A FRAMEWORK FOR SUSTAINABLE DATA SHARING IN PUBLIC TRANSPORT

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INTRODUCTION

Data is crucial for the digital transformation of the public transport sector. Today's digital era is characterised by an enormous growth in consumer and industry data, triggered by rapid developments in digital solutions such as Internet of Things (IoT) and personal data-generating devices including smartphones and connected wearables.

COVID-19 has accelerated the need to review data-sharing practices because transport authorities (PTAs) and operators have been impacted by lockdowns, contact tracing and the need to make swift critical decisions. It is evident that citizens are the ultimate beneficiaries, when sharing of data enables cities with better mobility planning and solutions. A reliable and well-funded public transport system is the prerequisite for a sustainable urban mobility ecosystem and can be further elevated by maximising the value that data brings.
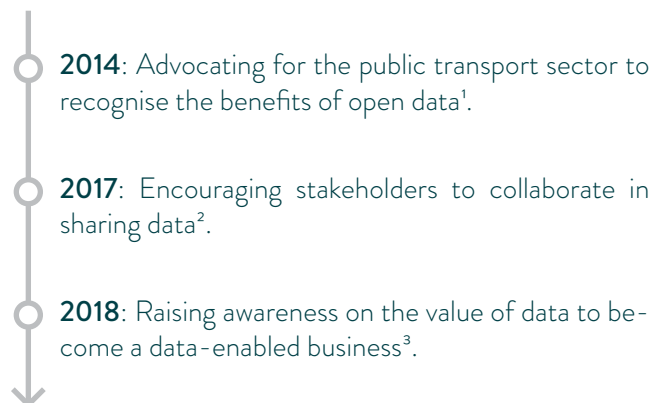
This Policy Brief addresses the need for the public transport sector to play an active role in the data economy through the facilitation of data sharing. 'Data sharing' does not necessarily equate to unconditional sharing and/or open data, but rather data sharing assessed from the perspective of sustainability and value creation. This paper provides policy makers, public transport planners and operators, mobility service providers and research institutions a framework to analyse the value and principles needed to create sustainable business models for data sharing.

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DEVELOPING CONFIDENCE IN DATA SHARING

Since 2014, UITP has been advocating for the public transport sector to share data. The journey started with:

2014: Advocating for the public transport sector to recognise the benefits of open data[1].

2017: Encouraging stakeholders to collaborate in sharing data[2].

2018: Raising awareness on the value of data to become a data-enabled business[3].

But data comes at a cost. Sharing it should be viewed as creating value and furthering sustainability efforts. UITP Asia-Pacific Centre for Transport Excellence published a study, *'Sharing of Data in Public Transport – Value, Governance and Sustainability'* in 2020[4], co-authored with Oxera Consulting LLP and co-funded by Land Transport Authority of Singapore, to review data sharing challenges, opportunities and practices for customer data and mobility data[5]. The key question was how to share data sustainably?

The Study uncovered that the concept of 'data sharing' holds polarising and conflicting views, which is unsurprising as there is no unanimous acceptance on the definition and boundaries . To instil confidence in data sharing, one must:

❯ Clearly define the parameters of the term 'data sharing'.

❯ Consider the properties of data.

❯ Understand the value of data sharing, including benefits and risks.

WHAT IS DATA SHARING?

In the Study, data sharing is defined as:

❯ A practice where a Data Provider shares the data with one or more Data Consumers.

❯ Flows unilaterally, bilaterally or multilaterally.

❯ A process to create value for stakeholders.

Yet, data sharing does not necessarily equate to:

❯ Free and open access of data.

❯ Sharing unconditionally.

❯ Sharing raw data.

❯ Physically transferring data from one location to another.

❯ Sharing or transferring ownership of data.

Conditions and parameters on data sharing vary widely. Hence, it is critical to delve deeper to truly understand data as an asset, value in sharing data and sustainability in the approach to data sharing.

DATA IS AN ASSET BUT IT IS NOT 'THE NEW OIL'

Data is a non-rivalrous intangible asset.

Before considering the value of data sharing and sustainability, it is important to think about the properties of data as an asset. Data has unique properties, which is unlike oil and other physical goods.

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1 UITP, 2014. *The benefits of open data*. Action Points.
2 UITP, 2017. *Stakeholder cooperation on data in public transport*. Action Points.
3 UITP, 2018. *The value for data in the public transport sector*. Action Points.
4 Hereafter referred to as "the Study".
5 The definition of Customer Data and Mobility Data is from UITP's 2018 Action Points publication. Customer Data refers to refers to all data on the customer, as well as passengers' preferences and their use of the system, e.g. personal data, travel behaviour data, customer journey data and customer relationship management (CRM) data. Mobility Data is defined as data which provides information on urban mobility patterns, e.g. network description, timetable information, car traffic and other mobility modes data, parking data and accessibility data.

Data is non-rivalrous.

Consumption of data by one user does not prevent others from using the same data.

Data usage brings along both positive and negative implications.

The impact of data usage can be good or bad. In the positive sense, an example is sharing research data among industry which can speed up new discoveries such as vaccines for viruses. In the negative sense, sharing data of customers can lead to misuse of private information.

Real-time data has more value than data with latency.

Real-time data is valuable as it generates immediate insights. However, accumulating it over a long period of time is also valuable as it provides long-term insights. When integrated with real-time analytics, it gives a vision for a better future rather than just a picture of the past.

Data's value can depreciate over time.

Data loses its value if the information it records becomes outdated.

Data's value increases with quality.

The more accurate it is, the better.

Data has increasing returns to combination.

Combining one type of data with new information can lead to new insights that cannot be extracted from only one source.

Data can display decreasing returns to volume.

Additional data always enhances a dataset's value However, the addition of one data point to a large dataset may add less value compared to adding the point to a smaller dataset.

Data is non-depletable.

Usage of data does not lead to scarcity.

Data has a cost of acquisition.

Costs can be incurred when collecting, storing, retrieving and preparing data.
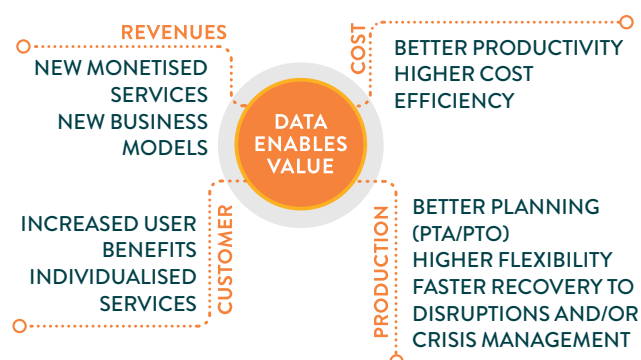
The value of the same type of data can change.

This is especially true for captured data as advances in technology improve infrastructure and identify more data sources.

Source: UITP, 2020

BENEFITS AND RISKS

The benefits from data come in various forms. Below is a summary of the key benefits.

Figure 2: Summary of benefits of data in the public transport sector

REVENUES
COST

NEW MONETISED SERVICES
NEW BUSINESS MODELS

BETTER PRODUCTIVITY
HIGHER COST EFFICIENCY

DATA ENABLES VALUE

INCREASED USER BENEFITS
INDIVIDUALISED SERVICES

CUSTOMER

PRODUCTION

BETTER PLANNING (PTA/PTO)
HIGHER FLEXIBILITY
FASTER RECOVERY TO DISRUPTIONS AND/OR CRISIS MANAGEMENT

Source: UITP, 2018

The value of these long-term and immediate benefits are further amplified when data is shared, by achieving the following:

- **Enhance economic competitiveness** by improving efficiencies and unlocking new monetising services and business models.

- **Optimise transport planning and network** through effective use of data and business intelligence to boost productivity and cost efficiency. This subsequently increases user benefits and opportunities for a range of innovative mobility services, such as ride-hailing or bike-sharing.

- **Bring greater harmony** to interactions between public and private stakeholders for better productivity as they can align their diverse motivations through sharing data.

- **Provide faster responses to recovery planning** in disruption and/or crisis management.

Undeniably, data sharing also comes with risks and key barriers:

- **Liability risk and potential reputational damage** as often organisations fear being held liable for another party's wrongdoing, such as breech in data protection legislation or misuse of data.

- **The risk of losing competitive advantage or market share**: This could be in the context of the public transport modal share or the market share of individual operators/mobility solution providers.

- **Inaccurate or misguided information released by third parties**, weakening relationships between an organisation and its customers, its partners and the greater community.

> Regulations such as open data policies, data protection laws and competition laws have a strong influence on organisations' openness and willingness to data sharing.
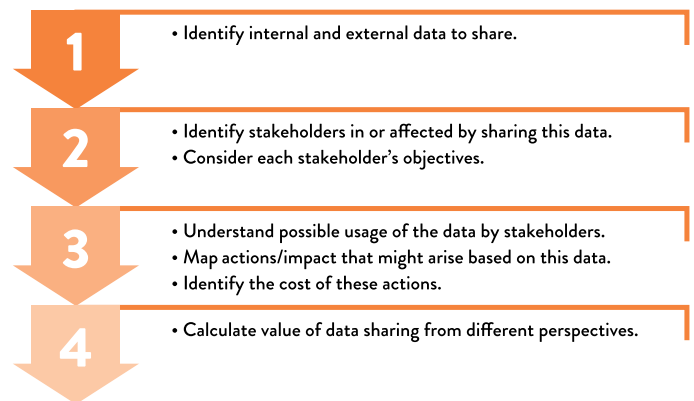>
> *Chapter 1 of the Study highlights key legislations impacting data sharing across the globe.*

VALUE OF DATA SHARING

Valuing data sharing starts with understanding the end goals of data sharing.

Systematically valuing the outcome(s) of data sharing can help stakeholders to better align their data sharing incentives and motivations.
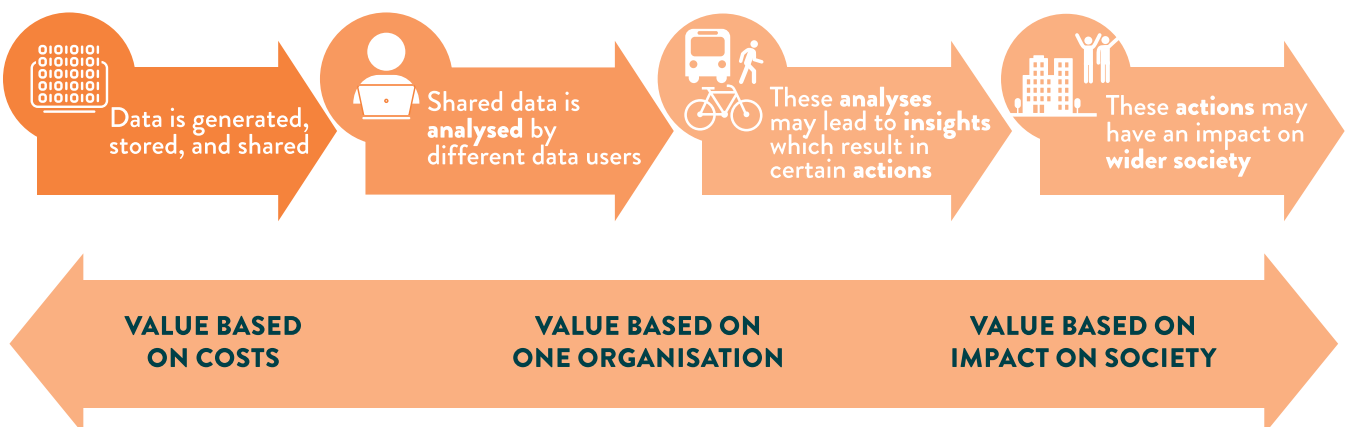
Figure 3: The valuation process for data sharing

1 • Identify internal and external data to share.

2 • Identify stakeholders in or affected by sharing this data.
  • Consider each stakeholder's objectives.

3 • Understand possible usage of the data by stakeholders.
  • Map actions/impact that might arise based on this data.
  • Identify the cost of these actions.

4 • Calculate value of data sharing from different perspectives.

Organisations should understand beyond the benefits and risks associated with sharing data, by recognising how to quantify the value of data sharing. Different parties will have different ways of cultivating value out of data which causes a varying degree of uncertainty on how data can be used. It is therefore important to understand the use cases between potential partners and to use this in the terms and conditions of the contracts or written agreements.

The valuation process helps to connect the factors influencing the valuation approach that each stakeholder may adopt based on their objectives. This leads to a better understanding of how one positions 'value of data sharing' in the data sharing spectrum (Figure 4). For instance, an organisation concerned with the costs of data sharing will focus its valuation on the costs associated with it. If the organisation is trying to maximise social value, it will focus on the value of end impacts enabled by data sharing.

Figure 4: Data sharing spectrum

Data is generated, stored, and shared

Shared data is **analysed** by different data users

These **analyses** may lead to **insights** which result in certain **actions**

These **actions** may have an impact on **wider society**

VALUE BASED ON COSTS

VALUE BASED ON ONE ORGANISATION

VALUE BASED ON IMPACT ON SOCIETY

Source: Oxera, 2020

6 Marr, 2019. How to create a data strategy: 7 Things Every Business Must Include. Forbes.
7 Adapted from: SAS, 2018. The 5 essential components of a data strategy. Christensen & Ackerman, Defining your data strategy. IBM.

WHAT IS A DATA SHARING STRATEGY?

A data sharing strategy is "a strategy for using data in the best way for your business"⁶. It sets a foundation for your business operations relating to data. A good data strategy should be driven by the overall business strategy with clear strategic priorities and key business questions.

WHAT IS A DATA SHARING STRATEGY?

A data sharing strategy aims to improve all of the ways in which one acquires, stores, manages, shares and uses data. It is a starting point for aligning a business' or organisations' objectives⁷.

A HOLISTIC APPROACH TO DATA STRATEGY

The sector needs a proactive approach to data sharing.

The data sharing strategy needs to be at the heart of the data strategy to ensure data sharing is an active and purposeful process rather than reactive. A robust data sharing ecosystem should include a data strategy that factors in data governance, the data sharing strategy, the data sharing culture, a structural approach to choosing sustainable business model(s) and risk assessments (Figure 5). The framework may not be a step-by-step process as it should accommodate agility whereby organisations should continually review and refine each component.

In the report, Chapter 6 features guiding principles and questions for organisation in formulating a holistic data strategy.

Figure 5: Data strategy framework
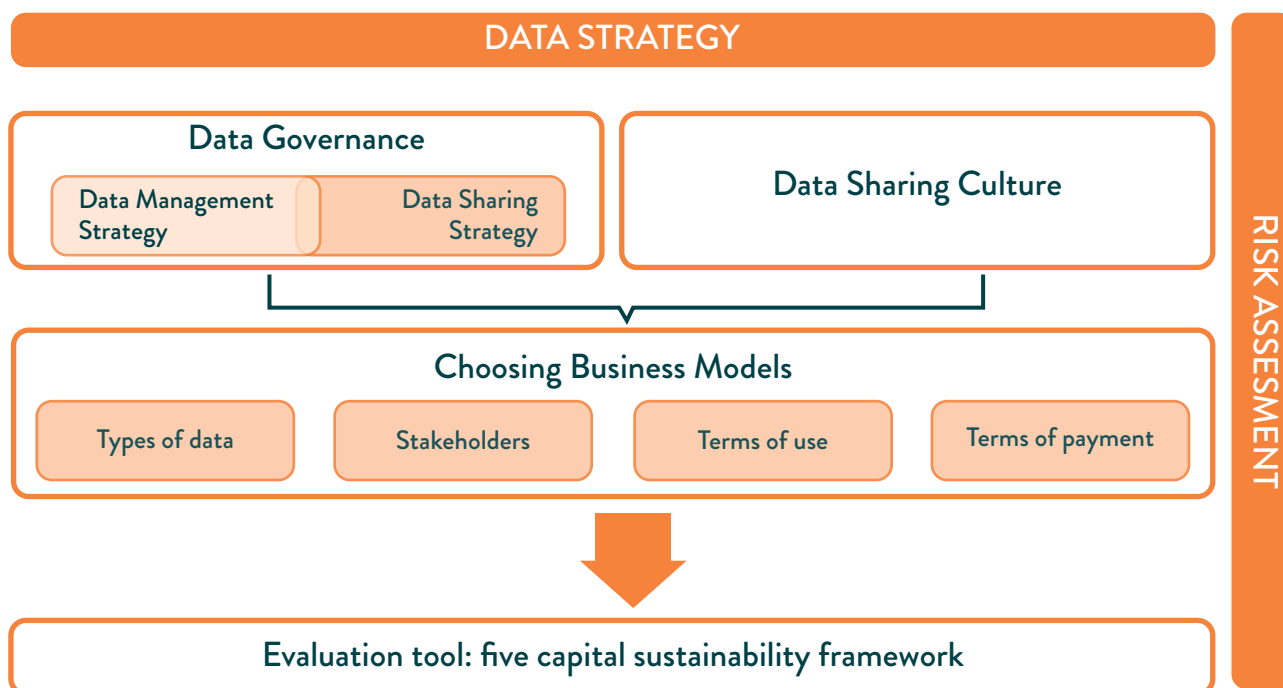
Source: UITP, 2020

FOSTER A DATA SHARING CULTURE

A data sharing culture is nurtured in an environment with strong leaders.

There are many key components in a data strategy but one key aspect is the need for a data sharing culture. This does not mean a culture to advocate data sharing at any costs and in every situation, but rather where people have a data-oriented mindset. To achieve this, four main components are required:

- **A 'data as an opportunity' mindset:** To move from 'compliance culture' to a culture of seeing 'data as an opportunity' as the motivation for continuous improvements to unlocks the potential for value creation. Organisations will have the perspective that sharing data will bring value to end users, rather than a checklist of expected benefits. Subsequently, the return on data sharing will come in various forms such as the benefits highlighted in Figure 2. Data sharing

strategy needs to be proactively integrated into the data management as part of daily operations and project life cycles. It does not mean downplaying the importance of risk, it means the need to accept that appropriate use and share of data can lead equally to success as well as failed trials that can be opportunities to learn and adapt.

- **Data executive leadership:** Senior management and decision makers need to recognise that data enables value. Support, such as funding of resources, and recognition and incentive schemes, towards sustainable data sharing contributions should be embedded into the organisation's processes and operations.

- **Building of trust:** There is a need to increase trust through an alignment of diverging interests and conflicting objectives. In addition, a harmonised regulatory framework and standards can enhance trust.

SETTING CLEAR RESPONSIBILITIES TO BUILD CAPACITY, LAND TRANSPORT AUTHORITY

Land Transport Authority (LTA) of Singapore took control of their data with the aim to be a data-driven agency. The public transport authority has defined clear roles and responsibilities that proactively build its capacity in data management, and assigned responsibility to Data Custodians and Data Trustees.

See the table below, outlining the responsibilities based on the areas of concern.

The Study's Case Studies chapter offers further insights.

- **Fostering of data literacy inside the organisation:** Data literacy extends far beyond the IT function to giving all employees the ability to read, write and communicate data in context . An organisation will benefit from having dedicated talent and resources in the data management strategy, data analytics, data distillation and to ask the right questions related to data.

BE EMPOWERED TO SHARE DATA THROUGH SUSTAINABLE BUSINESS MODELS

Data sharing is a complex matter with risks and opportunities on the balancing scale. The Study proposed tools to encourage stakeholders to break down the complicated issue using simple frameworks as guiding principles. **The goal in data sharing is to have sustainable business models, allowing society to reap the highest benefits for all parties.**

There are four defining elements in data sharing models that determine the analyses and actions that may result from the model:

- **The type of data that can be shared:** Legal, security and commercial constraints can affect what kind of data is shareable as well as the insights that can be drawn from it, and therefore the actions that could result from the model.

- **Who can access the data:** The type of entity that can access the data along with their motivations play a role in determining the analyses that can be performed. The level of trust that exists in the data sharing ecosystem will also determine how any data sharing arrangements are structured and therefore who can access the data.

Responsibilities of Data Custodians and Data Trustees at LTA

AREA OF CONCERN	DATA CUSTODIANS	DATA TRUSTEES
Data Management	- Be in charge of the operation and management of systems and servers that collect, manage and provide access to enterprise data - Ensure adequate protection of all data under their custodianship, including data received from third parties	- Head business function positions in their respective departments - Hold overall accountability for the management of all functional business data entrusted to them
Data Sharing	- Assess the availability of the requested data, whether it could be shared, and the safeguards that are required when sharing - Seek approval from the data trustee	- Approve sharing requests if the data does not contain sensitive and/or personally identifiable information - Seek approval from the LTA CDO in cases of sensitive and/or personally identifiable information

- **Terms of use:** This refers to any contractual limitations on what the shared data can be used for by those who have access to it.
- **Terms of payment (if applicable):** This is to be determined by the identification and alignment of stakeholders' objectives, as well as by the value identified for the data sharing process.

DATA SHARING BUSINESS MODEL

There is no 'one-size-fits-all' approach to data sharing.

The approach to data sharing can broadly be broken down into three types of business models (Figure 6).

The key conditions and skills require to build a sustainable business model for data sharing are:

- Clear engagement guidelines amongst stakeholders which include clarity in: the role of each stakeholder, the allocation of risks and alignment of motivations in data sharing.
- Ability to value data as an asset.
- Long-term partnerships help to justify the time and resources invested into data sharing.

There are different types of stakeholders who can interact in multiple ways with each other in a transport data sharing ecosystem.

Figure 6 illustrates how government bodies play an overarching role in regulating and overseeing the different stakeholders in each model. This does not mean PTAs must play the central role as the trusted third party, although they are obvious contenders. There are many factors to consider beforehand. For example, in large-scale projects such as city-wide Mobility as a Service (MaaS), the Centre of Regulation in Europe recommends that authorities play the central role to ensure the objectives align with overarching urban mobility goals. In other instances, such as smaller data sharing projects especially between private organisations, may not require PTAs to play the central role. Not every city has a mature and resourceful transport regulatory body to perform this function within the data-sharing ecosystem and it may be counterproductive to enforce such responsibility onto PTAs.
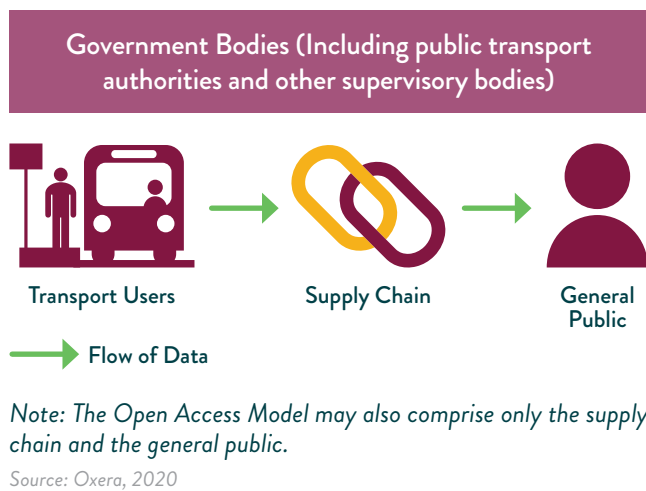
Data trusts, blockchain and public-private partnerships help to overcome the issue of trust in data sharing. As data sharing ecosystems develop and mature, business models may change to ensure net value is maximised across all stakeholders.

The Study's Chapter 7 highlights the latest research, ongoing projects and technological advances.
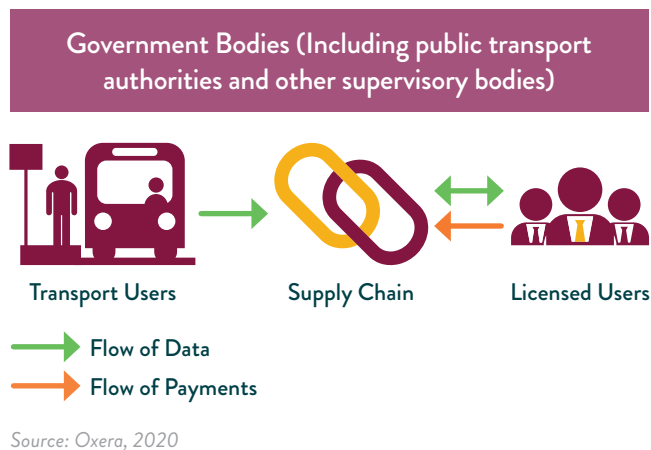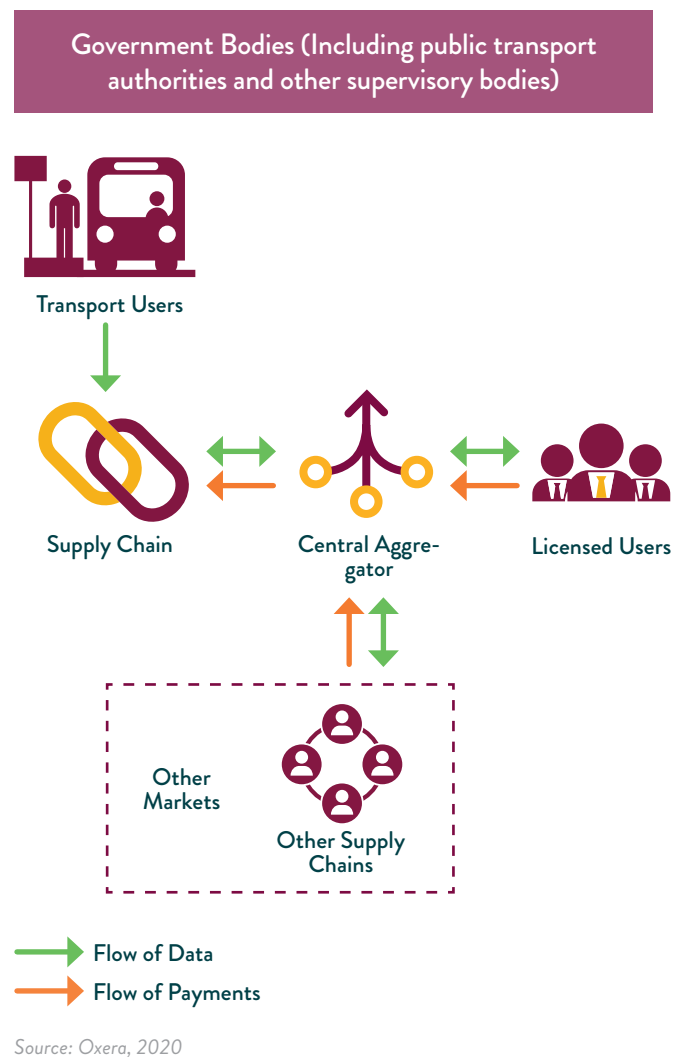
▶ *Figure 6: Illustrations of Stakeholder's Relationships*

OPEN ACCESS

Government Bodies (Including public transport authorities and other supervisory bodies)

Transport Users → Supply Chain → General Public

→ Flow of Data

Note: The Open Access Model may also comprise only the supply chain and the general public.

Source: Oxera, 2020

BILATERAL

Government Bodies (Including public transport authorities and other supervisory bodies)

Transport Users → Supply Chain ⇄ Licensed Users

→ Flow of Data
→ Flow of Payments

Source: Oxera, 2020

MULTILATERAL

Government Bodies (Including public transport authorities and other supervisory bodies)

Transport Users → Supply Chain ⇄ Central Aggregator ⇄ Licensed Users

Central Aggregator ⇄ Other Markets / Other Supply Chains

→ Flow of Data
→ Flow of Payments

Source: Oxera, 2020

An organisation often uses a combination of business models depending on the purpose and data shared.

In the study, Chapter 3 and 6 offer more details and case studies are used to illustrate how public transport organisations across the world share data.

GOVERNING AND ENABLING MULTI-STAKEHOLDER DATA SHARING, ÎLE-DE-FRANCE MOBILITÉS

Data sharing in the Paris region takes place on multiple platforms operated by different actors, predominately motivated by open data legislation whereby public interest data are required to be provided for free. This raises operational sustainability questions as providing data to the public requires financial resources. To overcome this challenge, IDF Mobilités requests the following two types of financial and non-financial contributions

from data users:

- **Non-financial contributions:** By introducing a share-alike clause to the licence for certain types of data, implying that users must 'share-back' any adaptation of the accessed data if the modification is for public use.

- **Financial contribution:** For data accessed through APIs beyond a certain number of requests, the legal framework allows the sharing entity to ask for a financial contribution to cover the marginal cost of the high number of requests.

IDF Mobilités plans to expand the scope of its open data platform to centralise all transport-related data from the Paris Region, including data from private non-contracted stakeholders. It is considering different business models and cooperation models that could bring mutual benefits to encourage private stakeholders to share their data.

IDF Mobilités has identified three main challenges:

- Technology-related (such as real time access, dynamic data, standardising data).

- Governance challenges (multi-stakeholder collaborations and competitive effects).

- Competitive effects.

To overcome these, IDF Mobilités is investing in human resources that have a primary focus on improving data quality and standardisation, and setting up data sharing partnerships.

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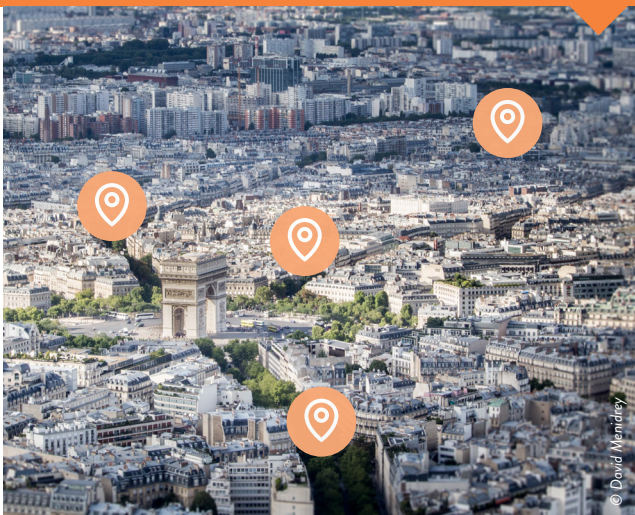
ASSESS THE SUSTAINABILITY OF A BUSINESS MODEL

Sharing data is important only because of how the outcomes affect wider society.

The data sharing ecosystem achieves sustainability when the process brings net positive value across all stakeholders (Figure 7). The net positive impact on the wider society may not mean positive outcomes for every stakeholder in the value chain of data sharing. One common fear is that data sharing could lead to the loss of an organisation's market share or relationship with the customers. The ecosystem is deemed to be sustainable even when one or two organisations may lose market share if the net impact is positive for the overall public transport sector. For example, when new players are able to compete in the market by overriding existing players' inefficiencies and bringing more passengers into the public transport system.
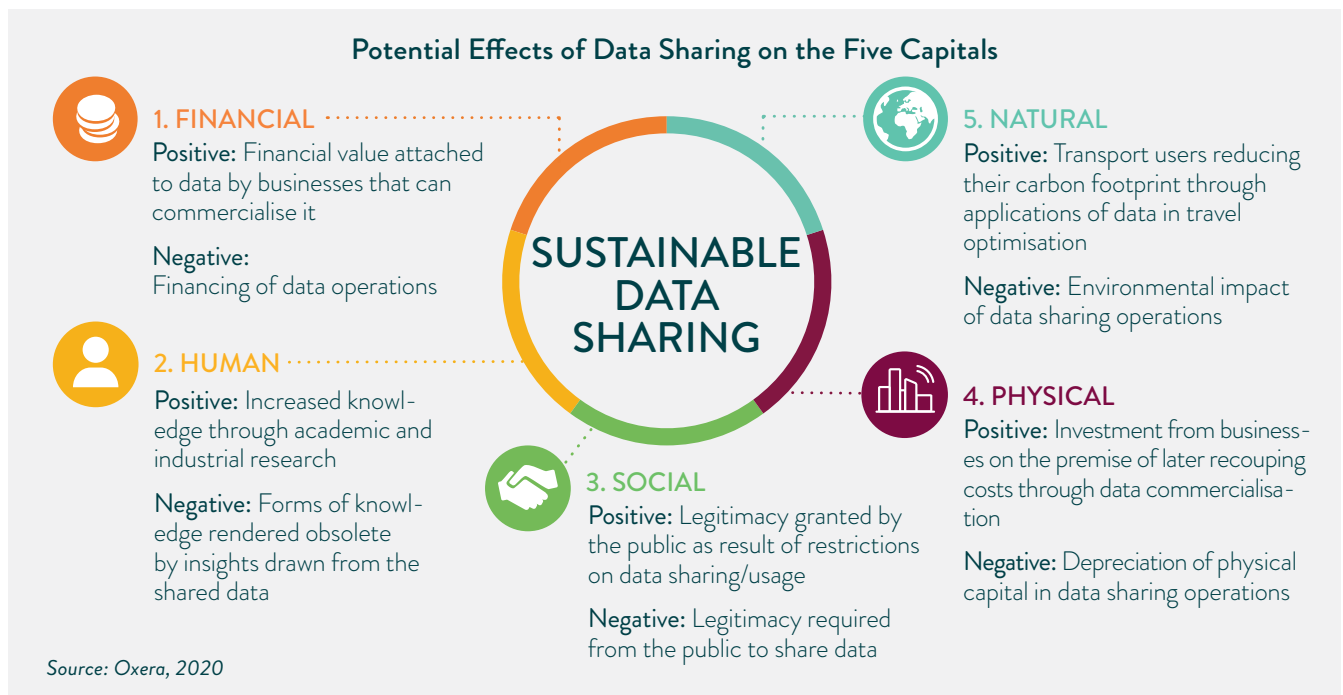
On the other hand, the data sharing ecosystem is unsustainable when sharing of data leads to not only one organisation losing market share but the whole public transport sector to lose modal share and the subsequent negative impacts will be on road congestion, safety, air quality and many more. The use of a common framework helps public transport organisations to decide the application of the appropriate data sharing model(s) under given circumstances.

THE ROLE OF DATA IN A CRISIS

The COVID-19 pandemic has forced the public transport sector to adapt as travel restrictions and social distancing requirements transformed the operations overnight. Many public transport agencies and operators across the globe were required to instantaneously share data with other government agencies to ensure adherence to government guidance on social distancing, continuity of service for essential activities, and provision of alternative means of transport for commuters.

Cities are challenged to restart the public transport sector operations under unpredictable social impacts and volatile passenger confidence . Many cities have placed a strong emphasis on the need for public transport stakeholders to work together, as they become one of the defence mechanisms for cities to resume their operations with safe and secure public transport networks. This information allows them to adjust the demand and supply of transport services and helps with crowd control management.

Potential Effects of Data Sharing on the Five Capitals

SUSTAINABLE DATA SHARING

1. FINANCIAL

Positive: Financial value attached to data by businesses that can commercialise it

Negative: Financing of data operations

2. HUMAN

Positive: Increased knowledge through academic and industrial research

Negative: Forms of knowledge rendered obsolete by insights drawn from the shared data

3. SOCIAL

Positive: Legitimacy granted by the public as result of restrictions on data sharing/usage

Negative: Legitimacy required from the public to share data

5. NATURAL

Positive: Transport users reducing their carbon footprint through applications of data in travel optimisation

Negative: Environmental impact of data sharing operations

4. PHYSICAL

Positive: Investment from businesses on the premise of later recouping costs through data commercialisation

Negative: Depreciation of physical capital in data sharing operations

Source: Oxera, 2020

Successful and sustainable cities need to have an efficient mass public transport system. UITP has been advocating for *'Mobility for Life'* to encourage international decision-makers to advance with more innovative, sustainable and multimodal collective mobility services. This pandemic undoubtedly brought many challenges, but it also presented an opportunity to bring attention to better data-sharing practices for the public transport sector to remain competitive, relevant and agile.

CONCLUSION

The topic of data sharing is becoming increasingly prevalent in many industries, and the motivations behind it should go beyond one's financial gains. While data sharing does not mean that all data should be available, or available for free, policy makers and organisations will need to develop a positive and open-minded outlook in extracting valuable information that can deliver a wide range of benefits.

The public transport sector is just at the beginning of its data-sharing journey. The shift to 'data as an opportunity' mindset will require stakeholders, public and private, to focus on creating value to end users and aligning their own objectives to this. Despite many uncertainties, different stakeholders and sectors will need to collaborate to provide strong, consistent and sustainable mobility services to citizens.

Data sharing is one critical tool that can help cities to achieve a sustainable society. Many aspects of data sharing, data governance and data management are not within the scope of this paper but outlined in the Report.

CHANGE OF MINDSET AND CULTURE

RECOMMENDATIONS	ACTORS	ENABLERS
To see data sharing as a tool to achieve a sustainable society.	All stakeholders in public transport and mobility sector.	Support from government and industry leaders in fostering the culture.
Ensure public transport is an active contributor to the data economy.	All stakeholders in public transport and mobility sector National and local government International development bodies	Support from national and local government bodies. Strong public transport regulatory body. Strong collaborations between public and private organisations.
Actively involve public transport sector in national data sharing regulations and policy discussions.	National and local government Public transport agencies	Support from national and local government bodies.
Understand the unique properties of data as an asset and its value and find the right approach to value data.	All stakeholders in public transport and mobility sector	Good communications and training on understanding data from an economic perspective. Strong support from leaders and executives that good understanding of data should be one of the key foundation knowledge for the work force.

MANAGEMENT AND CAPACITY BUILDING

RECOMMENDATIONS	ACTORS	ENABLERS
Put data sharing at the centre of the data strategy with a clear definition and objectives of its data sharing strategy and a strong data sharing culture.	All stakeholders in public transport and mobility sector	Strong support and commitment from leaders and management to spearhead the data strategy and data-oriented culture. Good communications and training on organisation's strategic visions and a clear roadmap on how data sharing will help to achieve them.
Break down silos within government agencies to lead with example with cross-agencies collaboration in data sharing.	National and local government	Support from national and local government bodies.
To have a talent development roadmap that fulfils the objective of maximising the value of data generate by public transport sector.	Public transport authorities	Clear definition of roles and responsibilities related to data sharing and data management within the agency. Access to experts to identify the requirements in skill gaps.

COLLABORATIVE PUBLIC TRANSPORT SECTOR

RECOMMENDATIONS	ACTORS	ENABLERS
Proactively look for public-private partnerships to encourage data sharing.	All stakeholders in public transport and mobility sector	Supportive PTAs to have a collaborative mind-set to work with public and private organisations by understanding how to assess data sharing business models and willingness to explore new solutions and platforms (e.g. data trusts) Perivate organisations to engage with PTAs on mobility projects; to build data sharing ecosystem based on the alignment of motivations. Strong structure of legal and economic ownership for public-private partnerships. Include experts in the fields of data privacy and data ownership to ensure the partnership has clear guidelines on rights to use data.
Collaborative crisis management through faster response time by data sharing.	All stakeholders in public transport and mobility sector	A clear data sharing strategy. High level of data interoperability between stakeholders. Collaborations between cross-functional stakeholders in various fields such as technology, legal and operations.

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