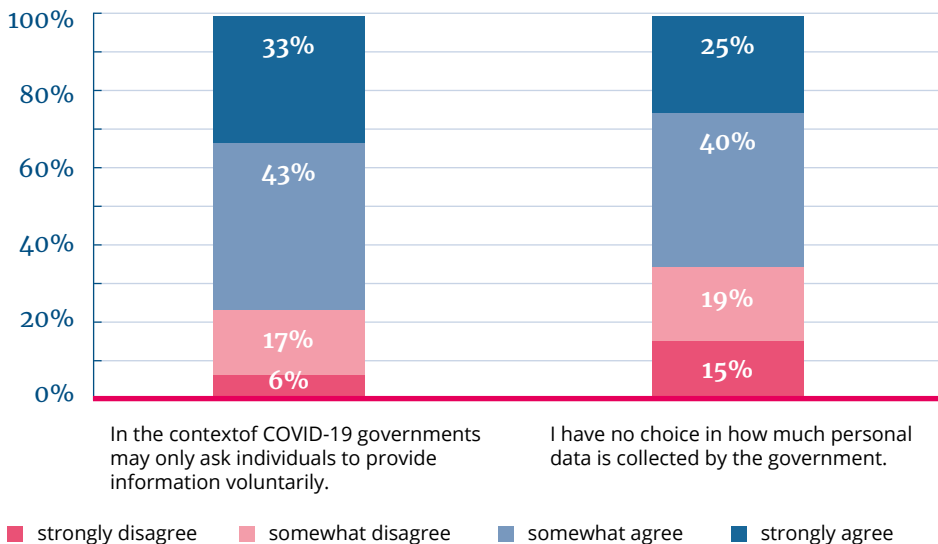

Figure 5: Perceptions of Singaporean respondents towards data collection by governments in COVID-19 and level of control over data collected by government.

Source: Survey by Konrad-Adenauer-Stiftung e. V. Values in percent. 3,060 respondents 1,020

The selective scrutiny of TraceTogether shows that apart from general trust in the reputation institutions like the state, trust and compliance from data subjects is also contingent on particular technologies and incidents. In other words, high levels of general trust in the government do not mean that Singaporean citizens will uncritically accept careless use and processing of their data. Concerned citizens and media outlets which brought this issue to the attention of politicians also show the significance of civic participation in bringing such questions to the public eye.

It is safe to surmise that at this point, apart from the issue of preventing data breaches and unauthorised access, concerns have also been raised over how public agencies handle personal data privacy in their own operations. Apart from privacy issues surrounding COVID-specific technologies, other concerns have also arisen about how public agencies handle citizens' data. In response to clients who had anonymously disclosed details of their financial difficulty to the public, agencies such as the Central Provident Fund (CPF) Board[5] and Ministry of Social and Family Development (MSF) have on multiple occasions revealed the identity of these persons as well as released sensitive information such as social work case histories and criminal records. One recent case occurred in response to a news article on how families were coping with the pandemic, where concern arose around the struggles of a low-income family, and the MSF published details of social assistance the family had received online (Tee, 2020). Such disclosure have been justified through the notion of upholding the reputation of public agencies as a form of public interest (Wong, 2020).

> Singapore has been able to be agile with data innovations because of its existing capacities, such as the presence of an agency like GovTech to develop technological tools, as well as relatively high mobile penetration rates and digital literacy.

In sum, **Singapore has been able to be agile with data innovations even during a pandemic because of its existing capacities, such as the presence of an agency like GovTech to develop technological tools, as well as ongoing efforts to create a Smart Nation which have resulted in relatively high mobile penetration rates and digital literacy.** But ongoing concerns about the stewardship of citizens' data collected and used by government agencies are expected to grow.

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5   The Central Provident Fund (CPF) is a compulsory savings programme for Singaporeans to fund retirement, housing and other needs. It is administered by the CPF Board.

Laws and Regulations

Data is thought to be something that creates value, but only if and when it is able to 'flow' across platforms and between stakeholders. From the perspective of governance and the public sector, Singapore's approach recognises the potential of innovations that comes with the sharing and movement of data, but also wants to be able to strike a balance with protecting the privacy and rights of citizens.

The main regulation in Singapore concerning data protection is the **Personal Data Protection Act (PDPA) of 2012.** At the time of writing, public consultations are ongoing for a proposed amendment. Recent legal debates have argued for the reconsideration of the relevance of the principle of consent that it is centred on, now that most data is not manually disclosed by individuals but digitally and automatically collected. This makes consent more impractical to implement, but also less relevant because information about an individual can be derived even if they do not disclose it themselves. Consent also depends on the context/purpose of data collection, and two exceptions to mandatory consent are proposed in the amendment bill.

- The first is the principle of **"legitimate interest"** – organisations would be able to act without consent when "the benefit to the public or any section of the public of the collection, use or disclosure (as the case may be) is greater than any adverse effect on the individual" (Personal Data Protection Amendment Bill, 2020).

- The second, potentially more contentious condition, is **"business interest"**, which would allow businesses to use (but not collect or disclose) data without consent, for purposes such as to "improve or enhance any goods or services", and "learn about and understand the behaviour and preferences of the individual or any other customer of the organisation in relation to the goods or services provided by the organisation".

From responses to calls for public consultation on the points that comprise this amendment in previous years, there has been considerable concern for the "onerous regulatory burden" that too many protections may impose on corporations with limited resources from the private sector. In contrast, legal experts have implied that if an organisation is unable to meet this standard, it is their business model rather than the regulation which needs to be adjusted. There is no clear answer to the optimal amount of regulation, as it is undeniable that a certain basic level of privacy is desirable but these restrictions reduce the usefulness of datasets to an extent.

A policymaker observed that one of the unique features of Singapore's regulatory regime is that the IMDA plays the dual role of regulation and development – there are policies which are meant to uphold standards and security, but others are meant to drive innovation. For example, within the PDPA, there are provisions mandating that firms and organisations obtain consent before collecting, using and disclosing data, which are meant to protect consumer privacy and security. However, data portability requirements as proposed in the current review of the Act would also serve the purpose of encouraging competition and innovation (Kwang, 2019). Beyond this piece of regulation, IMDA also runs programmes to facilitate innovation in industry and digital readiness in citizens through mechanisms such as the **Data Regulatory Sandbox and the Trusted Data Sharing Framework, which facilitates** data sharing partnerships in line with data protection requirements. Funding and

training is also provided to businesses in order to encourage digitalisation. **Especially in the areas of public infrastructure and digital commons, innovation needs to be government-driven because of the lack of a profit incentive.** Thus, the interviewee asserted that having the same teams consider the maximisation of innovation and minimisation of risk was key to avoiding a conflict or imbalance between the two objectives.

> Especially in the areas of public infrastructure and digital commons, innovation needs to be government-driven because of the lack of a profit incentive.

A common **criticism of the PDPA is the exemption of public sector agencies and other organisations handling public sector data from the regulation.** A common response from public servants is the insistence that the public sector has its own set of regulations and statues to abide by, such as the Public Sector (Governance) Act and the Official Secrets Act. Yet, there have been multiple concerns about inadequate data protection in the public sector raised in recent years even before the COVID-19 pandemic. Cyber-attacks such as the SingHealth data breach in 2018 and the lapses in public sector IT controls found by the Auditor-General's Office (AGO, 2019; Public Accounts Committee, 2020) are some of the most recent examples. In response to the most recent Public Sector Data Security Review where three in four agencies were found to be non-compliant with IM8, public sector rules are being updated in 2020 to "harmonise" with the rules governing the private sector (Baharudin, 2019) and a broader overhaul of systems is aimed to be completed by 2023 (Low, 2019). However, existing reporting suggests that these reforms are focused mainly on cybersecurity, with little examination of the ethics of data sharing with and by public agencies.

Case 2

Mobility in Singapore: Ride-Hailing Platforms
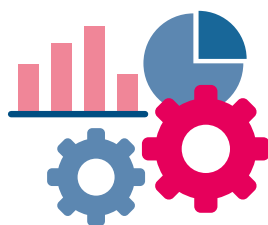
Outline of Stakeholders and Relationships

In Singapore, the **Land Transport Authority (LTA)** is responsible for maintaining fundamental infrastructures for mobility as well as for planning the long-term land transport network. Some of the aims of these long-term plans include reduced reliance on cars, greater accessibility of public transport, and improved convenience and connectivity through technology.

Timeline:
- Uber introduces ride-hailig apps in Singapore
- Grab enters the market — 2013
- More ride-hailig cars than taxis — 2016
- Uber collapses — 2018
- Grab and Gojek become the biggest platforms in South-asia

Ride-hailing apps were introduced in Singapore by Uber in 2013, shortly after which Grab entered the market. By 2016, the number of private-hire cars providing ride-hailing services had overtaken the number of taxis in Singapore (Tan, 2017). However, in 2018, Uber collapsed in the region and it had to sell its Southeast Asian services to Grab. Grab's success in this rivalry is attributed in part to their knowledge of the local context, for example, accepting cash when Uber only accepted digital payments for years (Ng, 2018). Currently, the two largest platforms in Singapore, Grab and Gojek, are also the two largest firms in the industry in Southeast Asia, with operations across the region. Business observers and those within the industry have observed that platforms such as these can no longer rely on a model of growth and geographical expansion at all costs. Both apps have yet to turn profitable, and doubts have arisen

about their long-term profitability especially as investor confidence in their American counterparts Uber and Lyft has waned (Ng, 2018). While both have already ventured into other services beyond ride-hailing, e-payments seem to be a key sector to expand into, with Grab recently securing funding from Japanese investors to develop its financial services (Lee and Uranaka, 2020).

The entrance of firms such as Grab and Gojek into the point-to-point transport market has led to intense competition for traditional taxi drivers and companies. This has compelled the largest taxi service provider in Singapore, ComfortDelGro, to undertake a "digital transformation" initiated in 2018 (Tan, 2019). For example, small teams who use data analytics to decide how and when to provide offers to customers have been introduced, and sample commuters are interviewed to assess the user experience of app functions. While most of their taxis are still street-hailed rather than booked online, there is also an option for riders to pay using their app.

data controllers

Large companies such as Grab or SMRT (a major public transport operator), as well as transport authorities like the LTA, can be understood as **"data controllers"** as the term is used in the GDPR. They have the capacity to collect large amounts of data, as well as determine how and why the data should be processed, hence they are deemed to have control over data. The LTA collects data pertaining to road traffic, public transport ridership (e.g., payment card data) and vehicle ownership, and much of this is available on the Land Transport DataMall website, in the form of open datasets and APIs. This is meant to promote co-creation and innovation for transport solutions. **At the same time, taxi and ride-hailing companies control specific information on point-to-point travel such as customers' travel history.** These companies often collect data on an even greater scale than the state due to their international operations. However, they are unlikely to share their data openly, whether because of commercial interests or foreign regulations which restrict cross-border data flows. In the mobility sector, and indeed many other Smart Nation efforts, these corporations play a key role as 'co-deliverers' of services.

Taxi and ride-hailing companies control specific information on point-to-point travel such as customers' travel history.

Data controllers also often collaborate with researchers with technical expertise, such as data scientists and engineers in institutions like universities. These collaborations are mainly for the purpose of conducting exploratory research, beyond what transport companies in the local scene currently have the capacity to do, or to test new innovations. The **research institutions** and researchers may be understood **as "data processors"** who analyse data on behalf of the controllers.

One example of how research institutions are involved in **developing transport innovation** is the **Grab-NUS AI Lab**, where data scientists and students develop "solutions to transform urban transportation" for Grab (National University of Singapore, 2018). The lab's role is not to generate the same insights that Grab uses in its day-to-day operations, but to develop and improve the methods that the firm would use to generate insights. This kind of research is becoming increasingly significant to platform

"super-apps" like Grab as they expand their services. Some of the doctoral students who work in the lab could then go on to be employed by Grab – this also indirectly involves the public sector as the doctoral programmes are funded by the Economic Development Board (EDB). Unlike global tech giants like Google, Grab may not yet have the resources to carry out a level of research requiring PhD-qualified researchers in-house, but it seems to be moving towards this scale as operations expand, and is thus seeking to attract talent from university programmes. At the same time, an EDB representative has also observed that large tech firms such as Google can draw and train talent that ideally later circulates in other local or smaller firms (Soo and Chua, 2019).

From interviews with both university academics and public sector employees, it was understood that **researchers such as those based in universities or government research agencies may seek to play the role of "trusted third parties" who can analyse data from private firms.** In this way, the third party researchers could generate new insights that could benefit all parties, but the firms would not have to disclose their data to each other or make it public. However, interviewees also suggested that a set of relationships like this is difficult to maintain, as companies may be reluctant to share their data if they perceive that they have to disclose more commercial information than their competitors but receive the same eventual benefits.

Researchers may seek to play the role of "trusted third parties" who can analyse data from private firms.

There is further potential for these third parties to play the role of data stewards which mediate between the interest of multiple groups, including users and platform workers whose interests are often overlooked as compared to the profit interests of firms (Kapoor, 2021). This may be especially important to give users a say in how their personal data is handled and build their trust in firms, especially as the companion survey to this study found that only 47% of Singaporean respondents agreed that they trust that companies collect and use their personal data appropriately. Furthermore, only 16% of respondents thought that companies should bear primary responsibility for keeping personal data confidential, while 50% thought individuals should bear responsibility, even though a majority of 72% agreed that they were at the mercy of Internet giants. This suggests that individuals should be given more avenues to exercise agency over the data which is disclosed to large platforms like the ride-hailing apps which are dominant in the region.
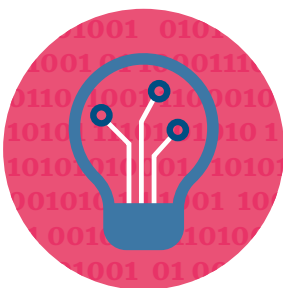
A final group of stakeholders that interviewees identified as part of the transport innovation ecosystem were **"idea generators"**, or people who come up with novel solutions but may not play a significant role in service provision and large-scale data processing. This includes startups and smaller firms.

One example is mobilityX, a startup that was seed-funded by major public transport operator SMRT and had its business development supported by the Economic Development Board. mobilityX specialises in Mobility-as-a-Service (MaaS). The firm test-beds MaaS solutions such as driverless vehicles to connect commuters to bus and rail networks, in collaboration with Nanyang Technological University (NTU) and Jurong Town Corporation (JTC), a government statutory board overseeing industrial development (mobilityX, 2018). They seek to create integrated platforms for route planning and payment, improving mobility for commuters and companies through "strategic marketing, payment services and data analytics" (mobilityX, 2018). As many of these startups are in the early stages of development, it is difficult to assess their successes in improving broader mobility.

However, everyday users and researchers who do not necessarily have technical experience can also play a role in contributing ideas, similar to the "co-ideation" model of collaboration outlined by GovTech in the previous section. In line with "lead user" theory and methodology of design (von Hippel, 1986), users or customers can generate ideas that are then taken on or supported by larger organisations, which can provide funding or access to data. The public sector is more likely to draw innovative ideas from these stakeholders than private companies.
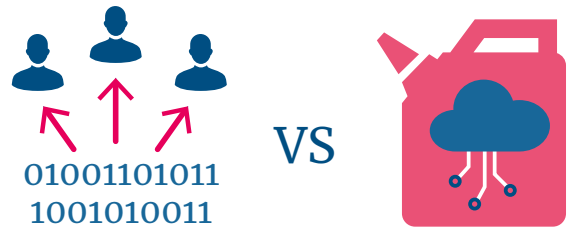
As regulators of the mobility sector, LTA is open to proposals from members of the public. There are open calls for funding applications such as the Land Transport Innovation Fund. The agency often works with students – some are hired as interns, or linked up with private companies. These individuals can then have access to more datasets that are too "sensitive" to be made openly accessible, in order to develop their ideas. The kinds of new ideas that are being sought and valued are typically "middle-moving" or paradigm-shifting plans such as changing the public transport culture and reducing the reliance on cars.

Data Cultures

Two seemingly conflicting ideas of what data means have emerged in the discourse around data governance – **data as a public good, versus data as the resource of a new economic frontier, "the new oil"**. The idea of public good suggests that data should not be private property, yet private organisations still have legal control over the data they collect. This control which is often ceded by individuals in users' agreement to various terms and conditions, giving firms effective control over data by allows them to collect, store and use their data for various purposes such as marketing and business development. Still, as legal experts who were interviewed pointed out, Singapore has yet to develop a clear legal regime around personal data as property, or defining legal ownership of it in these transactions. Also, when discussing how individuals can protect their personal data, it is presented as something they have the right to own, but **aggregated data is treated as the property of the data collector or controller, because of the resources they have invested in collecting and storing the data**. The ambiguity then becomes slightly problematic here – the government absorbs the cost of digitising, sanitising, and aggregating the open data
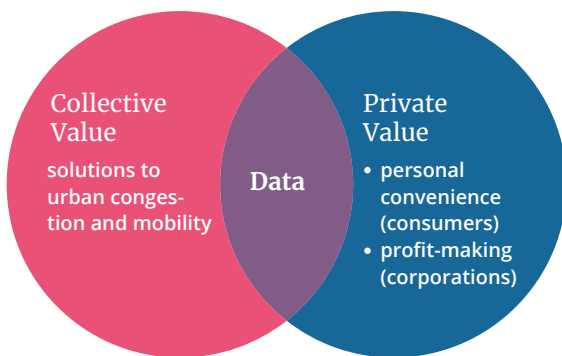
that is made available to the public, because this aggregated data in the hands of the state can be used to improve, for example, urban mobility.

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Two seemingly conflicting ideas of what data means have emerged in the discourse around data governance – data as a public good, versus data as the resource of a new economic frontier, "the new oil".

Thus, in the transport sector, data takes on both a collective value in the form of solutions to urban congestion and mobility, as well as a private value in the form of personal convenience to consumers and profit-making to corporations. From the perspective of platform ride-hailing apps, data also serves as a fundamental resource for other "value-added" services such as delivery, e-payment and so on. In the case of Grab, data science is described as a "profit centre" supporting "business metrics such as allocation rates, revenue and cost savings" (Lye, 2018). At the same time, the firm and its collaborators speak of **data being used to address customers' "pain points" (ibid.) and create solutions to congestion and other issues of mobility in Southeast Asian cities.** Meanwhile, transport planners and regulators from the public sector also acknowledge private firms as valuable collaborators both for their innovative capacities and the user data they collect, which may be shared on a limited basis with "trusted parties", as previously mentioned.

Collective Value
solutions to urban congestion and mobility

Data

Private Value
• personal convenience (consumers)
• profit-making (corporations)

In the transport sector, data takes on both a collective value in the form of solutions to urban congestion and mobility, as well as a private value in the form of personal convenience to consumers and profit-making to corporations.

Collaboration and negotiation between public and private sectors

Questions of ambiguity thus arise between private property and public good, or at least how to address the positive externalities assumed to accompany data sharing. **Firms are free to use the LTA's open data to plan their services, but are not obliged to share their aggregated data with the public service to improve national transport planning.** The uncompensated labour of each user, including both riders and drivers, in creating data is also rarely considered in discourses, regardless of whether they are centred on privacy or competition. As Rida Qadri observes, the efficiency that platforms like Grab and Gojek creates is often attributed to the technology itself but is in fact created also by the localized knowledge and social networks of drivers (2020). While there is little public information on exactly what data and how much data is shared by private firms with public agencies, in the absence of such obligations, firms are likely to disclose their data only when the benefit to their business can be demonstrated, or as a condition for receiving funding or other resources. For example, in the most recent regulatory sandbox application for bike-sharing, the LTA stipulates that approved licensees must share data such as the location of all unhired vehicles, trip route data, and trip start and end-times, on a weekly basis.

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Thus, resources may be shared between government agencies and private companies to support innovation with broader goals of national mobility in mind.

One example was the GrabShuttle service which ran from 2017 to 2019. Envisioned as a key complement to public transport, this was a collaborative effort between GovTech and Grab, where Grab ran shuttle buses to supplement the public transport network, providing more direct access to residential estates, industrial estates, army camps and so on. The app was based on GovTech's open Beeline smart mobility technology (discontinued in 2020), which was a cloud-based platform that allowed commuters to book seats and suggest routes. While this was a stand-alone app, developers could also make use of the open-sourced code and API to "scale up" the platform or develop new services (GovTech, 2017).

> Resources may be shared between government agencies and private companies to support innovation with broader goals of national mobility in mind.

The LTA also issues **sandbox licenses** to certain service providers, most recently in the area of **bike-sharing**. This allows companies to test their products for a limited period without certain regulations in place, after which regulations and policies would be designed based on this test period. The latest application cycle began in January 2020, and being part of the sandbox licenses allow successful applicants to operate a limited fleet of bicycles (and previously, other Personal Mobility Devices or PMDs) island-wide for one to two years. If they prove themselves able to manage issues such as indis-

criminate parking, rates of fleet utilisation and so on, they can then apply to expand their fleets and obtain a full license. While previous bicycle and PMD-sharing schemes have not developed into sustainable models, the LTA considers this a key part of their vision of "car-lite" mobility.

Data as an economic resource

Interviewees from transport service providers suggested that **the value that comes from aggregated data is not something that individuals can easily perceive from their vantage point;** only something that data controllers, whether public or private, can understand. As with any relationship between data producers (i. e. users or customers) and controllers (i. e. data collectors such as tech firms), sharing data with controllers such as ride-hailing companies is a matter of trust and perceived benefit. Service providers suggest that users should share their data with the organisation, which will then make it useful in ways that will eventually benefit the consumer base, for example, by designing services and offering promotions that better suit each consumer's needs. We would also contend that the potential to generate value from data is not only a matter of perception, but control over the tools to process the data and generate meaningful results.

Those with experience working with private sector transport providers whom we interviewed also pointed out that **not even data controllers are fully aware of the value of the data they collect, when they collect it.** Quite unlike European data controllers who must abide by the data minimization obligations enshrined in the EU's GDPR, **Singapore's ride-hailing companies tend to collect as much data as possible,** and decide how to analyse it later on. An issue arises here as to how the users whose data could be used for purposes they did not initially agree to should be notified or give consent to this use – as mentioned in the previous section, proposed amendments pertaining to "business interest" in the PDPA would allow companies to use data for these new purposes without consent.

> Singapore's ride-hailing companies tend to collect as much data as possible, and decide how to analyse it later on.
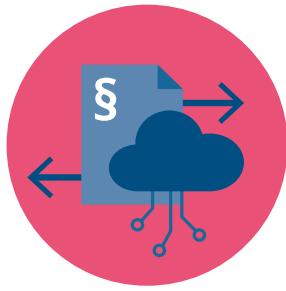
With regard to the commercial value of data, innovation is not confined to traditional boundaries between economic sectors as the potential business value of data extends beyond any single 'industry'. For example, information on a person's travel routes can be used not only to optimise ride-hailing services, but also anything from courier to food delivery services, for example by analysing consumer data to provide

targeted marketing. Thus, while Grab and Gojek may have started out as ride-hailing and ride-sharing platforms, **the data they collect from this service as well as the fleets they build up in each territory may be considered the fundamental infrastructure upon which they develop other services.** During the COVID-19 period for Grab Singapore, an uptick in demand for food delivery also helped to make up for the lack of demand for passenger transport for Grab Singapore (Aravindan and Daga, 2020).

While Grab and Gojek may have started out as ride-hailing and ride-sharing platforms, the data they collect from this service may be considered as the infrastructure upon which they develop other services

This being said, the extent to which Grab and Gojek's financial success is purely a result of data innovation is debatable, as their **aggressive business tactics** have also allowed them to capture a huge market share. For example, in the years of competition between Grab and Uber, they both engaged in price wars and offered many promotions to riders and drivers to encourage adoption over traditional taxis. It may be argued that if these models innovate, it is at least in part because they work around the usual regulations meant to protect workers and promote competition – for example, by treating **drivers as "partners" rather than employees**, and using common resources to provide multiple services. While some interviewees lamented that regulations restricting the use of physical resources such as car fleets across services limited their business models, there is little to prevent firms from using transaction data from the same app to target different services at clients.
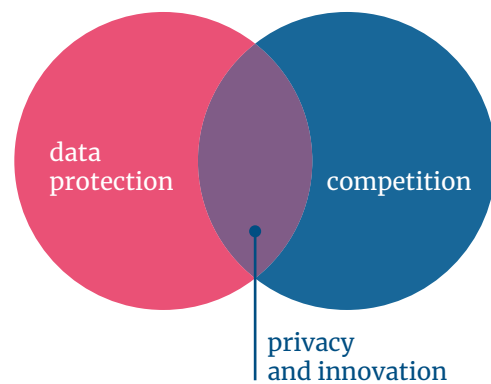
However, other forms of innovation may also help carve out a place in this market. TADA is one company which does not see itself as a direct competitor to companies like Grab, and is even open to collaborating with them in the future (Ellis, 2018). **TADA** seeks to promote more "transparent sharing of mobility-related data". The firm aims to consolidate ride and transaction data from its app on a blockchain platform. This data is referred to as "consentable data" fully owned by drivers, who can then consent to sell it to other parties in the mobility ecosystem including vehicle repair services, insurance companies and used car services (Tang, 2018; Sek, 2018). However, no mention has been made of whether riders have any control over the data they generate. **TADA's business model also differs from the larger firms as it does not have the aim of profitability**. The company charges no commission from its drivers, though it would earn revenue from trading data as well as its cryptocurrency, the "MVL coin", which drivers can redeem by driving safely and providing good service. Still, as a relatively new entrant, it is difficult to assess if this will be a successful model in the years to come.

Laws and Regulations

Regulations to Protect Both Privacy and Competition

The relationship between **privacy and innovation** is also where principles of **data protection intersect with principles of competition**. Economic competition is considered in the Personal Data Protection Act (PDPA), but is also protected by the Competition Act of 2004. In the case of data portability, it is argued from a data protection standpoint that the data portability requirements in the PDPA would allow individuals greater control and understanding of how their personal data is used, as well as facilitate consumer choice and right of access because consumers can choose to transfer their data from one organisation to another. This is a counterpart to the right to data portability outlined in the GDPR, which refers to the rights of an individual to transfer their data from one organisation to another, and the obligation of organisations to store data in commonly used, machine-readable formats. From a competition standpoint, such a requirement would lower barriers to entry and increase efficiency by minimising switching costs (Personal Data Protection Commission & Competition and Consumer Commission of Singapore, 2019).

On the other hand, corporations argue that such a requirement would be anti-competitive as the transference of certain data can reduce the incentive to innovate and compete by encouraging free-riders. Regarding user activity data, Grab contends that firms who do not invest the resources to "instrument for, digitise, collect and store" the data can nevertheless benefit from it to improve their competitive advantage (2019). They also put forth the argument that access to user activity can lead to information about other forms of data that should be considered commercially confidential information.

Among interviewees within the private sector, generally speaking, a **trade-off is assumed between data protection regulation and innovation**. In the transport and ride-hailing sector, this was discussed in two main ways – data and resource sharing across multiple services, and across international borders.

International Data Transfers and Innovative Processes

From a competition law perspective, regulations are necessary to prevent excessive monopolisation by platform giants, though they may also prevent traffic congestion and disruptions to existing passenger services. As legal experts have pointed out, apps like Grab and Gojek with a regional presence enjoy the advantages of network effects which can allow them to drive out competitors using strategies such as "bundled discounts" for using multiple services in the same app (Ong and Tan, 2020). **Platform companies built on ride-hailing services often have a limited physical presence in the countries of the consumer bases they target, which also suggests uneven economic benefits across the region, and regulation of the anti-competitive effects would require multilateral cooperation.** For example, where these multina-

tional companies set up their headquarters, they would also create jobs and direct capital flows from their markets across the region towards their host countries.

With regard to transfers of data across national borders by organisations, multiple interviewees raised the issue that some countries have requirements for **data localisation** which are difficult to adhere to in the world of cloud computing. **It is particularly difficult to host the data originating from one country within the same country when third-party services are used, such as relying on Google server farms located worldwide** – companies like Google might only be obligated to ensure that the data is stored in the correct jurisdiction for large multinational clients like the ride-hailing platforms which operate in Singapore. Data localisation requirements also make it difficult to aggregate data from different jurisdictions for analysis when they are stored on different servers.

> Platform companies built on ride-hailing services often have a limited physical presence in the countries of the consumer bases they target, which also suggests uneven economic benefits across the region, and regulation of the anti-competitive effects would require multilateral cooperation.

Relationship between Data and Innovation

Some interviewees suggested that privacy and innovation are not entirely mutually exclusive or zero-sum, although the innovations that emerge from a highly regulated environment will be of a particular nature. For example, there would have to be advances in cybersecurity technology to keep up with expectations of privacy. One data scientist pointed to federated machine learning as one such innovation: where data is stored in multiple locations to avoid re-identification, machines can learn in a distributed manner before piecing together the insights from each location. Thus, regulation compels innovation in processes, in order to allow insights to be generated while adhering to regional regulations of data privacy and protection.

Conclusion

Government-led Digitalisation

The case of Singapore has shown how important it is for structural changes within the government to align with the responsiveness expected to come with achieving Smart Nation initiatives. Singapore did well in this aspect in the restructuring and formation of the Smart National Digital Government Group and GovTech with it. GovTech has the flexibility to work with many government agencies, and came up with many innovations in response to the COVID-19 pandemic. **But concerns around the governance of personal data in TraceTogether in particular, have also illuminated the importance of transparency and citizen engagement.**

While information about the stewardship of data collected by TraceTogether is available, there are gaps in terms of how well they have been communicated and the extent to which citizens are engaged in the process of thinking through the design and implementation of TraceTogether. Uncertainty and fears about stewardship of personal data collected by the government are also underlined by prolific data breaches in the past, where millions of citizens' personal data have been stolen. **Updates to the PDPA and Public Sector (Governance) Act that will build public trust, especially for government-driven innovations, are critical,** since the data protection provisions in the PDPA do not apply to public agencies or organisations acting on their behalf. It remains to be seen how ongoing revisions to public sector regulations to align them with the PDPA will be received.

Challenges for Regional Data Governance

On the part of private companies and commercial interests, trends in the mobility and ride-hailing market in Singapore and the broader Southeast Asian region raise questions of regional and inter-sectoral regulation with respect to both competition and data protection law. The region will have to consider the purported benefits of financial inclusion and urban mobility alongside the consequences of a few "super app" platforms having exclusive access to much location and payment data in the region. **The extent to which data infrastructures and other resources can be used across different services by these firms, and how user data will be monetized, remains to be negotiated between the corporations and policymakers.** Meanwhile, users themselves are likely to have little say in the process, especially with the proposed amendments to the PDPA which would increase the range of conditions for which consent and notification are not required.

Collaborations across Institutions and Sectors

In the two cases we have analysed, data controllers who collect large volumes of data (such as ride-hailing service providers or government ministries which collect data on public health or land transport) collaborate with data processors who analyse this data and use it to develop more innovative solutions. Within the public sector, GovTech may be considered a data processor which processes data and creates new platforms and apps using data consolidated from other government agencies. At the same time, the data controllers also collaborate with other parties such as startups, researchers and users, who are just as indispensable to innovation in various ways. Users and citizens give feedback on the design of products and systems, whether directly as with the developers who sought tighter privacy controls in Trace-Together, or indirectly in the ways that they use or refuse digital platforms and services. Researchers and startups work with shared datasets to develop new models of analysis, and can also play a crucial role as third-party stewards who consolidate and analyse data collected by different organisations (such as competing firms) while maintaining confidentiality between them.

But the COVID-19 crisis has brought forth many disruptions, including heightened consciousness of privacy issues and a lack of understanding about how data is collected and used. **The challenge ahead is for policymakers and corporations to engage citizens and communicate clarity about these questions, which will be beneficial in building trust. Such trust and transparency are essential especially if citizens are expected to participate and contribute to data innovations.**

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Sample of Questions

Semi-structured interviews were conducted with questions broadly aligned with three themes:

1. How the regulation of data affects innovative capacities

2. Data cultures, or perceptions around data and innovation

3. How data creates value or values

Regulation	• To what extent do you think the laws and regulations around data protection have been helping or hindering the innovation capabilities of firms and organisations? • Do you see the legal landscape, as in the laws and regulations in specific, or the legal framework, changing in the next few years? • How can the current laws and regulations, including the legal framework, be improved so that the innovation capabilities of organisations can be further enhanced?
Data Cultures	• How is personal data seen in Singapore? For example, do people see it as something that they need to protect? Or as byproducts of economic transactions? • How might perceptions of personal data and privacy have an impact on innovation? For example, what types of data would be considered taboo to share, and in what contexts?
Data and Value Creation	• What do you think is the value that organisations bring when they are successful in managing their data, including analysing, storing, protecting, and sharing their data? • How do you think frameworks like the GDPR affect domestic and trans-border operations, and to what extent do you think a similar framework would be feasible in Singapore?

Methodology

The overall methodology of this project adopts a case study approach. Following case study best practices, we collect our data from multiple sources (Eisenhardt 1989; Yin 2014), in this case, through semi-structured expert interviews and published documents.

16 interviews

Research was completed through a triangulation of semi-structured interviews and document analysis. **Sixteen interviews were conducted with members of the public, private and people sectors, including participants with different areas of expertise such as computer scientists, business analysts, and social researchers.** Most of the interviews were carried out over online calls given public health restrictions, but one interview was done in person and one interviewee opted to answer questions over email. Interview questions were modified based on the expertise of each interviewee, but largely focused on three broad concerns: the value and values associated with data, stakeholders in innovation ecosystems, and the regulatory environment.

125 relevant documents

125 relevant documents such as whitepapers, press releases and public consultation papers were gathered and coded according to themes such as values associated with data, principles of data governance and partnerships in data sharing. For the purpose of this analysis we focused on documents defined and released since the announcement of the Smart Nation initiative in 2014. Sources for documents included news reports (e.g., from national newspapers), laws and regulations, government reports, and practice-based literature, such as country reports from tech consultancies. Using the research questions as a guide, we developed a codebook which was then used to analyse the documents. Common themes which were coded for included the value of data, principles of governance, and narratives from particular disciplinary or institutional points of view. Findings from the coding were then synthesised with insights from expert interviewees.

As an accompaniment to the qualitative interviews and document analysis of this study, a telephone survey among 1,020 respondents was carried out in Singapore from June to October 2020 in order to understand perceptions of data privacy, data controllers and regulations among the general population.

1,020 telephone interview participants

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Wong Kwang Lin is a researcher with a background in anthropology, with an interest in issues including digital justice, urban spaces and heritage, and migrant advocacy.

We would like to thank all expert interviewees who have been generous in sharing their time and insights on the topic. All interviewees and their affiliations have been anonymised, as guided by the approved ethical guidelines of this project.

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Imprint

Data fuels digital change. The ability to collect, process, and make available ever-increasing amounts of data is a key to innovation and growth.

This report is the first in a series surveying seven different Asian territories to deepen understandings of innovation and data policies, and contribute to debates about data governance and data protection. The report is centred on Singapore's digital public services, especially the Government Technology Agency (GovTech) and innovations introduced during the COVID-19 period, as well as mobility and online ride-hailing services.

Through these cases, we seek to understand how innovation is driven in the context of relationships among key stakeholders such as citizens, government agencies, firms and research institutions.

**DATA AND
INNOVATION**
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