

Sustainable Mobility: Policy Making for Data Sharing



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Sustainable Mobility: Policy Making for Data Sharing



Table Contents

List of Abbreviations	iv
Foreword.....	1
A Note from the Authors	2
Executive Summary	3
Acknowledgments	7
1. Why Data Sharing Matters for Sustainable Urban Mobility.....	8
Opportunities to achieve sustainable urban mobility objectives through data sharing.....	8
Challenges to data sharing	11
2. Policy Framework for Mobility Data Sharing	15
Prevailing policy context	15
Why policy making matters	17
Policy framework overview.....	18
Customized approaches to policy making	21
3. Good Practices and Policy Suggestions	26
Data Sharing collection and merging.....	28
Data Standards	31
Data infrastructure	34
Governance and Accountability.....	36
Use and Analysis.....	39
4. Conclusion and Call to Action.....	42
Call to action	42
Appendix	44
Appendix A: Terms and Definitions	45
Appendix B: Detailed Policy Suggestions.....	49
Appendix C: Principles to Enable Data Sharing.....	66
Appendix D: Global Case Studies.....	69
Appendix E: Selected Bibliography	90

List of Abbreviations

API	Application Programming Interface
B2G	Business-to-Government
CDEI	Centre for Data Ethics and Innovation
CCPA	California Consumer Privacy Act
CPRA	California Privacy Rights Act
DPIA	Data Protection Impact Assessment
EDI	Electronic Data Interchange
GDPR	General Data Protection Regulation
GRA	Global Roadmap of Action toward Sustainable Mobility
GTFS	General Transit Feed Specification
IRF	International Road Federation
LOM	Mobility Orientation Law (France)
MaaS	Mobility-as-a-Service
MDS	Mobility Data Specification
MMP	Master Mobility Plan
MWCOG	Metropolitan Washington Council of Governments
OSLO	Open Standards for Linked Organizations
PIA	Privacy Impact Assessment
SIRI	Standard Interface for Real-time Information
SLA	Service Level Agreement
SUM4ALL	Sustainable Mobility for All
TfL	Transport for London
TOMP	Transport Operator Mobility-As-A-Service Provider
TUM	Transforming Urban Mobility
WBCSD	World Business Council for Sustainable Development
WZDEx	Work Zone Data Exchange

Foreword

Sustainable Mobility for All (SuM4All) is the premier advocacy platform for international cooperation on transport and mobility issues. It brings together 55 public organizations and private companies including bilateral partners, multilateral development banks, U.N. organizations, intergovernmental organizations, and civil society with a shared ambition to transform the future of mobility. It is an innovative model for action in transport that leverages the knowledge, expertise, and influence of its member organizations to assist countries worldwide in their ambition to attain universal access, efficiency, safety, and green mobility.

SuM4All action in countries is guided by a data-informed approach to diagnose transport and mobility issues and a coherent global policy framework contained in the Global Roadmap of Action toward Sustainable Mobility (GRA). The GRA offers a catalogue of more than 180 policy measures to achieve sustainable mobility. Based on this novel attempt, SuM4All's priority for 2020 was clear; its implementation in countries—with South Africa as the first beneficiary country—and its refinement in four cutting-edge policy areas: data sharing, e-mobility, gender, and transport-energy nexus.

SuM4All Members formed four groups with a mandate to get a better understanding of these four areas, collect global experience, and deep dive into the associated policy measures in the GRA to make them more actionable for country decision makers.

We are pleased to share the first of five papers that will be published in 2021 in the “GRA in Action” series. The paper builds on the work on *Enabling Data Sharing: Emerging Principles for Transforming Urban Mobility* by the World Business Council for Sustainable Development (WBCSD) and unpacks the GRA's policy measures on data sharing platforms into 5 areas of policy interventions, 33 policy suggestions, 10 case studies, and 6 recommendations as a call to action for policy makers.

We thank the WBCSD and the International Road Federation (IRF) for leading the engagement with our Members on this important topic of data sharing, contributing to raising its visibility for policy making, and leading the production of this paper in a collaborative way.

Sustainable Mobility for All Steering Committee

(On behalf of our 55 Member organizations)

February 2021, Washington, D.C.

A Note from the Authors

Led by WBCSD’s Transforming Urban Mobility (TUM) program and the IRF, this working group is united by a common goal to support policy making on data sharing for sustainable urban mobility. To this end, this working group has developed a policy framework and actionable guidance building on the initial four policy measures defined in the GRA.

We believe that increasing digitalization of mobility can accelerate the transition toward sustainable urban mobility. Progressively more intelligent transportation systems aggregate data from various sources spanning on-vehicle and roadside sensors, roadside cameras, smartphones, banking, data about pedestrians, and micromobility modes, and can coordinate multiple actors—supply and demand—to achieve sustainable mobility goals, generate economic value, and improve transportation experiences. Policy making is essential to harness these technological advances toward a harmonized, secure, privacy-centric, and ethical data sharing ecosystem. The absence of policy making on the other hand can lead to siloed approaches that can exacerbate a region’s mobility problems, and potentially create a digital divide where few organizations control access to data and have the resources to use that data toward value creation.

In this regard, we are pleased to share the outcomes of our collective efforts in this report, in the form of a policy framework composed of 5 areas of policy intervention, covering 33 policy suggestions. In addition, 10 case studies illustrate how the policy framework can be applied practically. These suggestions are encapsulated in 6 recommendations as a call to action for policy makers. We hope policy makers will be inspired to adopt this framework and to implement it in collaboration with the private sector and other key stakeholders, toward the common objective of realizing sustainable urban mobility through secure, ethical, and privacy-centric data sharing.

Sustainable Mobility: Policy Making for Data Sharing Working Group Members

Executive Summary

The next generation of urban mobility and transportation is likely to take the form of progressively more evolved intelligent transportation systems. Such systems will be designed to coordinate multiple actors, supply, and demand to achieve sustainable mobility goals, generate economic value, and improve transportation experiences. While raw data alone is not sufficient, the sharing of data can help generate actionable insights, which are necessary to achieve these goals. Well-orchestrated policies will be critical to shape future data sharing ecosystems, realize shared value for the public and private sectors, and achieve the desired sustainability outcomes. Data Sharing policies should also aim to minimize risks around privacy and cybersecurity, minimize mobility biases rooted in race, gender, and age, prevent the creation of runaway data monopolies, and bridge the widening data divide. These granular designs are requisite corollaries that support data sharing platforms that espouse the foundational principles laid out in WBCSD's TUM *Enabling data sharing: Emerging principles for transforming urban mobility*, and are arbiters of a key policy measure identified in the [GRA Catalogue of Policy Measures](#).

This report, the first of its kind, offers a global policy framework and practical guidance for policy making on data sharing. Recognizing the hyperlocal context of mobility needs and policies, the nascent state of the data sharing market, and limited evidence from regulatory practices, we offer multiple case studies from across the globe to document emerging good practices and policy suggestions.

Opportunities and barriers to data sharing

Multiple transportation solutions, including multimodal and integrated mobility services, optimized planning and operation of EV charging infrastructure, integration of informal and formal transit options, and optimized fleet management rely on the backbone of advanced data collection and use capabilities. Similarly, governments are using data to better monitor transportation systems, complementing—and in some cases replacing—traditional methods to regulate transportation systems and plan infrastructure to meet future needs.

However, uncoordinated data-driven solutions can leave much of the economic, social, and environmental value on the table and in many scenarios exacerbate a region's transportation challenges.

A policy-guided shared digital framework is essential to harness ongoing disruptions and realize a sustainable mobility future while minimizing externalities. While much raw data by itself may be of little value, merging data can generate new insights and means to operate transportation systems, plan for future infrastructure needs, and incentivize customer behavior change.

Entities are averse to sharing data for several reasons. Many of these are rooted in concerns around privacy, cybersecurity, and competition. Equally, data holders who expend significant resources collecting and cleaning data, and expect significant returns, may be averse to sharing that data in the absence of any incentives. Data and its use can also hide or accentuate underlying societal biases and inequities based in race, gender, age, and wealth. Lastly, data and the ability to use it for value generation, are increasingly becoming concentrated in the hands of a few entities.

Role of policy making for data sharing

The [catalogue of policy measures \(CPM\)](#) from the *Global Roadmap of Action toward Sustainable Mobility* (GRA) contains more than 180 policy measures that have been used and tested around the world in support of sustainable mobility. This paper takes a deep dive into policies and global experience available to act on “data sharing program and platforms”—measure 124 in the CPM—and associated measures including “establish data protection regulations”, “requirement for service providers to report standardized data”, “develop data repositories and data collection guidelines”, and “use of data to support decision making”.

Policy making is essential to harness technological advances toward a harmonized, secure, privacy-centric, and ethical data sharing ecosystem. The absence of policy-making frameworks on the other hand can lead to siloed approaches that can exacerbate a country’s mobility problems, and potentially widen an existing digital divide where few organizations control access to data and have the resources to use that data toward value creation.

To this end, the global use-case agnostic policy framework presented in this report serves as a guide for policy makers to intervene and enable mobility data sharing for sustainable mobility. The mobility data sharing policy framework (figure ES-1) is built on good practices from existing policies and data sharing initiatives, and embodies the principles presented in the foundational in the foundational WBCSD report on [Emerging Data Principles](#). It consists of the essential building blocks of five interdependent and complementary layers and nine elements for policy intervention that address the entire lifecycle of a data sharing initiative. Each layer defines an area of policy intervention corresponding to data flow in a data sharing collaborative including: (i) data collection and merging, (ii) data standards, (iii) data infrastructure, (iv) governance and accountability, and (v) use and analysis. Within each layer, specific policy elements are embodied which discuss and guide the role of policy making for each corresponding layer.

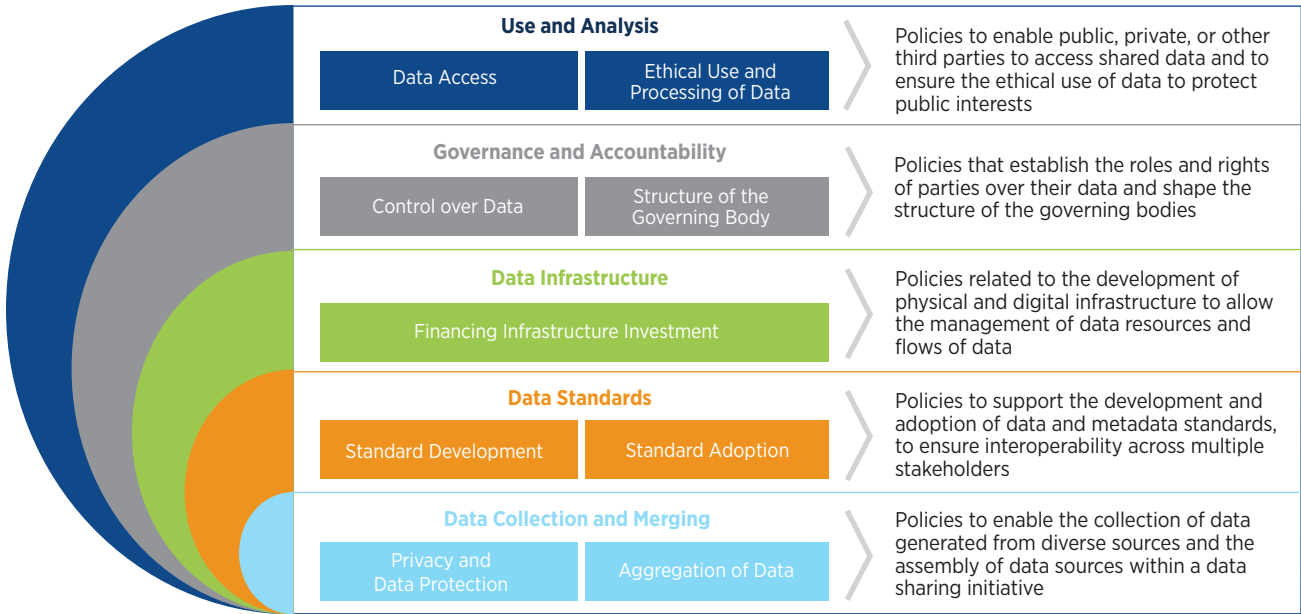
- **Use and analysis:** policies to enable public, private, or other third parties to access shared data and to ensure the ethical use of data to protect public interests.
- **Governance and accountability:** policies that establish the roles and rights of parties over their data and shape the structure of the governing bodies.
- **Data infrastructure:** policies related to the development of physical and digital infrastructure to allow the management of data resources and flows of data.
- **Data standards:** policies to support the development and adoption of data and metadata standards to ensure interoperability across multiple stakeholders.
- **Data collection and merging:** policies to enable the collection of data generated from diverse sources and the assembly of data sources within a data sharing initiative.

Figure ES-1. Policy Framework for Mobility Data Sharing

Vision

Policies adopted by city, provincial, and national governments play a powerful role in the successful development of mobility data sharing initiatives between and among public and private sector stakeholders that advance green, accessible, efficient, and safe urban mobility systems.

Policy Framework



Data Sharing Principles

1. Data sharing should enable all stakeholders to create and capture value
2. Data sharing must be ethical, inclusive, and unbiased
3. Data sharing should incorporate privacy by design
4. Data sharing should embrace cyber-security by design
5. Data sharing should be adaptive and iterative

The framework offers 33 policy suggestions that can be tailored and adapted by policy makers to suit their local mobility systems, urban environment, and priority use cases. Also, the policies are categorized based on the stage of development of a region’s data sharing ecosystem adopted from other existing studies that is nascent, emerging, and mature, and that targeted policy makers involved—municipal, regional, national—in the adoption of the suggested policy.

Ten global case studies annexed to the report illustrate how the policy framework can be applied practically and how the policy suggestions complement each other regardless of the level of economic development, as fewer developed countries can have regions of high data sharing capabilities and vice versa. Cities or countries profiles vary based on the local enablers that are mobility system characteristics, digital maturity, and regulatory environment; and leaders or decision makers must take them into account while designing the appropriate pathway for that area.

The report *Sustainable Mobility: Policy Making for Data Sharing* encapsulated six key recommendations as a call to action for policy makers at all levels—municipal, regional, and national.

- **Adopt a collaborative approach for data sharing between diverse stakeholders:** Collaboration between policy makers, governments, citizens and civil-society members, businesses and academia are required to define a common vision for sustainable urban mobility and how data sharing is expected to deliver these objectives. Corollary to these requirements are the principles of purpose specification and data minimization, which suggest that the minimum amount of data be collected toward explicitly stated purposes with the appropriate consent from parties that generate data. This is especially valid for business-to-government (B2G) data transfer for regulation or planning purposes, and data from individual citizens.
- **Commit to shared value across stakeholders to enable and accelerate:** Data Sharing for a common vision leads to the creation of social, environmental, and economic value that may be shared among all. Policy makers can help create a fair and competitive data sharing ecosystem by considering the interests and varying capacities of each stakeholder.
- **Prioritize skill development and capacity building to increase competitiveness:** Governments should prioritize skills development in areas such as artificial intelligence, machine learning and cloud computing, which are necessary for advanced data processing and sharing capabilities. National policies, for example, should also account for disparate in local contexts, and provide incentives to local governments to address any knowledge gaps to ensure successful implementation of national priorities.
- **Seek harmonization across jurisdictions while allowing for customization based on the local context:** Data Sharing models are often more effective when tailored and adapted to the local mobility system. Scaling and replication of data-sharing models is facilitated by overarching national or international architectures and harmonized data sharing approaches that break down inter-organizational. For example, interdepartmental and intergovernmental, silos and improve interoperability and cost efficiency in areas such as data sharing agreements, digital tools and platforms, and policy-making processes.
- **Establish trust frameworks as a foundation for implementation of multistakeholder data sharing:** Governments can endorse and facilitate the development of trust frameworks—standardized legal and contractual agreements—to support effective collaboration between various stakeholders and ensure that data sharing adheres to the common vision. Governments, through rule-making processes, can address common biases that may result in inequitable outcomes along gender, race, or age differences.
- **Embrace iterative, incremental, and adaptive policy-making processes:** Continuous and proactive learning will allow policy makers to develop data sharing models through demonstration projects, iterative experimentation and fast-failure approaches, and regulatory sandboxes. Starting small with priority policy objectives to understand types of data and means to access and process it can be a recipe for long-term success.

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1. Why Data Sharing Matters for Sustainable Urban Mobility

Opportunities to achieve sustainable urban mobility objectives through data sharing

Governments and businesses alike are using mobility data for innovative uses. Many disruptive mobility businesses including those which are modeled on the shared economy—ride hailing, shared micromobility and vehicle sharing—and others offering mapping and routing services, fleet use optimization and telematics, and autonomous driving capabilities, are all built on the backbone of static and dynamic data collection and processing abilities. Similarly, governments are using data to understand and monitor transportation systems better, that complement and, in some cases replace, traditional methods that regulate transportation systems and plan infrastructure to meet future needs.

Increasing levels of digitalization of transportation systems, faster and omnipresent Internet networks, and shifting customer expectations will increase the use of data in transportation. Vast troves of data from diverse supply-side sources—on-vehicle sensors, road-side sensors and cameras, micromobility modes, and pedestrians—and demand-side sources—education and healthcare services, places of employment, shopping and recreational centers, smart infrastructure, smartphones, and banking—will be analyzed for new streams of value creation. Governments, researchers, and planners can harvest these data to generate new insights and analysis, and accelerate the transition toward a more sustainable future.

True smart mobility serves broad policy objectives and individual needs through sustainable business models.

Jean Coldefy
Mobility 3.0 Programme Director,
ATEC ITS France
Advisor to the Transdev Chairman and
CEO
Former Deputy Director of
Greater Lyon Mobility Directorate

Yet, in certain cases, technology solutions could leave many of the system-wide benefits unrealized and may also have externalities that exacerbate a region's transportation challenges. Ride-hailing services for example, that offer convenient ways for people to travel, have simultaneously contributed to increasing levels of congestion and emissions in multiple cities.¹

A shared digital framework that allows aggregation of multiple new sources of data and enables data-driven decision making is needed to harness ongoing disruptions and realize a sustainable mobility future. Shared data will constitute the nervous system of future sustainable urban mobility systems. While data alone are not sufficient, data sharing between multiple stakeholders will underpin more efficient transportation systems and are better for the environment.^{2,3}

For example, by integrating real-time data from smartphones, connected vehicles and infrastructure, public safety officials can respond more quickly to emergencies, using live traffic data and intelligent traffic systems to identify the quickest route to the scene. The same traffic and navigation software application or app can be used to redirect other travelers away from the incident, and traffic light systems can respond to the data and events by creating a green wave of uninterrupted but safe transit for first responders. For example, in Las Vegas, Waycare's proactive traffic management system has enabled the local traffic control center to achieve a 17 percent reduction in crashes and a 12-minute (50%) reduction in incident response time arriving at the scene. These outcomes help reduce the cost of fatal and non-fatal crash injuries, estimated to be approximately USD 1.8 trillion from 2015–2030.

Similarly, in developing countries, data from increasingly omnipresent smartphones that are being used to map formal and informal transport services in real-time⁴ data could be used to generate information to help users of transit plan multimodal journeys, and create valuable insights for city planners on transport access, transit network analysis, ridership, and revenue estimates (box 1-1).

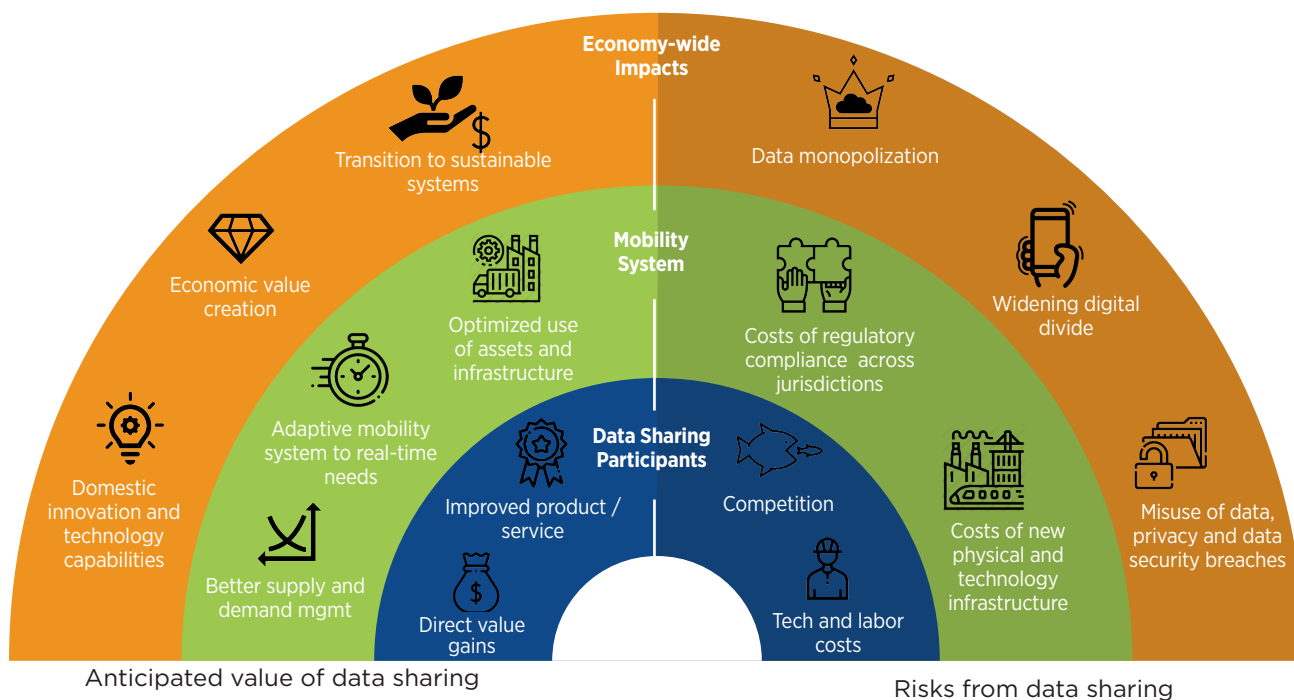
Such sharing of data will require deep collaboration between multiple stakeholders, signaling the alignment of interests and objectives, and intent to create shared value through aggregation of data.

“While much raw data are worthless, collecting, cleaning and analyzing data involves significant costs. Raw data carries significant but ephemeral value over a short lifecycle. However, data can be mined to generate valuable insights that can inform future investments and planning strategies. Policy makers, businesses, representatives from the civil society and other stakeholders should collaborate to develop a value exchange framework to apportion value from data sharing between various parties involved in the value chain.”

~ Daniel Deparis
Head of Urban Mobility Solutions, Daimler

A myriad of new applications with the potential to create public good and value become possible when mobility data can be exchanged across multiple parties.⁵ Equally, the true potential value of data sharing is largely unknown. The benefits and risks of data sharing may be shared not only among stakeholders directly participating in data sharing initiatives but also across the mobility system and even society at large (figure 1-1).

Figure 1-1. Illustrative potential benefits and risks of data sharing



Box 1-1. Data sharing and digitalization to support mobility systems leapfrog for developing regions

The World Bank estimates that 35 percent of the world’s largest cities and 92 percent of the largest low- and middle-income cities do not have complete transportation maps. Additionally, the overall level of digitalization of transportation in developing countries remains relatively low. At the same time, increasing smartphone penetration and falling costs of data storage and communications infrastructure offer an opportunity toward rapid economic development.

It is increasingly recognized that effective digitalization and data sharing can support developing nations to leapfrog traditional modes of mobility systems development toward a more sustainable urban mobility system. In addition, use of existing transport infrastructure can be optimized, and in some cases help avoid large and costly infrastructure projects.

For example, in some Asian countries where physical transport infrastructure has not been heavily developed, there is more freedom to incorporate sustainability by design based on mobility data insights that can better help plan new infrastructure or increase adoption of mobility services, and use existing infrastructure at higher efficiencies.

Additionally, countries with relatively low digital maturity and penetration can bypass the convoluted structure of multiple payment mechanisms and payment portals to achieve a seamless and potentially universal payments and booking-based customer platform. Such a system can enable an integrated mobility services market that supports use of low-impact and cost-effective modes of passenger mobility.

Similarly, the efforts of DigitalTransport4Africa and Datum showcase the benefits of data sharing by collecting, mapping, and integrating data from multiple transportation options in fragmented mobility markets in countries around Africa and Latin America.

Challenges to data sharing

Data sharing is impeded by several risks and challenges. For reasons around privacy, perceived and real competition, interoperability, and concerns around cybersecurity and ethical use of data, entities are reluctant to share data that they hold.⁶ For example, public transit operators and private sector view data about their customers as a source of differentiation and value creation, and do not want to provide full access owing to concerns about losing the ownership of passengers or undercutting fares.

Several mobility sector stakeholders consider data to be an asset that can yield significant value, although it may also decline with time. By some estimates, the value of vehicle-generated data could create a total revenue of pool of USD 450–700 billion by 2030.⁷ Another study estimates that the global intelligent mobility market could be worth approximately £ 900 billion by 2025.⁸ However, much of that value is realized only by aggregating data with other sources. In the case of mobility, aggregating data are complicated by issues that not all data are created equal and that not all data are equally valuable. Acknowledging the inherent value that some stakeholders attach to data, a value exchange framework—where value could be realized through monetary transactions, a quid pro quo arrangement, a shared-costs basis or some combination of these—may be needed.

Moreover, originators of data, often individuals, and the holders of those data have different understandings of who controls and owns what piece of data, and consequently who has the right to aggregate, analyze or share it. This is further accentuated by the lack of policies and regulation around data ownership and transfer that until now has been relegated to the domain of service agreements between originators of data and data aggregators, and controllers.

The rapid proliferation of mobility data leads to a few challenges that have become all too familiar in the information age (box 1-2). Information overload has translated into data overload. In the absence of capacity, public authorities may tend to overcollect data; much of these data are of poor quality or not directly useful in meeting policy needs. On the other side, private companies may push certain solutions and datasets without clearly understanding the needs of the city.

“As inequality grows in the world, data are losing its agnostic value. Who you are and where you come from matters very much in equity of access and equity of outcomes, but knowing these necessary facts about users conflict with personal privacy rights. Anonymized data can still target certain groups of people, and data can be weaponized into misinformation campaigns or planning practices executed in bad faith to protect vested interests. Independent governance and oversight structures should include local representation to allow independent review and oversight in decision-making. Government operates at scale – policy makers need to understand the risks - how bad can this get if we get it wrong?”

- Justin Coetzee
CEO, GoMetro

Box 1-2. Master Mobility Plans: From data to insight

Cities around the world must contract our master mobility plans periodically (MMPs). MMPs include household surveys, travel diaries, traffic counts in several points, a transport-demand model, and reports with analyses and recommendations. MMPs therefore have volumes of information, data, and knowledge. Some cities disclose fully the reports, others also include GIS layers, and others anonymize and disclose the household survey and travel diaries. Washington D.C., for example, posts data from traffic counts to long-term plans, see <https://rtdc-mwcog.opendata.arcgis.com/>. The Transportation Planning Board (TPB) of Metropolitan Washington Council of Governments (MWCOC) makes the transport model files—another part of an MMP—available to the public upon registering: <https://www.mwcog.org/transportation/data-and-tools/modeling/data-requests/>. Also, all data related to the regional travel demand model are available from here: <https://www.mwcog.org/transportation/data-and-tools/modeling/>

Service providers and planners can use such data to understand mobility needs of cities and address existing gaps in transportation systems through new and innovative services and apps.

“For a thriving ecosystem, it is important to ensure that all players have sufficient resources to develop their technical capabilities. Resources should be made available both to small organisations with limited capabilities to invest and to big organisations with complicated systems. This way policy makers can ensure that all players in the market can reap the benefits of data sharing and the data economy.”

- Ida Schauman,
Policy Lead, MaaS Global

Another challenge for regulators is the consolidation of data within the hands of a few large technology companies due to costly burdens of data sharing regulations and characteristics of digital platforms such as network effects, economies of scale, and winner-takes-all scenarios.⁹ Data monopolies may lead to negative outcomes such as stifled competition, disproportionate influence in society, and potential abuses of power for private gains.¹⁰ While some policy makers, such as the Flemish government, view the data economy as a natural monopoly that takes shape as a public data utility,¹¹ this regulatory perspective is not shared universally and remains a contentious and evolving topic (box 1-3).

Box 1-3. Addressing equity and bias in mobility

A key tenet of sustainable urban mobility systems is equity for all users, regardless of gender, race, age, differences in ability, or other sociodemographic factors. However, limited data are available on the varying mobility needs of different populations to demonstrate what the needs are and to what extent these needs are being met.

For example, initial findings have identified different mobility patterns by gender, specifically in areas such as transport mode, travel distance, and trip purpose. However, in a recent study, over 80% of global transport professionals surveyed indicated that the data used for transport decision making only contained poor or inconsequential data on the different social groups, including the disabled and women.

Digitalization and data sharing in the mobility sector enables better data collection, which allows policy makers to better understand and address equity issues through evidence-based mobility policies. However, disaggregated data increases the risk of violations of personal privacy and potentially accentuating biases in the mobility sector if the data are misused. Policy makers need to protect vulnerable populations and deliberately design policies to prevent negative impacts from the collection and sharing of mobility data. Many regions across the world have already adopted gender-specific transport policies (a few examples listed below), and policy makers should look to follow suit in mobility data sharing.

- The Los Angeles LA Metro published the *Understanding How Women Travel* study, which will inform the development of a Gender Action Plan in 2019.
- The government of Kerala in India established Gender Park In 2013, a platform that converges gender policy, research, and social initiatives. Gender Park subsequently launched She Taxi, a women-only transport service that increases female literacy, education, and work participation.
- In Sweden, the Gender Equality Council for Transport and Information Technology was established in the late 1990s.

Notes

- 1 Please see: Estimated TNC Share of VMT in Six US Metropolitan Regions, Fehr & Peers, 2018.
- 2 See Appendix 4, Case Study on Africa – Digital Transport for Africa, a Digital Commons and Global Community.
- 3 <https://www.lahti.fi/en/housing-and-environment/transportation-and-streets/citicap/>
- 4 <https://www.wbcds.org/Programs/Cities-and-Mobility/Transforming-Mobility/Transforming-Urban-Mobility/Resources/Enabling-data-sharing-Emerging-principles-for-transforming-urban-mobility>
- 5 Ibid.
- 6 WBCSD: Enabling Data Sharing: Principles for Transforming Urban Mobility
- 7 <https://www.mckinsey.com/-/media/mckinsey/industries/automotive%20and%20assembly/our%20insights/monetizing%20car%20data/monetizing-car-data.ashx>
- 8 <https://static1.squarespace.com/static/565ebf94e4b0f2a77109071e/t/56631604e4b0672d1446accf/1449334276748/Intelligent+Mobility+Data+Report+-+Final.pdf>
- 9 <https://unctad.org/news/restoring-competition-winner-took-all-digital-platform-markets>
- 10 <https://brownpoliticalreview.org/2017/12/titans-tech-regulating-monopolies-digital-age/>
- 11 https://datanews.knack.be/ict/nieuws/vlaamse-regering-wil-data-nutsbedrijf-oprichten/article-news-1646889.html?cookie_check=1604588282

2. Policy Framework for Mobility Data Sharing

Sum4All's [Global Roadmap of Action toward Sustainable Mobility \(GRA\)](#)¹, identifies “Supporting data sharing programs and platforms” as a key policy measure in the GRA that can help in the transition toward a greener, safer, more accessible, and efficient mobility system in all countries.

Data Sharing can enable or enhance other policy measures identified in the GRA report such as: (i) improve intermodal connections in transport hubs; (ii) ensure an optimal level of vehicle availability and use; (iii) provide effective car and bicycle sharing systems; (iv) implement mobility as a service packages; (v) and implement ITS solutions for providing transport information. Each of these measures affect all four policy goals identified by the GRA, and must be taken up by all countries under the different country groups A, B, C, and D specified by the GRA.²

A thriving data sharing ecosystem also relies on several fundamental data related policy and regulatory measures that are mentioned in the GRA and further elaborated in this report. These include: “develop data repositories and data collection guidelines”; “establish data protection regulations”; and “require service providers to report standardized data”.

Additionally, the European Mobility Strategy³ also emphasizes the need to leverage mobility digitalization and data sharing toward the implementation of the European Green Deal. The strategy discusses how a smart mobility system that enables “connected and automated multimodal mobility” and “innovation and the use of data and artificial intelligence” is an essential pillar toward decarbonization of the European transportation sector, and the creation of a vibrant, innovative and competitive EU data economy.

Prevailing policy context

Policy makers in many regions are increasing digitalization of mobility systems and data sharing to achieve sustainable mobility objectives, preserve transport systems competitiveness, and boost economic activity.⁴ At the same time, progress is hampered by an absence of a holistic policy framework on mobility data sharing. While some governments have introduced policies covering mobility data sharing either explicitly—as in the European Strategy for Data and the UK Future of Mobility Urban Strategy—others look at data sharing from broader perspectives and goals around innovation and smart urbanization, as in the Brazil National Digital Transformation Strategy and the Singapore Smart Nation Programme.

Policies on data sharing have been initiated by policy makers at all levels of government—municipal, regional, and national. A coordinated approach, whereby national governments provide the broader architecture and framing that subnational governments use to develop customized local solutions, can help mobilize efforts and resources at scale. The Government of Netherland's approach to data sharing and mobility-as-a-service (MaaS) implementation demonstrates such an approach (appendix D). Additionally, a crosssectoral approach on data sharing—such as the one followed

by Europe through the emerging European Data Strategy—ensures that systemwide benefits of data sharing and digitalization beyond transportation can be realized. In China, the Shanghai EV data Center (SHEVDC) was established by the Beijing Science and Technology Department but registered as an independent nongovernment organization. Automotive manufacturers are required to link sold EV and PHEV in-car data to SHEVDC as of 2015, while SHEVDC is tasked with the diligent integration of the data, its visualization, and analyses.

Contemporary trends in policies on mobility data sharing include a push toward greater privacy, interoperability, and experimentation (box 2-1). Generally, policy makers are passing increasingly stringent privacy and data protection regulations. Examples include California Consumer Privacy Act in USA, the draft Personal Data Protection Law in China, and General Law for the Protection of Privacy in Brazil. Policy makers have also sought greater standardization in mobility data and application programming interfaces (API) to acquire that data, and harmonization in related use cases. The European Committee for Standardization, Open Mobility Foundation, and SAE International are examples of government-led or -facilitated efforts. Further, governments are adopting a proactive and experimental approach to policy making to keep up with rapidly changing technologies. Examples include MaaS pilots in the Netherlands and the data regulatory sandbox in Singapore.⁵ Policies may not be effective if they are perceived by the market as too restrictive or costly before the viability of the designated data sharing model has been proven or realized.

Policies about mobility data also range from a light to heavy touch approach, reflecting political intentions to allow either private or public stakeholders to drive development in the sector. In European countries, public stakeholders use a panoply of policy measures to enable and govern data sharing, from regulations on data architecture⁶ and mandated open data⁷ to investments in project implementation.⁸ In contrast, the Japanese government aims for businesses to take the lead in designing, monitoring, and enforcing data sharing rules to achieve the nation's Society 5.0 vision, with government serving as a facilitator.⁹ In China, the

“In Japan, we see policies that aim to support businesses in creating and driving value in the mobility market. As can be seen in almost all jurisdictions, it takes effort to overcome a dilemma of promoting data-enabled algorithmic economy and data protection. The government seeks to adopt a minimal regulatory approach just sufficient to be acknowledged by global partner nations and regions, while embracing local opportunities in a business-to-business context.”

- Atsushi Yoshino

Senior Manager, Deloitte Touche Tohmatsu LLC.

Box 2-1. Transport for London: Benefits of Sharing Data from Public Transportation

Transport for London or TfL is the integrated transport authority responsible running the day-to-day operation of London's transport network and main roads. By making their data—static, feeds and API—available freely to all third-parties and developers, TfL hopes to deliver new products, apps and services for our customers. Additionally, TfL also hosts other data that it does not collect itself including crowdsourced traffic data.

According to TfL, over 17,000 developers have registered for their open data including “unified API (application programming interface) that powers over 600 travel apps in the UK with over 42% of Londoners using apps powered by this data” (see: <https://tfl.gov.uk/info-for/open-data-users/open-data-policy>).

According to a study by TfL and Deloitte, provision of open data, creates an additional value of about £130 million per year improving journeys, saving people time, supporting innovation, and creating jobs.

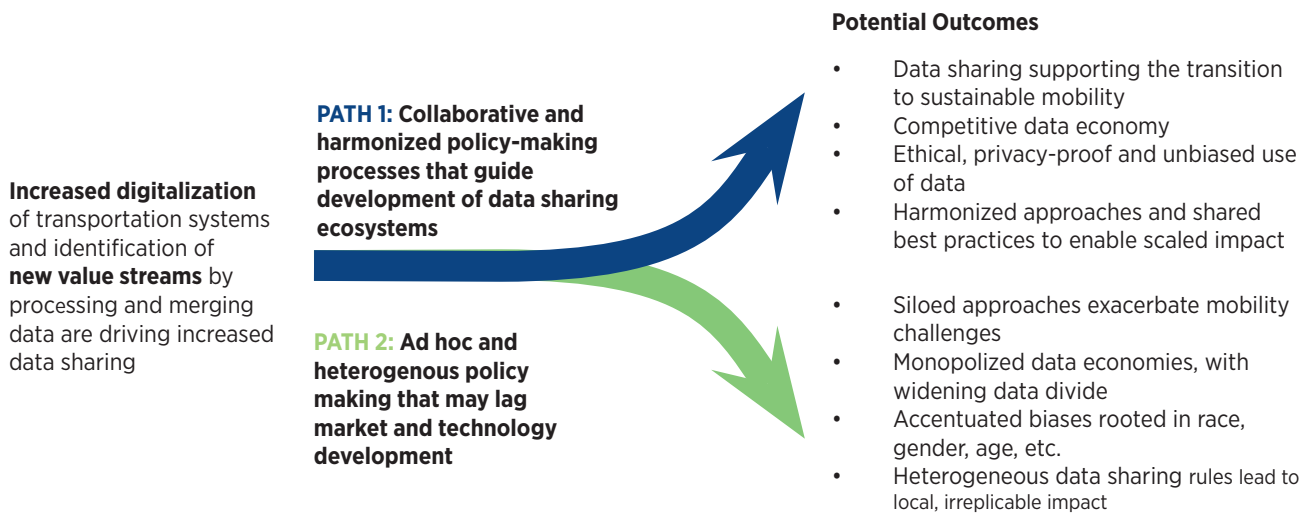
government has shown a clear intention in the draft Data Security Law to manage and regulate the nation’s market in data to protect both the public as well as the state’s data interests.¹⁰ The Netherlands exemplifies a more moderate approach, emphasizing cross sector collaboration between businesses, government, and knowledge institutions.¹¹ The policy framework in this report seeks to be globally relevant and agnostic to such approaches at a national or subnational level.

Why policy making matters

A sound policy framework is vital to the development and scaling of effective, economically viable, secure, and ethical data sharing models to achieve a more accessible, efficient, safe, and green mobility system (figure 2-1). Policies play a critical role in five ways:

- Align data sharing initiatives to achieve sustainable mobility objectives.
- Ensure appropriate safeguards are in place to protect core public values such as equity, privacy, and security.
- Capture broader economic value by establishing a fair and competitive market that prevents data monopolies and supports innovative organizations of all sizes.
- Guide harmonization of data sharing approaches and models across different jurisdictions to accelerate the development and scaling of data sharing.
- Generate significant economic value and build a high-skilled labor pool for an innovative technology-based data economy.

Figure 2-1. Why policy making matters.



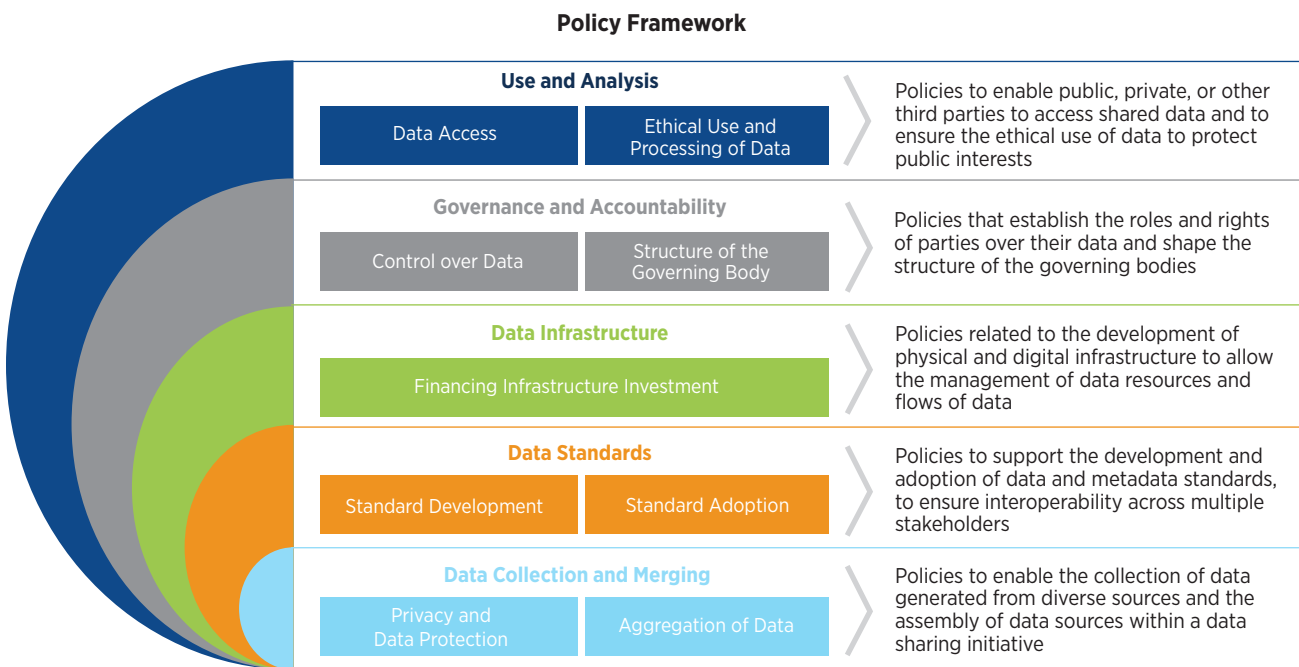
Conversely, the lack of coordinated policy actions may counter the development of sustainable mobility systems, while threatening core public values such as equality, privacy, and security, and potentially increasing concentration of raw data and capabilities for innovation with larger players.¹¹²

Policy framework overview

The mobility data sharing policy framework presented in this report seeks to serve as a comprehensive guide to policy makers globally, providing a categorization of the policies required to enable, facilitate, and catalyze data sharing in the mobility sector among public and private stakeholders.

The policy framework (figure 2-2) consists of five interdependent and complementary layers and nine elements for policy intervention which address the entire lifecycle of a data sharing initiative. Each layer defines an area of policy intervention corresponding to data flow in a data sharing collaborative: (i) data collection and merging; (ii) data standards; (iii) data infrastructure; (iv) governance and accountability, and (v) use and analysis. Additionally, embedded within each layer are specific policy elements that discuss the role of policy making for each corresponding layer.

Figure 2-2. Policy framework for mobility data sharing.



Policy makers may use this framework to take stock of the inventory of existing policies in a region, for the purposes of assessing the readiness or attractiveness of a region for mobility data sharing initiatives, and to identify areas of policy strengths and gaps. Other data sharing stakeholders also may find this framework useful for assessing existing initiatives, guiding business strategies and policy advocacy, and sparking dialogue and establishing trust among diverse stakeholders.

“The next generation of urban mobility and transportation is likely to take the form of progressively more evolved Intelligent Transportation systems, designed to coordinate multiple actors, supply, and demand to optimize for sustainability, economic viability, and improved transportation and freight experiences. Achieving this with current structures is a material challenge, with insufficient coordination of ecosystems, politically, economically, and digitally. While data in itself is not sufficient, exchange of data is a necessary foundation to achieve these goals, and also constitutes - through policy - a means of shaping the ecosystem and its operating model. Well architected and governed data sharing platforms can in turn facilitate and incentivize data sharing within urban mobility ecosystems, and ultimately effective implementation patterns will emerge and become affordable and accessible to cities worldwide.”

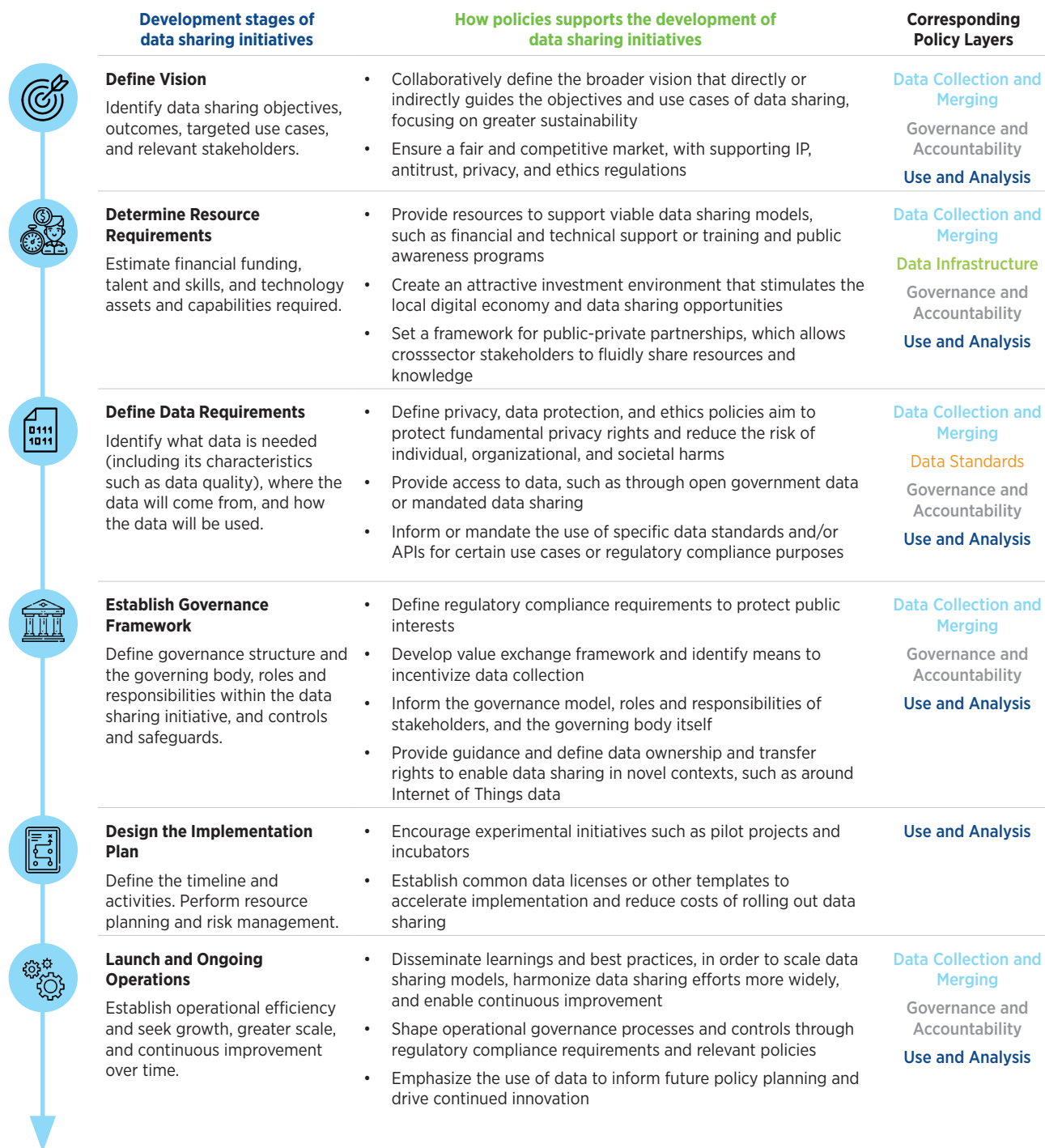
- John Stenlake

Director, Connected Vehicle, Mobility Services, & Sustainability,
WW Automotive Industry, Microsoft Corporation.

The policy framework practically supports the development of data sharing collaboratives in a specific context (figure 2-3). Policy makers, businesses, and other stakeholders should use this framework as a guide toward the deployment, scaling and replication of data sharing collaboratives and evaluate policy readiness to meet sustainability objectives.

While figure 2-3 shows a linear process starting with visioning leading to eventual deployment, in practical applications, the launch of a data sharing collaborative and adjacent policy-making processes may go through several iterations and feedback loops where lessons from deployments are ideally incorporated into future policy making.

Figure 2-3. A process diagram demonstrating applicability of policy making in the context of a data sharing initiative.



Source: Icons from flaticon.com

Customized approaches to policy making

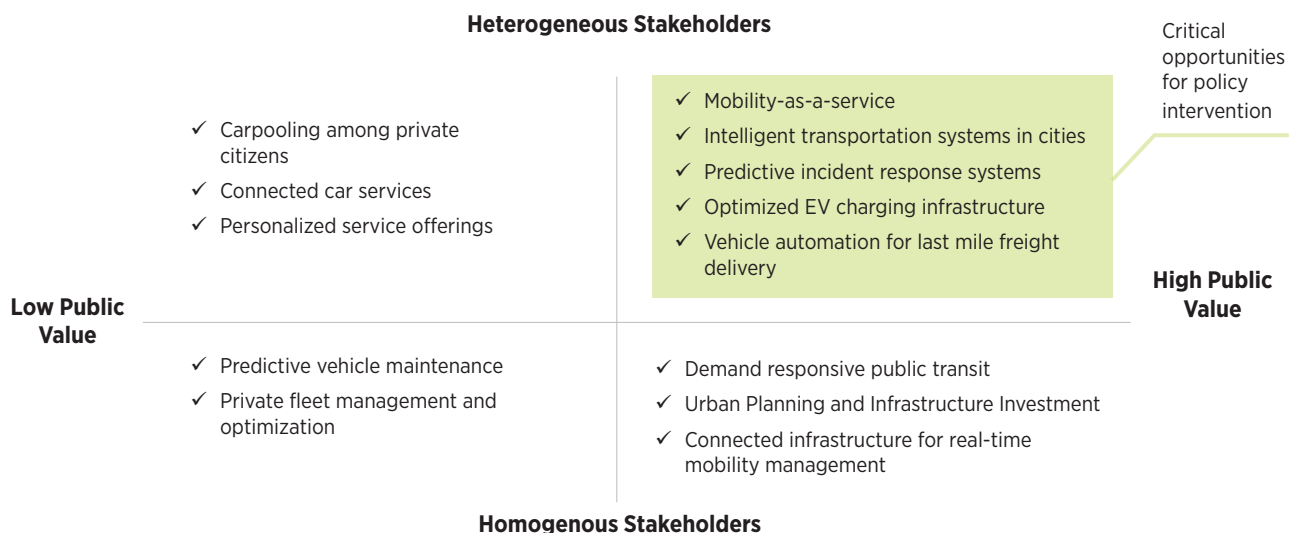
The policy framework outlined in figure 2-2 and the process diagram of figure 2-3 provide guidance for policy-making processes and the deployment of data sharing collaboratives. However, policy making for mobility data sharing is highly contextual, and needs to account for the overall vision for transportation development for a given region. The following subsections describe a set of use cases that may require policy making and a set of factors that characterize the types of policies that may be applicable for that region. Appendix C builds on this and includes examples of various options for the setup of a data sharing collaborative.

Use cases Suitable for Policy Intervention

The use cases for mobility data sharing or ways in which data can be used for a given mobility application are numerous for both developing and developed countries. These use cases range from: (i) sharing route and fare data between informal and formal transit options to create a more digitally integrated transportation system; (ii) planning transportation infrastructure and regulating mobility service operators to address inequities and improve access to underserved communities; (iii) developing digital twins of cities to operate an intelligent transportation system; (iv) dynamic curbside management; (v) regulating shared micromobility fleets in real time; and (vi) planning and operations of connected charging infrastructure. Notably, seamless and fully integrated MaaS (appendix A) offerings require merging and sharing of data from diverse transportation demand and supply sources including data on public transportation (see box 2-2), biking and walking.¹³ In the future, data sharing, and operating a fleet of electric, connected and autonomous vehicles would also require sharing data between vehicle telematics systems, on-vehicle sensors, road-side sensors, and other data from governments about lane access or entry restrictions, infrastructure maintenance, to name a few.

However, policy intervention will be most effective in use cases with a potential for sizeable public good, and where multiple heterogeneous stakeholders are involved, and where normal public sector operations and private sector commercial mechanisms are unlikely to achieve the desired objectives (figure 2-4).

Figure 2-4. Critical opportunities for policy intervention.



Diverse stakeholders representing independent, and at times conflicting, interests often require an external force—including financial incentives, quid pro quo data settlements, conditional licensing, and mandates—to catalyze data sharing. Data Sharing initiatives that are largely between private sector stakeholders for private financial gains can often be self-regulated, provided fundamental safeguards to protect consumer interests exist for example, B2B data sharing for the development of connected car services.

The most common data sharing use cases are assessed against two dimensions (figure 2-4). In this diagram, the top right quadrant represents a set of use cases where significant societal gains—emissions and congestion reduction, safety improvements, systems costs reductions—can be expected. At the same time, the highlighted use cases may involve multiparty, multidirectional sharing of data between governments, businesses, and citizens.

Box 2-2. Public Transit Data: Data from FCS, PIS, and FMS systems

Public transport system has the potential to generate data from: (i) the Fare Collection System (FCS), (ii) the Passenger Information System (PIS), and (iii) the Fleet Management System (FMS). Integrating data from these sources could help public transit authorities better match public transit capacity against demand at any given hour of the day. Additionally, multiple public transit authorities globally are also considering offering innovative pricing options such as through dynamic pricing options to incentivize higher usage of public transit during off-peak hours.

Cities frequently contract out items such as the FCS, PIS, and FMS. In such cases, often a question raises about ownership of data that is collected from such systems—the users of public transit whose data are being collected, the FMS hardware provider whose systems are being used to collect the data, or the city since the city pays the contractor for these services? And who benefits from these data? Clarifying ownership of such data, or any insights generated through the use of these data, through policy or contract agreements can help ascertain necessary value exchange to enable transfer of ownership rights for a vibrant and trustful data sharing ecosystem.

While some policy intervention may be valuable for the use cases across all four quadrants of the matrix, certain use cases require policy intervention for success. Examples of use cases where policy intervention would be the most critical and effective include data sharing to enable mobility as a service, intelligent transport systems, and predictive incident response systems. Policy makers should consider their local context and tailor the policy framework to their own prioritized use cases.

Local Enablers of Data Sharing

The following three dimensions illustrate important considerations for policy makers when applying the policy framework to local mobility systems.

Mobility system characteristics: The existing state of the local mobility system serves as a baseline on which policy makers can develop data sharing strategies for targeted use cases. A region's motorization rates, population distribution and density as well as its existing transportation infrastructure—as defined by the transport infrastructure index by World Economic Forum, Global Competitiveness Index¹⁴—define the local mobility needs that shape the priorities of policy makers and the scope of local policies. The transport modes available and their level of usage provide

information on behavioral and movement patterns, the types of data that can be collected, and the potential data sharing use cases.

Digital maturity: Data sharing requires stakeholders involved to have or be able to acquire a certain baseline of technological capabilities. At the same time, as costs of technology continue to fall, and a continuously increasing pool of individuals who are well-versed in technology enter the job market, it is likely that this factor may eventually become less important with time. In some cases, developing countries stand a chance to leapfrog to more advanced stages of technology development, bridging the digital maturity gap at a rapid pace. A region's level of smartphone penetration, and other qualitative metrics including digital infrastructure development, the strength of the digital economy, and the accessibility to data and digital skills facilitates the development and operations of sharing data initiatives. Digital penetration and digital literacy, particularly among vulnerable groups such as youth, elderly, differently abled, and the less educated needs to be considered.¹⁵

Regulatory environment: Some regions emphasize an open market approach with minimal regulations, while others are more regulated with governments actively influencing the market. Some governments' fiscal approaches may also influence how they value certain benefits or costs of data sharing. Governments that operate more like businesses—with more emphasis on balancing budgets versus using governments' leverage toward serving broader societal and economic goals—may focus more on overall economic success at the expense of equity or distributional impacts.

The structures of local regulatory bodies and their scope of authority as well as the relationships dynamics and level of trust between the public and private sectors, affect policy priorities, approach, and mechanisms used, and the stakeholders involved in policy making. The coordination and influence between the municipal, regional, and national policy makers are also important factors. Local value systems may shift the balance toward either private or public sector players taking on a leading role in the mobility market, influencing the degree of oversight of the municipality over corporate activity and the government's fiscal approach and priorities.

Another important factor to consider is the level of trust that citizens put in their governments. The level of trust can be affected the level of corruption, political stability, regulatory quality, and rule of law in each jurisdiction. Trust can have an impact on the scope and approach to regulation in that market. The Government Effectiveness metric as part of the Worldwide Governance Indicators (WGI) project of the World Bank could be a proxy for this measure.

Figure 2-5 illustrates salient characteristics of some cities across these dimensions.

Figure 2-5 Four city profiles characterized by the three external dimensions.^{a,b}

	Singapore	Mumbai	Los Angeles	London
Mobility System	<ul style="list-style-type: none"> Population density: >7,800 per km² Developed Public Transit infrastructure 	<ul style="list-style-type: none"> Population density: >22,900 per km² Diverse transit modes, significant ridehailing 	<ul style="list-style-type: none"> Population density: >2,800 per km² Automobile-centric urban sprawl 	<ul style="list-style-type: none"> Population density: >5,700 per km² Integrated public transit modes
Digital Maturity	<ul style="list-style-type: none"> Smart Urban Mobility is a Strategic National Project Focused on re-skilling and digital inclusion 	<ul style="list-style-type: none"> Digitalized metro system Access to strong digital talent pool 	<ul style="list-style-type: none"> Developed the MDS standard for micromobility Close to tech hub 	<ul style="list-style-type: none"> Surface Intelligent Transport System with AI capabilities TransportforLondon hosts open public transport data
Regulatory Environment	<ul style="list-style-type: none"> Central government plays a strong coordinating role IMDA published Trusted Data Sharing Framework 	<ul style="list-style-type: none"> Supportive policies for target sectors, such as subsidized rollout of electric vehicles and charging infrastructure 	<ul style="list-style-type: none"> Progressive state relative to other regions in the US Experimental approach to policy making 	<ul style="list-style-type: none"> Strong partnership with academia and research Collaboration between public and private sectors
Key Challenges	<ul style="list-style-type: none"> Establish Governance Framework Congestion Costly delays 	<ul style="list-style-type: none"> Heavy congestion Safety on roads Transport accessibility 	<ul style="list-style-type: none"> Pollution Heavy congestion Private car ownership 	<ul style="list-style-type: none"> Heavy congestion Funding gaps Noise and light pollution
Key Opportunities	<ul style="list-style-type: none"> Connected infrastructure Cybersecurity 	<ul style="list-style-type: none"> Infrastructure investment Shift to low carbon modes 	<ul style="list-style-type: none"> Last mile demand responsive transit Shared mobility 	<ul style="list-style-type: none"> Passenger behavior change Electric vehicles

Notes:

a. <https://www2.deloitte.com/us/en/insights/focus/future-of-mobility/deloitte-urban-mobility-index-for-cities.html?id=us:2em:3pa:future-of-mobility:eng:di:090920#>

b. <https://www.oliverwymaforum.com/mobility/urban-mobility-readiness-index.html>

Notes

- 1 See SuM4ALL's Global Roadmap of Action here: <https://www.sum4all.org/global-roadmap-action>
- 2 Country groups can be found at <http://pubdocs.worldbank.org/en/350451571411004650/Global-Roadmap-of-Action-Toward-Sustainable-Mobility.pdf>; pages 29 and 30
- 3 European Mobility Strategy: https://ec.europa.eu/transport/themes/mobilitystrategy_en
- 4 Leveraging Digital Technology and Data for Human-Centric Smart Cities – G20 Report
- 5 <https://www.imda.gov.sg/programme-listing/data-collaborative-programme>.
- 6 EU Regulation 2017/1926 – establishment of National Access Points
- 7 Finnish Act on Transport Services
- 8 <https://www.intelligenttransport.com/transport-news/97665/european-data-sharing-project-launched-by-uitp/>
- 9 https://www.meti.go.jp/english/press/2020/pdf/0713_001a.pdf
- 10 <https://thediomat.com/2020/09/chinas-draft-data-security-law-a-practical-review/>
- 11 <https://www.government.nl/topics/mobility-public-transport-and-road-safety>
- 12 <https://www.economist.com/special-report/2018/06/28how-regulators-can-prevent-excessive-concentration-online>
- 13 Since 2009, Zurich, Switzerland provides open access to all its walking and cycling data. This can be accessed at: https://data.stadt-zuerich.ch/dataset/ted_taz_verkehrszaehlungen_werte_fussgaenger_velo.
- 14 See 'The Global Competitiveness Index 4.0 Methodology and Technical Notes'. <http://www3.weforum.org/docs/GCR2018/04Backmatter/3.%20Appendix%20C.pdf>
- 15 IMD's Digital Competitiveness Index may provide a methodology and a set of metrics to assess the level of digital maturity of a given region. For more information, please see: <https://www.imd.org/wcc/world-competitiveness-center-rankings/world-digital-competitiveness-rankings-2019/>

3. Good Practices and Policy Suggestions

The development of the 33 policy suggestions presented in this section has been informed by consultations with subject matter experts, case studies of ten global data sharing initiatives (appendix D) as well as research on existing policies and data sharing models (appendix C).

The policy suggestions are organized according to the structure of the policy framework presented in chapter 2 and include:

- A description of the suggested policy;
- Prioritization of the suggested policy based on the stage of development of a region’s data sharing ecosystem adopted from other existing studies;¹
- Policy makers involved (municipal, regional, national) in the adoption of the suggested policy.

This prioritization framework aims to provide general guidance to policy makers on the potential sequence of policy actions as well as how the policy suggestions complement each other. It should be noted that these stages are indicative and not correlated with level of economic development as less developed countries can have regions of high data sharing capabilities and vice versa. Data Sharing capabilities can be developed everywhere, and it may not be possible for one geography to simply emulate another other leading city. Cities profiles vary based on the local enablers described above, and city leaders must take those into account while designing the appropriate pathway for that region (table 3-1).

Table 3-1. Stages of maturity of data sharing ecosystems

Stage of Data Sharing Ecosystem	Data Sharing in the Mobility System	Digital Maturity	Regulatory Environment
Nascent Examples: Mukono, Uganda, Kathmandu, Nepal	<ul style="list-style-type: none"> • Low volumes of data collected and shared • Few basic or ad-hoc data sharing initiatives 	<ul style="list-style-type: none"> • Low levels of digital capabilities and digitalization of the mobility sector, though high opportunity for digital leapfrog may exist 	<ul style="list-style-type: none"> • Rights of stakeholders are defined and protected • Few policies or guidelines targeting data sharing • Authorities and responsibilities are not clearly delegated among government organizations
Emerging Examples: Bengaluru, India; Bogota, Colombia	<ul style="list-style-type: none"> • Growing volume and diversity of useful mobility data • Several pilot projects or data sharing initiatives are being implemented 	<ul style="list-style-type: none"> • Growing digitalization of the mobility sector • Efforts to develop or acquire digital talent • Siloed technologies and capabilities for specific or limited purposes 	<ul style="list-style-type: none"> • Siloed policies addressing data sharing • Policies supporting only specific stages of the data sharing lifecycle • Appropriate controls and protections are in place to safeguard public interests and rights of stakeholders

Table 3-1. Stages of maturity of data sharing ecosystems

Stage of Data Sharing Ecosystem	Data Sharing in the Mobility System	Digital Maturity	Regulatory Environment
<p>Mature</p> <p>Examples: London, UK; Singapore, Finland</p>	<ul style="list-style-type: none"> • High volume of useful mobility data from diverse transport modes and other sources • Several successful and innovative data sharing initiatives between public and private organizations 	<ul style="list-style-type: none"> • High % of digitalized mobility assets and infrastructure • Sophisticated technology capabilities to store, manage, and analyze data • Strong and adaptable digital skills in the public and private sectors and the general public 	<ul style="list-style-type: none"> • Policies to promote data sharing under a long-term vision of sustainable urban mobility • Coordinated efforts at the municipal, regional, and national levels to advance data sharing • Effective enforcement and compliance mechanisms

Data Sharing collection and merging

Mobility data sharing initiatives require stakeholders to make relevant mobility data accessible and usable by other parties. Concerns around privacy of individuals and entities, and competition may inhibit collection of data. Merging disparate datasets in many cases can generate significant value beyond what can be derived from the original datasets. The value of data can also be difficult to ascertain, and stakeholders, especially small and medium enterprises, may need some incentives to share data.²

“Building trust in data sharing requires a practical approach to privacy policy making. Privacy officers within organizations play a key role in this regard, helping organizations build data protection into products and services, while assisting data subjects and serving as the point of contact for regulators.”

- Caitlin Fennessy,
CIPP Research Director, International
Association of Privacy Professionals

Why policy making matters

The suggested policies seek to harmonize data collection practices and offer safeguards that engender trust among stakeholders, the lack of which may lead to increased risks of harm and reluctance to share data. These policies also offer the requisite incentives to overcome barriers to data sharing. Public authorities can act on behalf of the society to enact policies that capture benefits that lie outside the transportation system.

Element 1: Privacy and Data Protection

Privacy is a fundamental human right defined in the UN Declaration of Human Rights. Many countries have established privacy rights and data protection laws that create a foundation of trust and protection. Data that can be used to uniquely identify a person, directly or in combination with other data, are deemed personal data.³ While policy makers may require entities to minimize personal data collection, even disparate datasets could be used to characterize, if not uniquely identify, individuals, even when those datasets may contain limited or no personally identifiable information.⁴ As past examples of data breaches and misuse have demonstrated, any personal data collected and held by organizations pose a risk for potential harm for all including financial loss and reputational damage. Policy makers need to carefully balance the opportunities to achieve sustainability mobility objectives and private value, with threats to individual autonomy, integrity, and dignity. Careful design of systems and a tiered approach to what data are available to whom and for what purpose are necessary to ensure privacy.

At Trafi, we believe that the cornerstone of every efficient MaaS system is its data. As such, data privacy should be appropriately balanced with driving innovation. This document is shining a light on a policy void that needs to be addressed -- its proposed framework is the perfect reference for policy makers in the data domain.

- Daniel Alarcon-Rubio
Chief Technology Officer, Trafi

Element 2: Merging Datasets

The incentives for stakeholders to share data must be sufficiently compelling to justify the investment of resources required and outweigh any perceived risks. Many mobility companies are reluctant to share operational data and/or data they collect about their customers, which can be a source of competitive advantage. However, such data when merged and analyzed could create significant value for the entire ecosystem (table 3-2). The public sector has historically been more active in sharing its data, from public census data to open government data, recognizing the opportunity to better serve its citizens and boost the digital economy through data sharing. Policies can play a unique role in encouraging, incentivizing, and mandating data sharing, where significant potential for public good is evident but hampered by weak incentives for independent stakeholders to collaborate organically. The choice of policy mechanisms needs to be thoughtfully selected based on local regulatory and business relationships and ability to deploy fiscal measures. As an example, following the success of Open Banking in the UK, the Department for Business, Energy, and Industrial Strategy seeks to mandate industry involvement in smart data initiatives in other sectors including transport, communications, and energy.⁵

Table 3-2. Data Collection and Merging: Policy suggestions to apply at municipal, regional and national levels.

				Policy makers Targeted		
				Municipal	Regional	National
	Prioritization	Policy Suggestion	Description			
Privacy and Data Protection	Nascent	Public outreach, education, and awareness initiatives	Implement public outreach, education, and awareness initiatives to build privacy and digital literacy and increase participation in data sharing initiatives among relevant stakeholders	n.a.	✓	✓
		Civil and criminal liabilities and penalties	Define civil and/or criminal liabilities and penalties for violators of privacy and data protection laws, to create credible deterrent and enforcement	n.a.	n.a.	✓
		Privacy and data protection authority	Establish a national privacy and data protection authority to consult with relevant stakeholders, enforce compliance with privacy laws, proactively audit and investigate violations, impose fines and sanctions, and manage public outreach	✓	✓	✓
Privacy and Data Protection	Nascent - Emerging	Privacy impact assessments	Develop a framework for privacy impact assessments and mandate its use within relevant organizations to enable consistent classification, evaluation, and mitigation of privacy risks and harms An example policy is the requirement for Data Protection Impact Assessments in the EU General Data Protection Regulation (GDPR).	✓	✓	✓

Table 3-2. Data Collection and Merging: Policy suggestions to apply at municipal, regional and national levels.

	Prioritization	Policy Suggestion	Description	Policy makers Targeted		
				Municipal	Regional	National
Privacy and Data Protection	Emerging	Comprehensive national data privacy law	Establish a comprehensive national data privacy law to define and protect data privacy rights An example policy is the EU GDPR that went into effect in 2018.	n.a.	n.a.	✓
		Personal data sharing tool	Encourage technology platforms to allow individuals to access and contribute to a global layer of interoperable data. Such a tool may also be used to provide consent for personal data sharing	✓	✓	✓
Merging Datasets	Emerging	Financial and technical support schemes	Establish programs to provide financial and technical support for organizations to participate in sustainable mobility data sharing schemes, in support of competitive and innovative ecosystems See Case Study 3 on the city of Bogota's laboratory for urban mobility that hosts a startup incubator.	✓	✓	✓
		Common data platforms	Build data management platform(s) at the regional and national levels where needed to enable sustainable mobility use cases that deliver public value	✓	✓	✓
	Mature	Mandate open data	Identify critical datasets for the realization of sustainable mobility use cases and mandate these critical datasets to be shared as open data (see page 74 for more details on open data) See Case Study 4 in appendix D that describes the Finnish Act on Transport Services and its role in enabling mobility-as-a-service.	✓	✓	✓
		Mandate data sharing	Require mobility stakeholders to share their mobility data with external parties, such as regulators to receive their license to operate or to receive public funding, to enable critical data sharing use cases.	✓	✓	✓

Notes: n.a. = not applicable

[Go to details on policy suggestions](#)

“Policies should encourage various data sharing models, especially data reciprocity, and data portability. For acceptance and adoption, it is also important to assess the costs of data sharing to data providers and offer support with tailored fiscal and non-fiscal schemes, if needed. Small and medium-size enterprises, in particular, may have trouble meeting data sharing requirements.”

- Piia Karjalainen
Secretary General, MaaS Alliance

Data Standards

Within the mobility sector, numerous formal and informal data and metadata standards exist on a semantic level, from technical standards for transmitting actual public transit data such as NeTEx or the general transit feed specification (GTFS) to business standards such as the electronic data interchange (EDI) and the transport operator mobility-as-a-service provider (TOMP) standard in the Netherlands. However, an effective standard is not simply a set of rules, but one that is widely accepted and implemented by the industry, which allows data held by one organization to be understood and used by others in a time- and cost-efficient and scalable manner. A database of commonly used open data standards can be consulted in the Open Data Standards Directory.⁶

Why policy making matters

Guided by sustainable mobility objectives, policies may play an important role in the development and adoption of standards to allow the accelerated scaling of data sharing. Lack of a harmonized approach to standards adoption may lead to varying data standards across geographies creating interoperability challenges, and posing additional burden on businesses to use different standards across geographies.

Element 1: Standard Development

The development of data and metadata standards have been initiated and led by actors from all sectors, typically driven by a recognized need, gap, or innovation in the industry. The development process itself requires investment of resources, and often the parties who undertake this exercise are those, or represent those who stand the most to gain. However, it is important that an inclusive and representative group of stakeholders is involved throughout the standard development process to build engagement and commitment as well as to ensure diverse perspectives have the opportunity to shape the form and function of the data standard, along with the common understanding of the definitions and mobility practices surrounding the underlying data. In many cases, valuable de facto standards such as the New York City taxi data may be established by an early data provider and subsequently adopted and updated by other stakeholders.

The management of standards' lifecycle should aim to be adaptable to build on existing standards and support the development of future-ready and continuously evolving standards. Given the rapidly changing mobility sector, standards risk becoming obsolete if they do not adapt.

“Twenty-first century transportation agencies need access to verifiable data to manage the public right of way. Accurate data enables innovation in our cities, while ensuring that private companies are following our rules and meeting our leaders’ policy expectations. Access to data is a two-way street however, and we must be clear and rigorous about how we use, maintain, and protect it. That’s why we developed the Mobility Data Specification to receive only the most essential data points from companies, why we created data privacy principles to ensure that limited information is protected, and why we joined other cities and founded the Open Mobility Foundation to improve mobility data infrastructure in an open and transparent manner.”

- Seleta Reynolds

General Manager, Los Angeles Department of Transportation

Element 2: Standard Adoption

The wide-spread adoption of data standards is often hindered by several obstacles. Voluntary standards may not reach a critical mass of adoptees, especially when competitive market forces, misaligned interests, and switching costs discourage collaboration. When government mandates a data standard, organizations may also face feasibility challenges on account of the burden of technical, organizational, and financial resources required to implement a new data standard.

Furthermore, variations in data standards across geographies may be a challenge for organizations operating with a large geographical footprint. The EU operates on a strong effort to harmonize data standards on various levels. The European Committee for Standardization and its portfolio of data standards aim to integrate mobility markets across European countries, creating benefits for regulators, multijurisdictional mobility operators, and passengers alike. The appropriate and optimal geographical coverage of standardization may be an open question in some cases. However, the rise of global institutions and multinational mobility service providers may lead the charge for harmonization and global standards in the future, and the international dataspace industry standard from Germany is a good example (table 3-3).

Table 3-3. Data Standards: Policy suggestions to apply at municipal, regional, and national levels

				Policy makers Targeted		
	Prioritization	Policy Suggestion	Description	Municipal	Regional	National
Privacy and Data Protection	Nascent - Emerging	Common and Standardized APIs	Encourage use of APIs to share data, through the development of standard APIs and standardization guidelines to enable convenient and flexible data sharing	✓	✓	✓
	Mature	Data and metadata standard development	Develop a data, metadata, or related standard that is use-case driven and suitable to the local context and sustainability mobility policy objectives, leveraging existing data standards where possible See Case Study 1 in appendix on Digital Transport for Africa’s development of the General Transit Feed Specification (GTFS) flex standard for informal transit.	✓	✓	✓

Table 3-3. Data Standards: Policy suggestions to apply at municipal, regional, and national levels

				Policy makers Targeted		
	Prioritization	Policy Suggestion	Description	Municipal	Regional	National
Standard Adoption	Nascent	Guidance on common standards	Provide guidance on acceptable and common industry data standards, allowing multiple data standards to accommodate data from different sources and sectors with the aim of encouraging voluntary adoption of data standards and harmonizing standards over time	✓	✓	✓
	Emerging	Mandate data standards	Require data and metadata standards where appropriate in the local context to realize sustainable mobility policy objectives, leveraging existing and open standards or APIs where possible, and following a phased adoption approach to enable organizations of all sizes and capacities to comply with the mandated standard An example policy is the Dockless Mobility Pilot Program in Los Angeles, which requires the use of the Mobility Data Specification.	✓	✓	✓

Note:

a. In addition to data standards, a public-private-research effort to align on data generation methodologies for select use cases is essential.

[Go to details on policy suggestions](#)

Data infrastructure

The data infrastructure policy layer refers to the physical technology infrastructure such as towers, cables, servers, networks, and the software systems—networking, compute, storage, flow, analytics and AI—that underlie the entire lifecycle of data sharing.

Why policy making matters

Policies can aim to develop robust data sharing infrastructure as a shared asset that provides public good, directs equitable distribution of benefits, and stimulates economic growth, while minimizing capital expenditure. In some cases, governments and private companies may choose to co-finance the development of such infrastructure in pursuit of broader economic objectives.

Element 1: Financing Infrastructure Investments

The financing available for infrastructure development varies by region. While highly developed countries may be looking toward new technologies such as 5G networks and connected sensors, other countries may be enhancing baseline capabilities such as broadband networks or leapfrogging to proven technologies. Policy makers play an important role in shaping budgets and prioritizing funding in this area. Telecommunications investment has been identified as a trigger for economic growth in the short and long term.⁷ Despite the growing importance of the digital economy, multiple regions around the world have a severe infrastructure financing gap. For example, in Asia it is estimated to reach USD 512 billion by 2040.⁸ Policy makers should consider how to best use public resources to optimize value from infrastructure investments. In many cases, leveraging existing technologies can avoid duplication of costs. Examples include centralized data portals such as the European Data Portal and common communications interfaces such as the international dataspace connector (table 3-4).

Table 3-4. Data Infrastructure: Policy suggestions to apply at municipal, regional and national levels.

	Prioritization	Policy Suggestion	Description	Policy makers Targeted		
				Municipal	Regional	National
Financing Infrastructure Investment	Emerging - Mature	Attractive investment environment	<p>Develop an attractive financing environment for companies to facilitate private investment in communications infrastructure, through the use of financial and non-financial measures including public private partnerships</p> <p>An example policy is the 2015 UK Digital Communications Infrastructure Strategy.</p>	✓	✓	✓

Table 3-4. Data Infrastructure: Policy suggestions to apply at municipal, regional and national levels.

	Prioritization	Policy Suggestion	Description	Policy makers Targeted		
				Municipal	Regional	National
Financing Infrastructure Investment	Emerging - Mature	Budget for communications infrastructure	<p>Allocate funding for critical communications infrastructure development in government budgets to supplement funding from other sources, providing a critical public resource to accelerate mobility data sharing and boost economic growth</p> <p>In 2019, ~60% of Singapore GovTech's budget was spent on Smart Nation Projects including a project to upgrade lamp posts with connected sensors and cameras. See Case Study 9 in appendix D on Singapore's Smart Nation Sensor Program.</p>	n.a.	✓	✓

Notes: n.a. = not applicable.

Go to details on policy suggestions

Governance and Accountability

The functions of good governance include formulating the strategic vision and objectives, delegating authority, defining roles and responsibilities, and providing oversight and transparency on the execution of the strategy to represent the interests of all stakeholders effectively. Within a mobility data sharing initiative, governance is responsible for decisions ranging from data provision and access rules to types of data standards used, which stakeholders can be involved. If the data sharing collaborative generates revenues or cost savings—for example, through ticketing or avoided fuel and trip costs—the governance body may also be responsible for setting rules for cost and revenue sharing, and settling all transactions.

Why policy making matters

Policies supporting good governance should provide data sharing stakeholders an incentive to protect other stakeholders from harm without hampering their ability to operate, innovate or limit the potential benefits. In that vein, policy has an important function in defining ownership rights, who controls or owns data, how data ownership and liabilities can be transferred, and importantly, how value from data sharing can be channeled to collaborating parties. Often, controllers of data may not necessarily own the data—although the entity that has control over data may eventually make decisions about who has access to the data, under what conditions, and for what purposes through the use of licenses, data sharing agreements, contracts, and other legal mechanisms.⁹

In the case of personal data sharing, data control is often gained through service level agreements (SLA) that may differ quite significantly in scope and extent of transfer of responsibilities. Policy making has an important role in providing safeguards, and means and mechanisms for redressal.

Element 1: Control over data

Responsibilities and powers of data controllers, who may not necessarily own the data, must be clearly defined to create trust. Differences between ownership and control of data have not been explicitly defined in policies. Data controllers may be empowered to act in their capacity to share data, with reduced risk of unintended loss of control. Some cases may have multiple data controllers for the same dataset, such as for the Internet of things (IoT) or MaaS data. Policies should carefully consider how control over data will impact the distribution of value derived from data. Some contractual requirements may include terms on data availability, timeliness of data, and other SLAs that data controllers must abide by. Data controllers can also have a unique capability to ensure safe storage of data, ethical collection of data, high quality of data, and appropriate anonymization of data.

Element 2: Structure of the governing body

The governance structure is the embodiment of the interests and ambitions of the stakeholders involved, representing shared fundamental vision and values. Stakeholders from diverse backgrounds often converge in their desire for a more sustainable mobility system that also embraces fair competition. When designing the governing body, democratic processes, public-private cooperation, and cross-industry and cross-jurisdictions of human-centric governance structures should also be considered (table 3-5).

Table 3-5. Governance and Accountability: Policy suggestions to apply at municipal, regional, and national levels

				Policy makers Targeted		
	Prioritization	Policy Suggestion	Description	Municipal	Regional	National
Control Over Data	Emerging	Experimentation of new control models	Explore new control models by developing and funding pilot projects to address gaps in existing control structures for enabling trust and control among diverse stakeholders	✓	✓	✓
	Emerging - Mature	Antitrust regulation	Examine requirement for entities to serve limited roles in the supply chain, in accordance with local antitrust laws, to limit anticompetitive behavior	n.a.	n.a.	✓
		IP laws	Examine existing intellectual property (IP) laws and regulations concerning new algorithms and business models for data use to avoid IP barriers to data sharing	n.a.	n.a.	✓
	Mature	Data ownership and transfer rights	Initiate multistakeholder validation of data ownership rights, conditions for transfer of ownership, liabilities for misconduct, and limits of liabilities, in particular for co-created data such as from the Internet of Things to provide a robust legal framework to facilitate data sharing	n.a.	✓	✓
		Responsibilities of data providers	Provide guidance on the responsibilities of data providers and data controllers toward the quality and traceability of their own data to improve accountability and trust in shared data	✓	✓	✓
Structure of the Governing Body	Nascent	Clear vision and objectives	Publish clear policies on the government's vision and objectives around data sharing, to build understanding between stakeholders on what data are needed and how it is intended to be used	✓	✓	✓
	Nascent - Emerging	Delegation of oversight authorities	Clarify and assign division of oversight and enforcement authorities, providing more than one path for restitution	n.a.	n.a.	✓
	Emerging	Structured learning process	Adopt a structured process of learning and experimentation within the governing body and the broader organization to ensure adaptability to a changing mobility sector See Case Study 6 in appendix D on the iterative regulation of micromobility in Los Angeles.	✓	✓	✓

Table 3-5. Governance and Accountability: Policy suggestions to apply at municipal, regional, and national levels

	Prioritization	Policy Suggestion	Description	Policy makers Targeted		
				Municipal	Regional	National
Structure of the Governing Body	Emerging - Mature	Public-private partnerships	<p>Create frameworks for public-private partnerships that allow mobility organizations and stakeholders to collaborate in governing local data sharing initiatives</p> <p>See Case Study 5 in appendix D for more information on the collaborations between private, academic, and public sectors in London.</p>	✓	✓	✓
	Mature	Clearinghouse for data sharing	<p>Establish an organization to serve as a clearinghouse, performing functions such as background checks, authentication, verification of service transactions, monetary exchange, and quality control to enable and catalyze data sharing</p> <p>See Case Study 8 in appendix D describing Netherlands' pilot that used blockchain to process transactions for mobility-as-a-service use cases.</p>	✓	✓	✓
	Mature	Harmonization of data sharing	<p>Designate a public organization to be responsible for converging data sharing best practices, building greater consistency and data interoperability across geographies, and collaborating with peer organizations globally to share knowledge and harmonize data sharing efforts</p>	n.a.	n.a.	✓

Notes:

a. https://www.acea.be/uploads/news_documents/20201007_Joint_Statement_-_Access_to_B2B_Data.pdf

n.a. = not applicable

Go to details on policy suggestions

Use and Analysis

The success of a data sharing initiative depends on the extent to which data are accessed by relevant parties and used toward the intended and agreed-on purposes. The act of making data available is only the first step—in many cases, a large, open database with irrelevant, outdated, or hard-to-find data can actually become a barrier to effective data sharing.

Why policy making matters

Policy making must ensure that data access is reserved to authorized parties—even though aggregated insights may be available to a broader group of users—its use is ethical and is compliant with existing laws and regulations. An empowered regulatory and oversight body is vital to trust building by ensuring that use is also limited to intended objectives.

Element 1: Data Access

Most commonly, licenses and other contractual agreements are used to establish the terms and conditions of data access. In recent years, governments worldwide have led open data initiatives, as part of the open government movement. The economic impact of open data is attractive; the European Data Portal estimates the market size of open data to be worth €325 billion for 2016–2020.¹⁰ Transport for London estimated the benefits of open data to be between £90 million and £130 million per year in 2017.¹¹ Open data emphasizes equitable access to data by all, in recognition of the value of data as a precious resource for the common good and as a driver for competitive markets. While public open data has become popular within governments, many use cases continue where partially open or restricted data may be more suitable, especially to protect sensitive data. In such cases, curated data or the insights may be shared instead of raw data. Data for ticketing for example, which may contain personal information, may not necessarily be open data. Ultimately, it is important to ensure that mandating data sharing does not become counterproductive by discouraging data providers from publishing data at all. Establishing a culture of sharing data can evoke a multiplier effect, where data sharing begets additional data sharing.

Element 2: Ethical Use and Processing of Data

Several incidents have brought the topic of ethical use of data to the forefront of public discourse. Behind the optimism surrounding new technologies, the true extent of the risks may remain relatively obscure. However, lessons learned from other sectors, such as healthcare, banking, and telecommunications may be applicable to the mobility sector. Transparency around data practices, metadata and processing will allow ethical concerns to be monitored and openly debated. In this regard, monitoring the use of data—for research or commercial use—beyond the original intent of SLAs is necessary. Additionally, the careful evaluation of both direct and indirect consequences of data use is essential to achieve desired outcomes while avoiding negative impacts. Data wield considerable power, and can be used to the benefit or detriment of stakeholders. At the same time, judgements of the ethical implications are typically subjective, varying between countries,

“In Switzerland, FEDRO is testing the concept of ‘conditional open data’. By default, all users can register and get a time-limited access to the real-time data. Those who would like to access the data for commercial purposes on a longer period, are kindly asked to make an equivalent amount of data available in return. This reciprocity allows a win-win situation and aims as an incentive for public and private organizations to share their own mobility data in a standardized way.”

- Valentino Scarcia
ITS Innovation Specialist, Swiss Federal Govt

organizations, or even individuals. It is critical to be able to monitor and prevent ethical violations in the first place, as negative impacts may be difficult to undo or correct. Active policy making on ethical practices may help build customer trust in data sharing, and enhance reputation of entities that are in compliance (table 3-6).

Table 3-6. Use and analysis: Policy suggestions to apply at municipal, regional, and national levels

	Prioritization	Policy Suggestion	Description	Municipal	Regional	National
Data Access	Emerging	Iterative policy development	Invest in experimental initiatives, such as pilot projects, incubators, and regulatory sandboxes, to test the accessibility and viability of different data sharing models See Case Study 8 in appendix D for more information on the mobility-as-a-service regional pilots in the Netherlands.	✓	✓	n.a.
	Emerging	Data license templates	Create common data license templates to reduce cost, effort, and time required in the licensing process to share data	n.a.	✓	✓
	Emerging	Flexible data sharing models	Adopt flexible data sharing agreements ranging from open data to custom data licenses to quid pro quo exchanges to encourage data sharing for a variety of use cases (within explicit limits). See Case Study 10 in appendix D for more information on Switzerland's quid pro quo data sharing model.	✓	✓	✓
Ethical Use and Processing of Data	Nascent	Independent enforcement bodies	Establish independent enforcement mechanisms to allow individuals and organizations to have access to effective redress channels	n.a.	✓	✓
	Emerging	Policies addressing the equitable and ethical use of data	Incorporate equity and ethics principles and objectives in data sharing policies and decision making, addressing issues such as gender, race, age, differences in ability, and other sociodemographic factors An example policy is Los Angeles' Gender Action Plan, which is under development.	✓	✓	✓
	Emerging - Mature	Operational-level oversight	Within each data sharing initiative, require the creation of an independent officer or commission with local representation to ensure ethical use, processing, and analysis of data	✓	✓	✓

Notes: n.a. = not applicable

[Go to details on policy suggestions](#)

“In Antwerp, mobility providers require an operating license from the city that is reopened after 4 years. Changes are discussed with all stakeholders in a co-creative manner. This allows buy-in from those stakeholders into the ecosystem of Antwerp and promotes open collaboration.”

- Stijn Vernailen
MaaS-Expert, Smart Ways to Antwerp

Notes

- 1 The prioritization framework is based on the stage of advancement along the local enablers detailed in Chapter 2.
- 2 <https://www.wbcds.org/contentwbc/download/8198/127647>
- 3 <https://iapp.org/resources/article/personally-identifiable-information/>
- 4 <https://www.nature.com/articles/srep01376>
- 5 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/915973/smart-data-consultation-response.pdf
- 6 <https://datastandards.directory/all>
- 7 https://www.researchgate.net/publication/48265006_Investment_in_telecommunications_infrastructure_growth_and_employment_-_recent_research
- 8 https://www.aiib.org/en/policies-strategies/operational-policies/digital-infrastructure-strategy/.content/_download/Full-DISA-Report_final-with-Appendix-2020-01-10.pdf
- 9 <https://theodi.org/article/data-trusts-in-2020/>
- 10 https://www.europeandataportal.eu/sites/default/files/analytical_report_n9_economic_benefits_of_open_data.pdf
- 11 <http://content.tfl.gov.uk/deloitte-report-tfl-open-data.pdf>

4. Conclusion and Call to Action

The policy framework and 33 policy suggestions presented in this report seek to provide comprehensive guidance to policy makers on the development of data sharing in the mobility sector for the purposes of creating more accessible, efficient, safe, and green mobility systems. As is exhibited through various case studies detailed in the appendix, concerted policy-making approaches are essential to guide the development of an effective, economically viable, secure, and ethical data sharing ecosystem for both public and private stakeholders.

This policy framework and suggestions—developed through consultations and input from more than 55 industry and subject matter professionals in both the public and private sectors—can help decision makers take stock of the inventory of existing policies in a region, for the purposes of assessing the readiness or attractiveness of a region for mobility data sharing initiatives and identifying areas of policy strengths and gaps.

The effects of the pandemic on mobility and the global economic recovery effort present an opportunity to bring the ambitious vision of sustainable urban mobility to life and create social, economic, and environmental value for all. Thoughtful data sharing policies and strategies as well as strong partnerships and collaboration are essential across public, private and civil society stakeholders in the mobility sector.

“Having the right data is the only way for effective public decision making in Medellín. An accelerated transition toward sustainable urban transport systems, and the governance schemes to facilitate these systems, depend on open-data and innovative cross regional data sharing initiatives. Thus, the invaluable contribution that the most recent #Sum4All report provides.”

- Carlos Cadena-Gaitán Ph.D.
Transport Secretary, City of Medellín

Call to action

- **Embrace a collaborative approach for data sharing between diverse stakeholders:** Collaboration between policy makers, governments, citizens and civil-society members, businesses, and academia will help define a common vision for sustainable urban mobility and how data sharing is expected to deliver these objectives. Engagement of citizens and civil society members is particularly important to design policies that effectively weigh value and risk of data sharing, and to foster long-term trust in data sharing ecosystems. Corollary to these requirements are the principles of purpose specification and data minimization, which suggest the minimum amount of data be collected toward explicitly stated purposes with the appropriate consent from parties that generate data. This is especially valid for B2G data transfer for regulation or planning purposes and data from individual citizens.
- **Commit to shared value across stakeholders to enable and accelerate data sharing:** Data sharing for a common vision leads to the creation of social, environmental, and economic value that may be shared among the different stakeholders. Policy makers can help create a fair and competitive data sharing ecosystem by considering the interests and capacities of each stakeholder, providing financial and non financial resources for parties such as small- and medium-sized enterprises or cities with fewer resources. Universally mandated data sharing that place an undue cost burden on small- and medium-sized enterprises may be counter to the vision for increased data sharing and commitment to shared value.

- **Prioritize skill development and capacity building to increase competitiveness:** Highly skilled public sector labor can significantly improve a government’s abilities to harness data for public good, and effectively guide and regulate data sharing ecosystems. Similarly, a local talent pool is vital for local economic development. Governments should prioritize skills development in areas such as artificial intelligence, machine learning, and cloud computing. National policies, for example, should also account for disparate level of capacity at the local level, and provide incentives to local governments to address any knowledge gaps to ensure successful implementation of national priorities. In some cases, this may mean collaborating with local academic organizations, businesses or nonprofits that may have required technical skills.
- **Seek harmonization across jurisdictions while allowing for customization based on the local context:** Data Sharing models are often more effective when tailored to the local mobility system. While some policies such as privacy laws are best implemented at a national level, regulatory sandboxes are necessary at the local level to achieve targeted objectives. Scaling and replication of data sharing models at a national and international level is facilitated by overarching architecture and harmonized data sharing approaches that break down interorganization—for example, intergovernmental or interdepartmental—silos and improve interoperability and cost efficiency in areas such as data sharing agreements, digital tools and platforms, and policy-making processes.
- **Establish trust frameworks as a foundation for implementation of multistakeholder data sharing:** Trust frameworks should include a set of standardized legal and contractual agreements for a given policy context, support collaboration between stakeholders and ensure that data sharing adheres with the common vision. Developed by public, private, or third-party stakeholders, these frameworks ensure individual privacy rights, representative and equitable governance structures, safeguards against abuses of power or authority, ethical use of data along with well-defined rights and responsibilities for data sharing parties and oversight authorities. In this regard, governments, through rulemaking processes should address common biases that may result in inequitable outcomes along gender, race, or age differences. Last, government intervention using suitable trust frameworks can enable greater crosssectoral collaboration.
- **Embrace iterative, incremental, and adaptive policy-making processes:** First, data sharing models and mobility systems are continuously evolving, and policies need to move in lockstep with these business and technology innovations. Demonstration projects, iterative experimentation, fast-failure approaches and regulatory sandboxes will help create continuous and proactive learning. Second, while this policy framework offers a global policy framework, local policy-making needs are highly contextual. Policy makers must adapt and customize data sharing policies based on the mobility and economic vision of that region, likely encapsulated in its mobility plans, and its mobility systems characteristics, regulatory environment, and digital maturity levels. Starting small with a focus on the understanding of the types of data and means to access and process it, can be a recipe for long-term success.

“Before MoviLab Bogota facilitates innovation, collective intelligence and go-to-market strategies accelerating technology-enabled solutions to make Bogota’s mobility inclusive, healthy and sustainable. With it we can promote best practices and continued learning through new perspectives in close work with the private sector, academia and citizens groups.”

-Nicolás Estupiñán
Secretario de Movilidad de Bogotá

Appendixes

Appendix A:

Terms and Definitions

Application Programming Interface (API): A software intermediary that allows for distinct applications or systems to interact with one another.

<https://amsterdamstandard.com/nl/post/api-definition-types-and-business-cases>

Data Consumer: Person who uses data for a specific purpose and can be affected by its quality.

<https://www.igi-global.com/dictionary/data-quality-model-web-portals/6704>

Data Discoverability: The ability to find suitable datasets for a specific purpose.

<https://opendatahandbook.org/glossary/en/>

Data Governance: Data governance defines roles, responsibilities, and processes for ensuring accountability for and ownership of data assets across the enterprise.

<https://www.cio.com/article/3521011/what-is-data-governance-a-best-practices-framework-for-managing-data-assets.html>

Data Infrastructure: Consists of

- 1) Data assets, such as datasets.
- 2) Standards and technologies used to curate and provide access to data assets.
- 3) Guidance and policies that inform the use and management of data assets and the data infrastructure itself.
- 4) Organizations that govern the data infrastructure.
- 5) Communities involved in contributing to or maintaining it, and those who are impacted by decisions that are made using it.

<https://www.stateofopendata.od4d.net/chapters/issues/data-infrastructure.html>

Data License: The agreed legal framework for data exchange between two or more parties, the permitted use of datasets for a project, the access term for those datasets and associated commercials.

<https://help.datarepublic.com/en/articles/1984642-what-is-a-data-license#:~:text=A%20Data%20License%20makes%20reference,those%20datasets%20and%20associated%20commercials.>

Data Portal: A software solution (usually a website) that presents a catalogue of searchable and downloadable datasets in a user-friendly and uniform way.

https://www.europeandataportal.eu/sites/default/files/european_data_portal_-_open_data_goldbook.pdf

Data Provider: Creators, licensees or sellers of data.

<https://www2.imda.gov.sg/-/media/Imda/Files/Programme/AI-Data-Innovation/Trusted-Data-Sharing-Framework.pdf?la=en>

Data Quality: A measure of the useableness of data. An ideal dataset is accurate, complete, timely, relevant, consistent, machine-readable, conforms to standards of nomenclature, and is published with sufficient metadata so that users can easily understand the content and context of the dataset.

<https://opendatahandbook.org/glossary/en/>

Data Service Provider: Organizations providing data services that support the data sharing ecosystem such as:

- 1) providing technical means (e.g., platform) to facilitate data exchange
- 2) data preparation, data management and technical/ risk/ governance advisory
- 3) acquiring data from providers and supplying data to data consumers

<https://www.imda.gov.sg/-/media/Imda/Files/Programme/AI-Data-Innovation/Trusted-Data-Sharing-Framework.pdf>

Data Sharing: While there is no universally accepted definition, data sharing is broadly understood to be the collection of practices, technologies, cultural elements and legal frameworks that are relevant to transactions in any kind of information digitally, between different kinds of organisations.

<https://eudatasharing.eu/what-data-sharing>

Data Sharing Agreement: An interorganizational or intraorganizational agreement to share data according to certain terms and conditions. Data Sharing agreements may include such parameters as for the collection, transmission, storage, security, analysis, re-use, archiving, and destruction of data.

<https://uwaterloo.ca/research/office-research-ethics/research-human-participants/pre-submission-and-training/human-research-guidelines-and-policies-alphabetical-list/data-sharing-or-transfer-agreements-what-are-they-and-when#agreement>

Data Standard: Data standards are documented agreements on representation, format, definition, structuring, tagging, transmission, manipulation, use, and management of common data.

<https://www.ga.gov.au/data-pubs/datastandards>

Data Subject: The identified or identifiable individual to whom personal data relates.

<https://ico.org.uk/for-organisations/data-protection-fee/legal-definitions-fees/#subject>

Data Trust: A legal structure that provides independent stewardship of some data for the benefit of a group of organizations or people. The trustors grant some of the rights they have to control the data to a set of trustees, who then make decisions about the data, such as who has access to it and for what purposes. The beneficiaries of the data trust include those who are provided with access to the data (such as researchers and developers) and the people who benefit from what they create from the data.

<https://theodi.org/article/defining-a-data-trust/#:-:text=A%20data%20trust%20takes%20the,and%20applies%20it%20to%20data&text=A%20data%20trust%20takes%20this,group%20of%20organisations%20or%20people.>

Distributed ledger technology: Use of independent computers (referred to as nodes) to record, share and synchronize transactions in their respective electronic ledgers (instead of keeping data centralized as in a traditional ledger).

<https://www.worldbank.org/en/topic/financialsector/brief/blockchain-dlt>

Interoperability: The ability of different information technology systems and software applications to communicate, exchange data, and use the information that has been exchanged.

https://www.europeandataportal.eu/sites/default/files/european_data_portal_-_open_data_goldbook.pdf

Mobility as a Service (MaaS): MaaS is the integration of various forms of transport services into a single mobility service accessible on demand. To meet a customer's request, a MaaS operator facilitates a diverse menu of transport options, be they public transport, ride-, car- or bike-sharing, taxi or car rental/lease, walking or a combination thereof. For the user, MaaS can offer added value through use of a single application to provide access to mobility, with a single payment channel instead of multiple ticketing and payment operations. For its users, MaaS should be the best value proposition, by helping them meet their mobility needs and solve the inconvenient parts of individual journeys as well as the entire system of mobility services. A successful MaaS service also brings new business models and ways to organize and operate the various transport options, with advantages for transport operators including access to improved user and demand information and new opportunities to serve unmet demand. The aim of MaaS is to provide an alternative to the use of the private car that may be as convenient, more sustainable, help reduce congestion and constraints in transport capacity, and can be even cheaper.

Metadata: Data about data.

https://www.europeandataportal.eu/sites/default/files/european_data_portal_-_open_data_goldbook.pdf

Micromobility: A range of small, lightweight transportation devices operating at speeds typically below 25 km/h and is ideal for trips up to 10 km.^a The device itself has a gross weight less than 500 kg.^b

Notes:

a. <https://www.itdp.org/multimedia/defining-micromobility/>

b. <https://www.intelligent-mobility-xperience.com/what-micromobility-is-and-how-it-is-shaking-up-urban-transportation-worldwide-a-903875/>

Mobility Data: Data generated by activity, events, or transactions using digitally-enabled mobility devices or services. This data most commonly contains geospatial and temporal information.

https://nacto.org/wp-content/uploads/2019/05/NACTO_IMLA_Managing-Mobility-Data.pdf

Open Data: Data that is freely accessible to everyone, can be manipulated, re-used and redistributed by anyone, for any purpose.^a

Specifically, data are required to be

- 1) Legally open: that is, available under an open (data) license that permits anyone freely to access, reuse and redistribute

- 2) Technically open: that is, that the data be available for no more than the cost of reproduction and in machine-readable and bulk form.^b

Notes:

- a. <https://opendatahandbook.org/guide/en/what-is-open-data/>
b. <https://opendatahandbook.org/glossary/en/terms/open-data/#:~:text=Legally%20open%3A%20that%20is%2C%20available,machine%2Dreadable%20and%20bulk%20form>

Personal Data: Any information that can be used to directly, or indirectly, to identify a specific person.

<https://infotrust.com/articles/pii-personal-data-personal-information-whats-so-personal-about-it-anyway/>

Policy Layer: There are 5 interdependent and complementary policy layers contained in the policy framework presented in this report. Each layer defines an area of policy intervention corresponding to data flow in a data sharing collaborative: 1) Data Collection and Merging, 2) Data Standards, 3) Data Infrastructure, 4) Governance and Accountability, and 5) Use and Analysis.

Policy Element: There are 9 elements for policy intervention contained in the policy framework presented in this report. The policy elements are embedded within the 5 policy framework layers and discuss the role of policy making for each corresponding layer. For example, the two policy elements within the Data Collection and Merging layer are Privacy and Data Protection and Merging Datasets.

Sustainable Mobility: Mobility systems defined by 4 conditions

- i. Universal access: Ensure for all equitable access to economic and social opportunities
- ii. Efficiency: Increase the efficiency of transport systems
- iii. Safety: Improve safety of mobility across transport modes
- iv. Green: Shift transport systems to low polluting (GHG/air/noise) and climate resilient path

<https://www.icao.int/Meetings/iwaf2018/Documents/Global%20Mobility%20Report2017.pdf>

Transportation Service Provider: Any party, person, agent, or carrier that provides freight, household goods, or passenger transportation or related services.

[https://www.law.cornell.edu/definitions/index.php?width=840&height=800&iframe=true&def_id=87e514699c7fecda45abca189ac71e2d&term_occur=1&term_src=Title:41:Subtitle:C:Chapter:102:Subchapter:D:Part:102-118:Subpart:C:Subjgrp:571:102-118.195#:~:text=Transportation%20service%20provider%20\(TSP\)%20means,related%20services%20to%20an%20agency.](https://www.law.cornell.edu/definitions/index.php?width=840&height=800&iframe=true&def_id=87e514699c7fecda45abca189ac71e2d&term_occur=1&term_src=Title:41:Subtitle:C:Chapter:102:Subchapter:D:Part:102-118:Subpart:C:Subjgrp:571:102-118.195#:~:text=Transportation%20service%20provider%20(TSP)%20means,related%20services%20to%20an%20agency.)

Urban Mobility: Movement from one point in a city to another by the inhabitants of a city, and the methods and conditions associated with such trips.

<https://www.igi-global.com/dictionary/urban-informatics-china/31097>

Appendix B: Detailed Policy Suggestions

The policy suggestions presented in Chapter 3: Good Practices and Policy Suggestions are described in detail in this appendix. Each policy suggestion includes additional information on the four following dimensions that support policy makers in assessing to what extent and how best to adopt the policy suggestions in their local jurisdictions.

- Actors: The main actors driving the adoption of the policy
- Impact: The potential impacts of the policy on the data sharing ecosystem
- Sample policies: Select policies that illustrate how the policy has been practically adopted
- Enablers: External enablers that have facilitated the adoption of the policy

Index of Appendix 2	
Policy Suggestions: Data Collection and Merging - Privacy and Data Protection.....	50
Policy Suggestions: Data Standards - Standards Development	52
Policy Suggestions: Data Standards - Standard Adoption	54
Policy Suggestions: Standard Adoption.....	55
Policy Suggestions: Data Infrastructure - Financing Infrastructure Investments	56
Policy Suggestions: Governance and Accountability - Control Over Data	57
Policy Suggestions: Governance and Accountability - Structure of the Governing Body.....	59
Policy Suggestions: Use and Analysis - Data Access	62
Policy Suggestions: Use and Analysis - Ethical Use and Processing.....	64

Policy Suggestions: Data Collection and Merging - Privacy and Data Protection

Policy Suggestion	Actors	Impact
Public outreach, education, and awareness initiatives - Implement public outreach, education, and awareness plans and initiatives to build privacy and digital literacy, and increase participation in data-sharing initiatives among relevant stakeholders.	<ul style="list-style-type: none"> Privacy regulators 	<ul style="list-style-type: none"> Reduces risk of potential harms from privacy violations by equipping the general population including high-risk groups such as youth and elders, with fundamental data privacy awareness. Increases public participation and buy-in for data sharing initiatives through open and transparent communications.
Civil and criminal liabilities and penalties - Define civil and/or criminal liabilities and penalties for violators of privacy and data protection laws.	<ul style="list-style-type: none"> National government 	<ul style="list-style-type: none"> Creates a credible deterrent and enforcement mechanism for violations of privacy and data protection laws.
Privacy and data protection authority - Establish a national privacy and data protection authority to liaise with relevant stakeholders, support compliance with privacy laws, proactively audit and investigate violations, impose fines and sanctions, and manage public outreach.	<ul style="list-style-type: none"> National government Privacy regulators 	<ul style="list-style-type: none"> Allocates dedicated resources to implement and provide oversight on data privacy and protection policies Recognizes that regulators need to be proactive in protecting privacy rights, as individuals cannot reasonably shoulder this burden alone.
Privacy impact assessments (PIAs)- Develop a framework for privacy impact assessments and mandate its use within organizations where relevant.	<ul style="list-style-type: none"> National and regional government Privacy regulators Organizations handling personal mobility data 	<ul style="list-style-type: none"> Provides guidance on how to reliably and consistently classify, evaluate, and mitigate privacy risks. Ensures privacy risks are addressed throughout the lifecycle of a data sharing initiative.
Comprehensive national data privacy law - Establish a comprehensive national data privacy law that, among many functions, defines and protects data privacy rights, incorporates privacy by design principles, and establishes supporting roles and responsibilities at a national, regional, or organizational level.	<ul style="list-style-type: none"> National government 	<ul style="list-style-type: none"> Creates a baseline of protection and trust to facilitate sharing of personal data and increase willingness of individuals to share data. Establishes a clear legal framework to guide the operational processes related to personal data within companies and other organizations. Requires the creation of roles such as Chief Privacy Officers or Data Protection Officers to support the implementation of data privacy and protection policies.
Personal data sharing tool for individuals -Encourage technology platforms to allow individuals to access and contribute to a global layer of interoperable data. Such a tool may also be used to provide consent for personal data sharing.	<ul style="list-style-type: none"> National and regional government Data Sharing initiatives 	<ul style="list-style-type: none"> Ensures the data subject is in constant control of their personal data, through the use of an empowering human-centered personal data management model. Allows individuals to access and contribute to a global layer of personal data for cross border and cross-sectoral sharing.

Notes:

- <https://www.priv.gc.ca/en/about-the-opc/what-we-do/awareness-campaigns-and-events/>
- [https://ca.practicallaw.thomsonreuters.com/5-518-8056?transitionType=Default&contextData=\(sc.Default\)&firstPage=true](https://ca.practicallaw.thomsonreuters.com/5-518-8056?transitionType=Default&contextData=(sc.Default)&firstPage=true)
- https://www.cpuc.ca.gov/uploadedFiles/CPUC_Public_Website/Content/About_Us/Organization/Divisions/Policy_and_Planning/PPD_Work/Pre_2013_PPD_Work/BigData.pdf
- <https://gdpr.eu/what-is-gdpr/>
- https://edps.europa.eu/data-protection/our-work/subjects/rights-individual_en

Example Policies	Enablers
<ul style="list-style-type: none"> The Privacy Commissioner of Canada leads a variety of public awareness campaigns and event including education for kids and seniors.^a 	<ul style="list-style-type: none"> Dedicated public organization and resources to protect and promote privacy rights of individuals.
<ul style="list-style-type: none"> The Brazil LGPD defines sanctions ranging from warnings to fines to deletion of the personal data to which the infraction refers to. The Mexican National Institute for Access to Information and Protection of Personal Data punishes violations with warnings, fines, and imprisonment.^b The California Public Utilities Commission has adopted privacy rules that provides customers the right to share their utility data but releases the utility company from any liability due to a security breach at the third party.^c 	<ul style="list-style-type: none"> Strong judicial system
<ul style="list-style-type: none"> Examples of privacy and data protection authorities include European Data Protection Board, Ireland Data Protection Commissioner, UK Information Commissioner's Office, and Singapore Personal Data Protection Commission. 	<ul style="list-style-type: none"> Strong centralized coordination Trusted legal institutions Access to privacy expertise
<ul style="list-style-type: none"> The EU GDPR requires a Data Protection Impact Assessment (DPIA) at the beginning of any project that is high-risk in terms of data security and privacy. The GDPR provides an outline of the elements required in a DPIA. 	<ul style="list-style-type: none"> Access to talent pool with privacy expertise Sufficient budget and resources, especially within smaller organizations
<ul style="list-style-type: none"> The EU General Data Protection Regulation (GDPR) is arguably the toughest privacy law in the world, comprising of 7 data protection principles, requirements on accountability, data security, and consent, and personal privacy rights.^d The EU GDPR outlines 8 data subject rights, one of which is data portability.^e The California Consumer Privacy Act (CCPA) establishes privacy rights for California consumers by enabling more individual control over the personal information collected by businesses. Consumers can request that their personal data be deleted or opt-out from the sale of their personal information.^f In November 2020, California voters adopted a new privacy law the California Privacy Rights Act (CPRA), which will replace CCPA and enter into force in January 2023.^g 	<ul style="list-style-type: none"> Strong national government role Trusted legal and judicial institutions
<ul style="list-style-type: none"> The European Data Strategy has recognized the MyData movement as a promising means to empower individuals to exercise their rights.^h Dutch municipalities and national government organizations collaborated to create The Blue Button, a platform which consolidates personal financial information from across government organizations. The Blue Button allows individuals to more easily apply for debt relief, with a complete set of data ready to be shared with the individual's consent. The Blue Button is a project under the MyData Initiative.ⁱ An example of a personal data portability tool is Onecub. It allows individuals to maintain control over their own data by requiring explicit consent for each data transfer. This French startup was launched in 2011.^j 	<ul style="list-style-type: none"> Strong technical capabilities High levels of trust in central data management platform

f. <https://oag.ca.gov/privacy/ccpa>

g. <https://fpf.org/2020/11/04/californias-prop-24-the-california-privacy-rights-act-passed-whats-next/>

h. <https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:52020DC0066&from=EN>

i. https://docs.google.com/presentation/d/1CxypSOvGRIW2EzD10fmixDuqTfqAcDSyt3ul15WmeTQ/edit#slide=id.g6d123e1161_2_1

j. <https://www.onecub.com/About>

International synchronization

Across the EU, there is a convergence of data privacy regulation reflecting the region's ambition for a more competitive and integrated market. This is advantageous for multinational mobility companies, as it reduces the administrative and operational burden of complying with piecemeal regulations. Countries with less developed privacy policies may also adopt leading privacy policies from other model countries, resulting in greater harmonization across geographies.

Resources for organizations:

- [NIST Privacy Framework](#) is a voluntary tool developed in collaboration with stakeholders intended to help organizations identify and manage privacy risk to build innovative products and services while protecting individuals' privacy.
- [NIST's Privacy Engineering Collaboration Space](#) is an online venue open to the public where practitioners can discover, share, discuss, and improve upon open source tools, solutions, and processes that support privacy engineering and risk management.

Resources for policy makers:

- [A Comparative Analysis of Privacy Impact Assessment in Six Countries](#) provides an overview of leading PIA policies in 6 countries – Australia, Canada, Ireland, New Zealand, UK, and US. Although this paper was published pre-GDPR, the Privacy Impact Assessment (PIA) best practices presented therein remain applicable today.

Policy Suggestions: Data Standards - Standards Development

Policy Suggestion	Actors	Impact	Example Policies	Enablers
<p><i>Financial and technical support programs</i> - Establish programs to provide financial and technical support for organizations to launch and participate in data-sharing initiatives.</p>	<ul style="list-style-type: none"> • National and regional government • Local economic development agencies and funding bodies 	<ul style="list-style-type: none"> • Enables smaller organizations to remain competitive and drive innovation. • Elevates data capabilities broadly across the mobility market. • Increases volume of mobility data shared and allows targeting funding of most relevant use cases. 	<ul style="list-style-type: none"> • The Smart Mobility Finland program, run by Business Finland, has a 50 million euro fund to support Finnish companies in developing disruptive mobility services and traffic systems through adoption of data usage and sharing.^a • The UK Geospatial Commission's Data Discoverability project aims to make it easier to find data from different organizations, supporting the creation of new insight and innovation.^b • Innovation challenges and other programs are a popular way to incentivize data sharing, such as the Japanese government's Smart Mobility Challenge in 2019.^c 	<ul style="list-style-type: none"> • Availability of talent and skills to develop innovative data sharing models • Organizational capacity and resources to participate in data sharing initiatives

Policy Suggestions: Data Standards - Standards Development

Policy Suggestion	Actors	Impact	Example Policies	Enablers
<i>Common data platforms</i> - Build data management platform(s) at the regional and national levels where suitable to enable sustainable mobility use cases.	<ul style="list-style-type: none"> National and regional government Technology service providers 	<ul style="list-style-type: none"> Invests in common technology infrastructure for data sharing that benefits the public. 	<ul style="list-style-type: none"> The city of Lyon in France had built the Grand Lyon Smart Data open data platform in 2013. It is now the most comprehensive set of open data in France, and possibly in Europe.^d 	<ul style="list-style-type: none"> High digital maturity Resources to invest in the common data platform
<i>Mandate open data</i> - Identify critical datasets for sustainable mobility use cases and mandate these critical datasets to be open data	<ul style="list-style-type: none"> National and regional government Public and private data providers 	<ul style="list-style-type: none"> Ensures availability of critical and priority datasets. Resolves stalemate situations where data providers are unwilling to voluntarily share data. 	<ul style="list-style-type: none"> The Finland Act on Transport Services requires all transport providers to provide access via open APIs to data on timetables, routes, ticket prices as well as real-time location data.^e The UK National Information Infrastructure will prioritize the release of government data that is likely to have the most significant economic and social impact.^f The French Mobility Orientation Law (LOM) requires transport authorities to provide open data on all transport modes.^g 	<ul style="list-style-type: none"> Collaboration between national and subnational governments to prioritize available datasets Strong privacy safeguards Feasibility for organizations large and small to provide the required open data
<i>Mandate data sharing</i> Require mobility operators to share mobility data with external parties, for example, with regulators to receive their license to operate or to receive public funding.	<ul style="list-style-type: none"> National and regional government Mobility operators 	<ul style="list-style-type: none"> Ensures availability of important operational datasets for the development of sustainable mobility use cases. Allows regulators to plan and manage the mobility system in their own jurisdiction. 	<ul style="list-style-type: none"> Los Angeles requires micromobility companies to share real-time trip data using the Mobility Data Specification.^h The UK Department for Business, Energy, and Industrial Strategy has indicated an intention to mandate industry involvement in Smart Data initiatives in sectors such as transport.ⁱ Transport for London publishes extensive open public data.^j 	<ul style="list-style-type: none"> Government's authority over mobility operators Sufficient digital resources within mobility operators, especially smaller organizations, to comply with data sharing requirements Strong privacy safeguards

Notes:

- <https://www.businessfinland.fi/en/for-finnish-customers/services/programs/smart-mobility-finland/>
- <https://ukhodigital.blog.gov.uk/2018/11/23/data-discoverability-improving-access-to-uk-geospatial-data/#::-:text=The%20aim%20of%20the%20Data,the%20end%20of%20January%202019>
- https://www.meti.go.jp/english/press/2019/0618_005.html
- https://cerre.eu/wp-content/uploads/2020/05/cerre_report_shared_mobility_maas.pdf
- <https://www.europeandataportal.eu/en/news/smart-mobility-finland#::-:text=The%20Finnish%20Government%20recently%20passed,as%20real%20time%20location%20data>
- <http://theodi.org/wp-content/uploads/2019/12/266889068-Who-Owns-Our-Data-Infrastructure-1.pdf>
- <https://futuramobility.org/fr/parlons-lom-loi-dorientation-des-mobilites/>
- <https://ladot.lacity.org/projects/transportation-services/shared-mobility/micromobility>
- https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/915973/smart-data-consultation-response.pdf
- <https://tfl.gov.uk/info-for/open-data-users/>

Case Study: Development Data Partnership

The Development Data Partnership is a platform that enables secure, efficient, and effective data sharing within development projects. The platform was launched by the World Bank in 2018, with more than 130 projects under implementation.

The platform provides end-to-end support, offering data license templates, centralized and secure IT architecture, data governance principles, multidisciplinary expert teams, and data partnership management. The platform aims to facilitate use of proprietary datasets to improve public sector services and infrastructure in emerging economies. (<https://datapartnership.org/>)

Policy Suggestions: Data Standards - Standard Adoption

Policy Suggestion	Actors	Impact	Example Policies	Enablers
<p><i>Common and Standardized APIs -</i></p> <p>Encourage use of APIs to share data, through the development of standard APIs and standardization guidelines</p>	<ul style="list-style-type: none"> National and regional government Technical Developers Mobility service providers 	<ul style="list-style-type: none"> Increases interoperability because of the ability to easily integrate between systems, at a relatively low cost. Lowers entry barriers for small companies or operators, especially if open APIs are used. 	<ul style="list-style-type: none"> TOMP-API defines the open-source standard business data interface between MaaS platforms and transport operators. It was developed in the Netherlands by public and private actors and will be adopted by the Benelux and Switzerland.^a The Government of Canada has published standards on how APIs should be developed across government organizations.^b 	<ul style="list-style-type: none"> Foundational technical and developer capabilities Collaboration with diverse stakeholders to understand business and technical requirements
<p><i>Data and metadata standard development</i></p> <p>Develop a data or metadata standard where needed based on the local context and sustainability mobility policy objectives, utilizing a transparent and inclusive process and leveraging existing data standards where possible.</p>	<ul style="list-style-type: none"> National and regional government Data Sharing stakeholders 	<ul style="list-style-type: none"> Creates a valuable, use-case driven data standard where there otherwise would be none. 	<ul style="list-style-type: none"> The Los Angeles Department of Transportation developed MDS to govern and regulate micromobility within the city.^c The Coordinated Metadata Catalogue, developed by EU partners, defines a common, minimum metadata set to describe the data within EU National Access Points.^d 	<ul style="list-style-type: none"> Access to top talent and experts to inform standard development Collaboration with diverse stakeholders including standard-setting bodies, private companies, and nonprofit organizations Balance between local standards for increased flexibility and global standards that enable scalability

Notes:

- a. <https://tomp-wg.org/>
- b. <https://www.canada.ca/en/government/system/digital-government/modern-emerging-technologies/government-canada-standards-apis.html>
- c. <https://ladot.lacity.org/projects/transportation-services/shared-mobility/micromobility>
- d. <https://eip.its-platform.eu/highlights/harmonised-metadata-national-access-points>

Policy Suggestions: Standard Adoption

Policy Suggestion	Actors	Impact	Example Policies	Enablers
<p><i>Guidance on common standards</i> - Provide guidance on acceptable and common industry data standards, accepting multiple data standards to accommodate data from different sources and sectors.</p>	<ul style="list-style-type: none"> National and regional government Nonprofits, consortiums and industry alliances 	<ul style="list-style-type: none"> Encourages data providers to voluntarily adopt data standards. Avoids restricting available data based on data standard requirements. Allows gradual harmonizing of standards over time. 	<ul style="list-style-type: none"> The Swiss Federal Roads Authority's Open data platform for mobility allows data providers to use any available or relevant data standards such as common industry standards or international standards. The UK Department of Transport provides guidance on TransXChange, a national de facto standard for bus data.^a CHOUETTE is an open-source software financed by the French Ministry of Ecology, Sustainable Development, Transport and Housing. It serves to capture and exchange data to facilitate the development of multimodal traveler information systems. Multiple data standards are supported: NeTEX, NEPTUNE, and GTFS.^b The European Committee for Standardization has developed several data standards such as NeTEX, the Standard Interface for Real-time Information (SIRI)^c and Datex2, with the aim of harmonizing standards across European countries.^d NeTEX and SIRI have also been identified as the desired standards for the National Access Points of EU member countries.^e 	<ul style="list-style-type: none"> Collaboration between various government organizations to identify acceptable standards
<p><i>Mandate data standards</i> - Require data and metadata standards where appropriate to realize sustainable mobility policy objectives, leveraging open standards or APIs where possible and following a phased adoption approach to enable organizations of all sizes and capacities to comply with the mandated standard.</p>	<ul style="list-style-type: none"> Regional and national government 	<ul style="list-style-type: none"> Accelerates interoperability of data shared from various sources. Increases competition by reducing differentiation between disparate datasets. 	<ul style="list-style-type: none"> The Los Angeles Dockless Mobility Pilot Program, launched in 2019, required the adoption of the MDS standard for licensed micromobility operators. MDS is currently an open standard.^f The Work Zone Data Exchange (WZDx) specification is a data standard for infrastructure owners and operators to make work zone data available for third party use. Data on road conditions, such as construction events, can help drivers and automated driving systems navigate safely and efficiently. This specification is still in the development and uptake phase. So far, the Texas Department of Transportation is the first location to implement this specification, reporting lane closures statewide through a single feed.^g 	<ul style="list-style-type: none"> Strong government role High digital maturity and resources within organizations adopting the data standard

Notes:

- https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/313471/1-1_Overview.pdf
- <http://www.transmodel-cen.eu/category/implementations/page/2/>
- <http://www.transmodel-cen.eu/category/standards/>
- http://netex-cen.eu/?page_id=11
- https://inspire.ec.europa.eu/sites/default/files/presentations/0900_insp-mm2018_antwerpen_v5.pdf
- <https://ladot.lacity.org/sites/default/files/documents/ladot-dockless-year-one-report.pdf>
- <https://www.transportation.gov/av/data/wzdx>

Policy Suggestions: Data Infrastructure - Financing Infrastructure Investments

Policy Suggestion	Actors	Impact	Example Policies	Enablers
<p><i>Attractive investment environment</i> -</p> <p>Develop an attractive investment environment to facilitate private financing in communications infrastructure, such as through the use of financial and non financial incentives and structures (e.g., public-private partnerships).</p>	<ul style="list-style-type: none"> National and regional government 	<ul style="list-style-type: none"> Increases amount of funding for communications infrastructure relative to public funds alone. Accelerates private investment, innovation, and competition in the market. 	<ul style="list-style-type: none"> In 2015, the UK Digital Communications Infrastructure Strategy confirmed the government's role to facilitate private investment in UK infrastructure, provide policy stability, and support the market through a favorable, competitive climate for companies.^a 	<ul style="list-style-type: none"> Ability of government to manage private investors to maintain a fair market and safeguard public interest Effective structure of legal and economic ownership for public-private partnerships
<p><i>Budget for communications infrastructure</i> -</p> <p>Allocate funding for critical communications infrastructure development in government budgets to supplement funding from other sources.</p>	<ul style="list-style-type: none"> National and regional governments 	<ul style="list-style-type: none"> Develops the necessary communications infrastructure to enable mobility data use cases. Provides a critical public resource to boost economic growth. 	<ul style="list-style-type: none"> Canada's 2018 federal budget allocated funding to data-driven technologies including C\$1.3 billion over five years for investments in laboratories and infrastructure for big data.^b Canada's Growth Plan for Northern Ontario specifies the need for investments in ICT infrastructure.^c To achieve Singapore's goal of equipping lampposts in the country with sensors and cameras, the government issued a tender. Singapore Technologies Engineering was awarded a SGD 7.5 million contract to implement a trial.^d 	<ul style="list-style-type: none"> Availability of government funding and political will Acceptable costs for the public sector, with accurate lifecycle costing and efficient tendering process

Notes:

- <https://www.gov.uk/government/publications/the-digital-communications-infrastructure-strategy/the-digital-communications-infrastructure-strategy>
- <https://www.mccarthy.ca/en/insights/blogs/snippets/2018-federal-budget-focus-data-and-data-driven-technologies>
- <https://www.ontario.ca/document/growth-plan-northern-ontario/infrastructure#section-4>
- <https://news.trust.org/item/20181013050142-yhfy9/>

Policy Suggestions: Governance and Accountability - Control Over Data

Policy Suggestion	Actors	Impact	Example Policies	Enablers
<p><i>Experimentation of new control models</i> - Explore new control models through methods such as developing and funding pilot projects for innovative control models (e.g., data trusts and data collectives) or establishing or identifying preferred institutions to govern new data control structures.</p>	<ul style="list-style-type: none"> National and regional governments Nonprofits and academia Third party service providers 	<ul style="list-style-type: none"> Address gaps in the market for innovative data control structures to enable greater trust and control among diverse stakeholders. 	<ul style="list-style-type: none"> In 2018, the Office for Artificial Intelligence and Innovate UK worked with the Open Data Institute to pilot data trusts. In one pilot, use cases related to sharing parking data were tested.^a An example initiative is BrightHive Data Trust, which provides a legal, governance, and technical framework that empowers networks of organizations to securely connect their data sources and create new, shared data resources.^b An example of a data collaborative is Driver's Seat, a gig driver-owned cooperative that collects data from its members who are on-demand drivers. The cooperative analyses the data, then sells it to city agencies. Profits from data sales are then distributed as dividends to members.^c 	<ul style="list-style-type: none"> Access to transport, data, legal, and privacy expertise
<p><i>Antitrust regulation</i> - Examine requirement for entities to serve limited roles in the supply chain, in accordance with local antitrust laws.</p>	<ul style="list-style-type: none"> National government 	<ul style="list-style-type: none"> Limits anticompetitive behavior and reduces conflicts of interest. 	<ul style="list-style-type: none"> In 2020, the US House Judiciary Committee released an antitrust report that presents policy recommendations, which include structural separation and restrictions on which lines of business companies could operate in.^d 	<ul style="list-style-type: none"> Strong regulatory and legal structures
<p><i>IP laws</i> - Examine existing intellectual property laws and regulations concerning new algorithms and business models for data use to avoid unreasonable IP barriers to data sharing.</p>	<ul style="list-style-type: none"> National government 	<ul style="list-style-type: none"> Fosters competition and innovation in the mobility market. 	<ul style="list-style-type: none"> An example patent is an invention for traffic prediction using real-world transportation data.^e Some business models or algorithms may not be patentable if consisting of generic ideas or broad business models. 	<ul style="list-style-type: none"> Strong legal system with effective IP processes
<p><i>Data ownership and transfer rights</i> - Initiate multistakeholder discussions around data ownership rights, conditions for transfer of ownership, liabilities for misconduct, and limits of liabilities, in particular for co-created data such as Internet of Things data.^f</p>	<ul style="list-style-type: none"> Regional and national governments Mobility operators and service providers Civil society 	<ul style="list-style-type: none"> Clarifies rights to use data, providing a robust legal framework to facilitate data sharing. Encourages the creation of a global layer of interoperable consent for data sharing that will allow crossborder and crosssectoral data sharing. 	<ul style="list-style-type: none"> In 2018, the British Academy, techUK, and the Royal Society convened a seminar for public and private stakeholders to discuss the concept of data ownership.^g 	<ul style="list-style-type: none"> Collaboration between cross-functional stakeholders in the legal, technology, and privacy fields

Policy Suggestion	Actors	Impact	Example Policies	Enablers
<p>Responsibilities of data providers -</p> <p>Provide guidance on the responsibilities of data providers and data controllers toward the quality and traceability of their data such as their duty to provide information on the provenance and lineage of data as well as external disclosure requirements.</p>	<ul style="list-style-type: none"> National and regional governments 	<ul style="list-style-type: none"> Improves quality and trustworthiness of data. Encourages accountability and proactive action from data controllers within data sharing initiatives. 	<ul style="list-style-type: none"> In March 2018, Italy published the White Paper on Artificial Intelligence, which recommends that all data providers ensure the quality and usability of their own data.^h 	<ul style="list-style-type: none"> Access to sufficient resources and talent for data providers to implement these obligations

Notes:

- https://theodi.org/?post_type=article&p=7891
- <https://brighthive.io/#data-trust-description>
- <https://www.driversseat.co/>
- <https://www.documentcloud.org/documents/7222836-Investigation-of-Competition-in-Digital-Markets.html#document/p4>
- <https://patents.google.com/patent/US9996798B2/en?q=transportation+data&oq=transportation+data>
- https://www.acea.be/uploads/news_documents/20201007_Joint_Statement_-_Access_to_B2B_Data.pdf
- <https://royalsociety.org/-/media/policy/projects/data-governance/data-ownership-rights-and-controls-October-2018.pdf>
- <https://ia.italia.it/assets/whitepaper.pdf>

Policy Suggestions: Governance and Accountability - Structure of the Governing Body

Policy Suggestion	Actors	Impact	Example Policies	Enablers
<p><i>Clear vision and objectives -</i></p> <p>Publish clear policies on the government's vision and objectives around data sharing including details on what data are needed and how it is intended to be used where possible</p>	<ul style="list-style-type: none"> National and regional government 	<ul style="list-style-type: none"> Clarifies the data sharing vision and objectives and to the extent possible, aligns data requests to specific policy actions and public objectives Reduces resistance from data providers that believe regulators are asking for data that will not be used 	<ul style="list-style-type: none"> Canada's Digital Charter outlines 10 principles that guide the federal government's work, describing the building blocks of a foundation of trust for this digital age.^a The UK Department of Transport's Future of Mobility Urban Strategy outlines principles that will guide the government's response to emerging transport technologies and business models.^b 	<ul style="list-style-type: none"> Strong trust in government and regulators Clear understanding of what data are needed to achieve a specific policy objective and a specific use-case
<p><i>Delegation of oversight authorities -</i></p> <p>Clarify and assign division of oversight and enforcement authorities. Oversight authorities may include various ministry organizations as well as organizations responsible for antitrust and data protection functions.</p>	<ul style="list-style-type: none"> National government Oversight and enforcement authorities Competition and antitrust authorities 	<ul style="list-style-type: none"> Enhances operational efficiency and facilitates coordination between the public authorities involved in different capacities. 	<ul style="list-style-type: none"> An example of a government-led governance is the Open Mobility Foundation. Governed by 13 cities, the OMF is an open-source software foundation that creates a governance structure around open-source mobility tools, centered around the Mobility Data Specification (MDS). OMF provides a forum for stakeholders including municipalities, companies, technical, privacy, and policy experts, and the public to shape urban mobility management tools that help public agencies accomplish their mobility policy goals.^c 	<ul style="list-style-type: none"> Strong legal and judicial systems Collaboration between the various oversight and enforcement authorities
<p><i>Structured learning process -</i></p> <p>Adopt a structured process of learning and experimentation within the governing body and the broader organization to ensure adaptability to a changing mobility sector.</p>	<ul style="list-style-type: none"> National and regional government Data Sharing initiatives and their governing bodies 	<ul style="list-style-type: none"> Allows policy makers and data sharing initiatives to rapidly test, learn, and readjust policies in response to an evolving market. 	<ul style="list-style-type: none"> The Los Angeles Department of Transport's Dockless Mobility Pilot Program allowed the city's regulators to quickly understand the dynamics of an emerging market and adapt to the rapidly evolving industry. 	<ul style="list-style-type: none"> Adaptability in governance and regulatory processes Rapid innovations in the mobility market
<p><i>Public private partnerships -</i></p> <p>Create frameworks for public-private partnerships that allow mobility organizations and stakeholders to collaborate in governing local data sharing initiatives.</p>	<ul style="list-style-type: none"> National and regional government Mobility operators and service providers 	<ul style="list-style-type: none"> Engages public and private stakeholders to build trust and achieve joint accountability and decision making. Allows alignment of interests and perspectives of public and private stakeholders. 	<ul style="list-style-type: none"> In France, local public enterprises are flexible and responsive businesses, at the intersection of private and public sectors, that follow general interest and community values. Three different legal status are defined including institutionalized public-private partnerships.^d 	<ul style="list-style-type: none"> Robust legal frameworks Mobility system comprised of diverse public and private stakeholders

Policy Suggestion	Actors	Impact	Example Policies	Enablers
			<ul style="list-style-type: none"> • Kansas City Interactive and Connected Kiosks: In 2014, Cisco and Sprint approached Kansas City to propose installing public kiosks with free Wi-Fi along a downtown route to encourage greater foot traffic and reduce traffic congestion. Kansas City provided US\$3.7 million toward the overall cost of US\$16 million. Revenues from the kiosks are shared between the city, Cisco, Sprint, and the advertising manager Smart City Media.^e 	
<p><i>Clearinghouse for data sharing</i> - Establish an organization to serve as a clearinghouse, performing functions such as background checks, authentication, and quality control to enable and catalyze data sharing.</p>	<ul style="list-style-type: none"> • National and regional government • Designated clearinghouse organization, which could be a public, private, or nonprofit organization. 	<ul style="list-style-type: none"> • Creates a trusted, central clearinghouse that has independence and integrity. • Accelerates development of sustainable mobility use cases that require collaboration between a large group of stakeholders, such as MaaS. 	<ul style="list-style-type: none"> • The US Regional Transportation Data Clearinghouse organizes and presents open transportation data from various sources such as member jurisdictions, state agencies, and transit authorities.^f • In the Netherlands, blockchain was piloted as an innovative method to manage financially sensitive data and transactions for a MaaS platform.^g (see case study on the Netherlands in Appendix D). 	<ul style="list-style-type: none"> • High level of trust in third party clearinghouse • Strong governance structure and processes
<p><i>Harmonization of data sharing</i> - Designate a public organization to be responsible for functions such as converging data sharing best practices, building greater consistency and data interoperability across geographies, and collaborating with peer organizations globally to share knowledge and harmonize data sharing efforts.</p>	<ul style="list-style-type: none"> • National government 	<ul style="list-style-type: none"> • Allows data sharing initiatives to be governed holistically, leveraging best practices and resources not just nationwide but also supranationally. 	<ul style="list-style-type: none"> • The INSPIRE knowledge base, which is building infrastructure for spatial information in Europe, is coordinated by a team composed of the European Commission from DG Environment and the Joint Research Centre (JRC) and staff of the European Environmental Agency (EEA). Each member state needs to designate a Contact Point, usually a public authority.^h 	<ul style="list-style-type: none"> • Strong public authorities • Integrated mobility systems or mobility similarities or dependencies with other geographies

Notes:

- https://www.ic.gc.ca/eic/site/O62.nsf/eng/h_00109.html
- <https://www.gov.uk/government/publications/future-of-mobility-urban-strategy#:~:text=The%20'Future%20of%20mobility%3A%20urban,transport%20technologies%20and%20business%20model.>
- <https://www.openmobilityfoundation.org/resources/>
- <https://www.lesepl.fr/local-public-enterprises-in-france-a-tailor-made-solution/>
- <https://www2.deloitte.com/content/dam/Deloitte/global/Documents/Public-Sector/gx-ps-public-private-partnerships-smart-cities-funding-finance.pdf>
- <https://rtdc-mwcog.opendata.arcgis.com/>
- <https://maas-alliance.eu/sony-and-dutch-ministry-of-infrastructure-and-water-management-joins-forces-for-blockchain-based-platform-for-maas/>
- <https://inspire.ec.europa.eu/whos-who-inspire/57734>

Talent and Skills Capacity Development

In 2017, APEC published a report stating that data science and analytics sits at the top of the skills shortage.^a In the same year, the European Commission predicted up to 756,000 unfilled jobs in the European ICT sector by 2020.^b To realize the potential of technology to achieve more sustainable urban mobility, a strong talent pool needs to be available to design, implement and operate new data sharing technologies. Competition for skilled workers is heating up, as regions around the world such as Silicon Valley and Bengaluru (formerly Bangalore) are attracting talent from near and far. Policy plays a unique role in building capacity, both in the near-term and over the long term, in government and private organizations as well as within the general public.

Skills are needed in both policy and technology fields, in topics such as privacy, legal, change management, risk management, data science, big data, artificial intelligence, machine learning, cloud computing, and cybersecurity, among others. In Colombia, the Citizen Digital Certification programme was introduced in 2009, with the aim to certify introductory digital skills. Funded by the Ministry of Information and Communications Technologies and aligned to the country's Vive Digital policy, the program certified public servants, teachers and the police in its first cohort including the President of Colombia, all his Ministers and 70 percent of of the members of the National Police.^c

Notes:

- a. https://www.apec.org/-/media/APEC/Publications/2017/11/Data-Science-and-Analytics-Skills-Shortage/217_HRD_Data-Science-and-Analytics-Skills-Shortage.pdf
- b. <https://epale.ec.europa.eu/fr/content/e-skills-and-jobs-digital-age>
- c. <http://en.icdlamericas.org/icdl-news?i=2156>

Community Engagement

Mapping the stakeholder ecosystem, engaging the broader community, and establishing feedback loops throughout the lifecycle of a data sharing initiative will contribute significantly to its successful launch, adoption, and continuous improvement. Communities and companies want to be engaged in a sincerely and transparent way—knowing that they have a real chance to influence policy motivates buy in and commitment to data sharing objectives and outcomes. The method of public engagement should reflect the unique local context in each jurisdiction. In New York City, the Department of Transportation (DOT) hosted 159 public presentations and 230 meetings with elected officials, property owners, and other stakeholders to understand user needs and gather public input on the design and operation of its new bikeshare program.^a

Notes:

- a. <https://ops.fhwa.dot.gov/publications/fhwahop16022/fhwahop16022.pdf>

Public Contracting and Procurement

Governments have an opportunity to support data sharing objectives through contracting and procurement processes, particularly in the public transportation industry. Transport operators have traditionally received exclusive government contracts with long time horizons. However, governments should avoid sole-source situations that result in reduced competition to remain innovative and adaptable.

Competition between data infrastructure and platforms should be encouraged. In addition, standardized contracting processes and simplified contractual models, rather than standardized contracts, would facilitate the launch of data sharing initiatives.^a

Notes:

a. https://www.accenture.com/_acnmedia/pdf-35/accenture-the-ethics-of-data-sharing.pdf

Policy Suggestions: Use and Analysis - Data Access

Policy Suggestion	Actors	Impact	Example Policies	Enablers
<p><i>Iterative policy development -</i></p> <p>Invest in experimental initiatives such as pilot projects, incubators, and regulatory sandboxes to test the accessibility and viability of data sharing models.</p>	<ul style="list-style-type: none"> National and regional governments Mobility operators and service providers 	<ul style="list-style-type: none"> Allows policy makers to rapidly test, learn, and readjust policies in response to an evolving market. 	<ul style="list-style-type: none"> The IMDA and PDPC administer data regulatory sandboxes, where upon request, the regulators will work with companies to provide guidance and implement prototype policies.^a 	<ul style="list-style-type: none"> Adaptability in regulatory processes Rapid innovations in the mobility market
<p><i>Data license templates -</i></p> <p>Create common data license templates to reduce costs and time required in the licensing process to share data (e.g., open, partially open, and restricted data).</p>	<ul style="list-style-type: none"> National and regional governments Independent nonprofits and academics, and other data sharing stakeholders 	<ul style="list-style-type: none"> Reduces cost and resource investment required to create data licenses. Facilitates data sharing among SMEs and smaller organizations with fewer resources. 	<ul style="list-style-type: none"> The Japanese Ministry of Economy, Trade, and Industry published contract guidelines on the utilization of data and AI, addressing legal and practical aspects of data provision, creation and sharing to promote effective data utilization.^b The Infocomm Media Development Authority in Singapore also provides a data sharing agreement template to facilitate data sharing between parties.^c Contracts for Data Collaboration has created a framework that outlines the key elements needed in a data sharing agreement, based on the analysis of 43 DSAs.^d 	<ul style="list-style-type: none"> Fragmented mobility system with many actors Strong contractual laws and rights Sufficient scale and volume of data sharing
<p><i>Flexible data sharing models -</i></p> <p>Encourage the adoption of flexible data sharing agreements ranging from open data to custom data licenses to quid pro quo exchanges to data sharing models for academic research, and others.</p>	<ul style="list-style-type: none"> National and regional governments Data Sharing initiatives 	<ul style="list-style-type: none"> Allows data licenses to be tailored to stakeholder needs to encourage data sharing. 	<ul style="list-style-type: none"> In the Lyon Smart Data platform, three types of data access licenses were used to ensure a fair and competitive ecosystem and boost volume of data shared. Licenses ranged from open to restricted to authenticated licenses. (see case study on Lyon in Appendix D). 	<ul style="list-style-type: none"> Highly competitive mobility market dominated by private companies

Policy Suggestions: Use and Analysis - Data Access

Policy Suggestion	Actors	Impact	Example Policies	Enablers
			<ul style="list-style-type: none"> An example of a flexible data sharing mode is the oneTRANSPORT data marketplace was launched in the UK in 2013. Transport operators, service providers, local government and transport authorities as well as national transport agencies were invited to join the paid subscription platform. Datasets available on the platform are either free or for sale. An example of a quid pro quo data sharing model is the Swiss FEDRO Open Data Platform for Mobility (see case study in appendix for more details). After 6 months of accessing data, users lose access to data unless they share their own data on the platform. Another option is to justify why they are not able to publish their own data on the platform in exchange.^e 	<ul style="list-style-type: none">

Notes:

- <https://www.imda.gov.sg/programme-listing/data-collaborative-programme>
- https://www.meti.go.jp/english/press/2019/0404_001.html
- <https://www.imda.gov.sg/programme-listing/data-collaborative-programme>
- <https://static1.squarespace.com/static/5b4f63e14eddec374f416232/t/5ee3e249b07a7d49fa6da34e/1591992905052/Laying+the+Foundation+for+Effective+Partnerships--An+Examination+of+Data+Sharing+Agreements.pdf>
- <https://opentransportdata.swiss/en/road-traffic/>

Data discoverability

Discoverability is the ease with which a data consumer can find and access the desired datasets. Discoverability is increased with the existence of centralized and known data portals, which means users know where to start looking for data. Standardized and high-quality data and metadata also increase the ease and speed of finding the right data. Data discoverability tools and other technical solutions such as search optimization can also be useful.^a

Notes:

- <https://datascience.codata.org/articles/10.5334/dsj-2019-003/>

Policy Suggestions: Use and Analysis - Ethical Use and Processing

Policy Suggestion	Actors	Impact	Example Policies	Enablers
<p><i>Operational-level oversight</i> -</p> <p>Within each data sharing initiative, require the creation of an independent officer or commission, such as an ethics review board, with local representation to provide oversight on ethical use of data.</p>	<ul style="list-style-type: none"> National and regional government Data Sharing initiatives 	<ul style="list-style-type: none"> Ensures ethical use, processing, and analysis of data from broad perspectives. Ensures proactive management and analysis of new ethical challenges over time. 	<ul style="list-style-type: none"> The EU GDPR requires certain organizations to appoint an independent data protection officer.^a An example of such operational-level oversight include Data Review Boards^b and Consumer Subject Review Boards.^c These have been identified as emerging mechanisms for organizations to make responsible decisions regarding data use and demonstrate commitment to ethical decision-making. 	<ul style="list-style-type: none"> Access to data and ethics expertise and skills Sufficient resources to create and maintain the oversight function
<p><i>Independent enforcement bodies</i> -</p> <p>Establish independent enforcement bodies such as watchdogs, commissions, and ombudsperson to oversee, audit, investigate, and rule on ethical violations.</p>	<ul style="list-style-type: none"> National and regional governments Independent enforcement authorities 	<ul style="list-style-type: none"> Allows individuals and organizations access to effective redress channels for ethical violations. 	<ul style="list-style-type: none"> The UK Information Commissioner's Office is responsible for upholding information rights in the public interest. Each year tens of thousands of concerns and complaints are handled.^d The Centre for Data Ethics and Innovation (CDEI) is an independent advisory body set up by the UK Government to connect policy makers, industry, civil society, and the public to develop effective governance regimes for data-driven technologies. The center produces actionable recommendations for the government as well as advice for regulators and industry to support responsible innovation and build a strong, trust-based system of governance.^e 	<ul style="list-style-type: none"> Strong regulatory authority and legal systems
<p><i>Policies addressing the equitable and ethical use of data</i> -</p> <p>Incorporate equity and ethics principles and objectives in data sharing policies, addressing issues such as gender, race, age, differences in ability, and other sociodemographic factors, to define a common vision of ethical and equitable use of data and provide guidance to stakeholders involved.</p>	<ul style="list-style-type: none"> National and regional governments Nonprofit and other trusted organizations 	<ul style="list-style-type: none"> Establishes a common understanding of what equitable and ethical use and processing of data entails. 	<ul style="list-style-type: none"> The EU Gender Equality Strategy 2020-2025 calls for solutions to potential gender biases in AI to support the development of equitable evidence-based policies.^f The Beijing AI Principles, backed by the Chinese Ministry of Science and Technology, proposes principles on the research and development, use and governance, and long-term planning of AI to ensure beneficial AI for mankind and nature.^g 	<ul style="list-style-type: none"> Large volumes of data being collected, used, and processed. Multistakeholder collaboration with diverse groups including civil organizations, industry alliances. Mechanism to update the vision of ethical data sharing over time.

Notes:

- a. <https://gdpr.eu/data-protection-officer/>
- b. <https://iapp.org/news/a/why-data-review-boards-are-a-promising-tool-for-improving-institutional-decision-making/>
- c. <https://fpf.org/wp-content/uploads/Calo-Consumer-Subject-Review-Boards.pdf>
- d. <https://ico.org.uk/about-the-ico/what-we-do/how-we-handle-concerns/>
- e. <https://www.gov.uk/government/organisations/centre-for-data-ethics-and-innovation/about>
- f. <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52020DC0152&from=EN>
- g. <https://www.baai.ac.cn/news/beijing-ai-principles-en.html>

Resources for Policy makers:

- [Governing Transport in the Algorithmic Age](#): in 2019, the International Transport Forum published the report which analyzes the need for transport policies to adapt to the age to algorithms and how policy makers can become algorithmically literate.
- [European Commission White Paper on Artificial Intelligence - A European approach to excellence and trust](#): presents policy options to enable a trustworthy and secure development of AI in Europe, respecting of the values and rights of EU citizens.

Appendix C:

Principles to Enable Data Sharing

World Business Council for Sustainable Development's (WBCSD) Enabling Data Sharing: Principles for Transforming Urban Mobility report, published in 2020, presents 5 fundamental data sharing principles that mobility system stakeholders should embrace to create data sharing models that benefit all parties. Businesses, governments, and other stakeholders can align these principles with their legislative, organizational, investment, and technology strategies better to achieve their data sharing objectives.

Data-Sharing Principles

Impact on the Policy Framework

1. Data Sharing should enable all stakeholders to create and capture value.

Governance of data sharing collaboratives must enable parties to reap measurable value—public and private, and monetary or nonmonetary—to be incentivized to participate and share data. Enabling sharing of data requires balancing the perceived competitive advantage of owning data with the value that could be unlocked through its fair sharing and aggregation.
2. Data Sharing must be ethical, inclusive, and unbiased.

First, the means and purpose of data sharing or use cases should be consistent with the overall vision of its stakeholders. Additionally, transparent and verifiable procedures should be created to address concerns around bias, discrimination, manipulation and the repurposing and re-use of data in ways that may contradict the original consented-to intent.
3. Data Sharing should incorporate privacy by design.

Privacy by design incorporated in data collection and aggregation ensures data protection and engenders trust in data sharing collaboratives. Among other measures, this requires minimizing collection of data to what is necessary for a given use case, minimizing collection of personally identifiable information, reducing data resolution to avoid identification through combination of multiple datasets. Appropriate safeguards must also be put in place such that aggregation of multiple types of data from different sources does not risk identification of individuals.
4. Data Sharing should embrace cybersecurity by design

Cybersecurity is essential in fostering trust between parties to data sharing. Cybersecurity threats can be compounded in transportation systems which incorporate dispersed physical and software infrastructure of multiple different vintages. Cybersecurity is a moving target, and policies should adopt principle-based approaches to address these issues, avoiding specific technical requirements that can become outdated.

5. Data Sharing should be adaptive and iterative

Data Sharing initiatives may need to be adapted and customized to suit local value systems and policy environment. Such initiatives may also need to be adaptable to different technology platforms and architectures. As such, adaptability and iterative and incremental development approaches should be embedded within data sharing initiative. Both are also general principles that are applicable to the development of data standards, governance practices, and data sharing policies.

Appendix D: Global Case Studies

Index of Appendix D

- Case Study 1:** Africa – Digital Transport for Africa, a Digital Commons and Global Community 70
- Case Study 2:** Antwerp – A Marketplace for Mobility to Drive Innovation in Public Procurement 72
- Case Study 3:** Bogota – Movilab Embodying the Startup Environment and Mentality in Government 74
- Case Study 4:** Finland – MaaS Global Leading the Disruption in Mobility 76
- Case Study 5:** London – Datastore and Cross Sector Partnerships Driving the City Data Strategy 78
- Case Study 6:** Los Angeles – Managing Micromobility using the Mobility Data Specification 80
- Case Study 7:** Lyon – New Mobility, Data, and Innovation Initiatives Supporting a Smart City Strategy 82
- Case Study 8:** Netherlands – Mobility-as-a-Service Regional Pilots Enabled by New Technologies 84
- Case Study 9:** Singapore – Smart Urban Mobility and Smart Nation Sensor Platform 86
- Case Study 10:** Switzerland – Federal Roads Office’s Open Data Platform for Mobility 88

Case Study 1: Africa – Digital Transport for Africa, a Digital Commons and Global Community

Africa is continuing to urbanize rapidly, with progress made in the development of infrastructure and city ecosystems. Most African cities rely on semiformal transport such as private paratransit in the form of minibuses that provide cheap, accessible, and flexible transport options. Challenges arising from a fragmented and decentralized mobility system include traffic congestion, pollution, poor road safety, and accessibility gaps. These issues are often difficult to manage because the lack of centralized planning and operational control capabilities.¹

DigitalTransport4Africa(DT4A)isacollaborativedigital commons and global community that scales up and supports urban mobility projects through open data and peer-to-peer knowledge sharing.

The Digital Transport for Africa Program brings much needed economies of scale to transit route data collection and mapping -- the foundation for meaningful urban transport improvement programs.”

- Holly Krambeck
Program Manager, The World Bank

Policy Framework	Relevant Projects and Policy Measures
Data Collection and Merging	<ul style="list-style-type: none"> DT4A projects do not collect personal data. The majority of projects focus on mapping transport and paratransit networks. Past projects such as those in Cairo, Djibouti, and Nairobi involve international cooperation and the development of local engagement and communities of practice. In previous projects, transit routes and timetable data have been collected in many ways, typically from fieldwork. For example, students have used GPS-enabled smartphones to gather data and map minibus routes.
Data Standards	<ul style="list-style-type: none"> DT4A projects typically create data in GTFS format, design a paper map, and then transfer the data to passenger information systems accessible on the web and on mobile phones. However, GTFS was initially created for fixed-route public transit. Initiatives are ongoing to perfect GTFS-flex, which adapts GTFS to become more suitable for flexible transport modes like paratransit.
Data Infrastructure	<ul style="list-style-type: none"> The Agence Française de Développement requires the recipients of infrastructure loans for mass transit in Africa to map the existing transport system and share the open data in a standardized format. The data collection is funded as part of the pre-project technical assistance. This allows transit investments to support integration across transport modes and encourages a digital data ecosystem to support improved transit operations.
Governance and Accountability	<ul style="list-style-type: none"> DT4A takes a digital commons approach to increase collaboration across a network of stakeholders that seek to improve public transport, promote integrated planning and innovation, and start shared dialogue and accountability.^a DT4A is hosted by the World Resources Institute and collaborates with network of partners including the Agence Française de Développement, La Fabrique des Mobilités, the World Bank, Columbia University, Massachusetts Institute of Technology (MIT), and others. The DT4A online knowledge center provides access to resources such as training materials, data sharing tools, and sample policies.
Use and Analysis	<ul style="list-style-type: none"> An example of a previous data sharing project is the DigitalMatatus. The University of Nairobi, Columbia University, MIT and a small design firm Groupshot collaborated to map Nairobi’s minibus (matatu) routes and stops using GPS enabled mobile phones. A paper map was designed, and then data were integrated into Google’s website and applications.^b

Notes:

- <https://digitaltransport4africa.org/covid-19-hit-public-transport-users-hard-heres-how-open-data-a-digital-commons-approach-helps/>
- <https://digitaltransport4africa.org/projects/>

Policy best practices:

- Develop new data standards to meet local needs, building on existing standards where possible.
- Leverage community and local resources in data sharing projects to build local data and digital ecosystems, instead of relying on consultants and nonlocal companies in the long term for data capabilities.

Engage diverse actors outside of government, such as nonprofits with a neutral mandate, to facilitate data sharing where appropriate.

Notes

- 1 https://git.digitaltransport4africa.org/learn/policy/open-data-for-inclusive-urban-public-transport-globally/-/blob/master/Open_Data_for_Inclusive_Urban_Public_Transport_Globally.pdf

Case Study 2: Antwerp – A Marketplace for Mobility to Drive Innovation in Public Procurement

Antwerp is home to Europe’s second largest port and faces significant congestion challenges as a logistics and maritime transport hub. The mobility objective of the city of Antwerp is to reduce traffic and keep the region accessible, liveable, and safe. Under the European-funded project CIVITAS PORTIS, Antwerp has developed the Smart Ways to Antwerp (SWtA) strategy that aims to achieve behavioral change in passenger and freight transport.¹

The Marketplace for Mobility was launched as a new platform for cooperation within SWtA in 2016. The city sought to engage private partners for a diverse range of mobility solutions such as bike and car sharing, electric vehicles, smart logistics, and mobility-as-a-service. Seven MaaS projects were selected in a 2019–2020 project call to receive a grant to develop APIs and integrate multiple MaaS applications. Projects received financial support for the development of the APIs along with a small fee for each transaction generated as well as tailored support from the SWtA project team.

Policy Framework	Relevant Projects and Policy Measures
Data Collection and Merging	<ul style="list-style-type: none"> The Marketplace for Mobility does not contain any personal data (unless as part of a validation of KPIs within a project call) and focuses on both people mobility and logistics use cases. The Marketplace for Mobility offers different options for partnerships between Antwerp and mobility providers: <ul style="list-style-type: none"> Partnerships with promotional support through access to the marketplace Partnerships with financial and substantive support through project calls (i.e., general calls and thematic calls such as MaaS, B2B, city logistics)^a These partnerships have led to a more integrated mobility system across various transport modes including the development of MaaS capabilities such as the SWtA mobility map and multimodal route planner that merges the real-time data from public transport, shared mobility, taxis, floating car info, and other sources.^b Mobility providers in Antwerp are required to integrate with at least 2 MaaS providers and have to deliver data to the city. Mobility providers in Antwerp require an operating license, which can be reviewed yearly and needs to be renewed every 3 years.
Data Standards	<ul style="list-style-type: none"> Flanders has adopted the Open Standards for Linked Organizations (OSLO) standardization program, which seeks to standardize the exchange of data by facilitating and recognizing semantic and technical data standards. SWtA actively participates in developing this standard.^c SWtA also makes data available to third parties following the NGSI data model.
Data Infrastructure	<ul style="list-style-type: none"> A new travel planner for SWtA was developed together with Be-Mobile, a private technology company, using the Microsoft Azure platform.^d
Governance and Accountability	<ul style="list-style-type: none"> Routeplan 2030 is the Antwerp Transport Region’s Mobility Plan. The city of Antwerp works actively with a broad network of partners including the Flemish government, the Flemish Waterways, public transport providers, the Port of Antwerp, Antwerp companies, and other European port cities.
Use and Analysis	<ul style="list-style-type: none"> Smart Ways to Antwerp offers a multimodal route planner and a mobility map to the general public on its public website. All the underlying data of the route planner and the mobility map are available through APIs as open data or according to the contract terms. The routing logic is being made available through API-calls to third parties. Other services used by SWtA will also be made available in this way in the near future.

Notes:

- <https://www.slimnaarantwerpen.be/en/mobility-providers>
- <https://civitas.eu/news/nudging-toward-sustainable-mobility-antwerp-post-covid-19>
- <https://joinup.ec.europa.eu/collection/oslo-open-standards-linked-organisations-0/about>
- <https://customers.microsoft.com/en-us/story/750114-cityofantwerp-government-azure>

Policy best practices:

- Establish several different public procurement tracks and tools to enable fit-for-purpose contracts and partnerships.
- Use agreements or license models with short durations and frequent renewal clauses to avoid vendor lock-in.
- Form partnerships with similar cities or regions to share knowledge, best practices, and resources.

Notes

- 1 <https://www.sciencedirect.com/science/article/pii/S2352146519301097>

Case Study 3: Bogota – Movilab Embodying the Startup Environment and Mentality in Government

Movilab Bogota is a laboratory for urban mobility information, bringing together ideas, resources, and regulation to create value for the general public. The laboratory works with academia, the public sector, the private sector, citizens and experts, mobility NGOs, and multilateral organizations to:

- Analyze and disseminate open data to capture the public value.
- Co-create, experiment, and implement services, best practices, and initiatives leveraging digital technologies.
- Engage and connect with stakeholders interested in the mobility innovation ecosystem.¹

The laboratory offers four services to support data sharing: an open database for mobility data; a physical space for coworking and events; a startup incubator; and calls for projects.

Policy Framework	Relevant Projects and Policy Measures
Data Collection and Merging	<ul style="list-style-type: none"> • Privacy and data protection in Colombia is governed by the Data Protection Law as well as several other laws (i.e., laws 1266, and 1581) and decrees.^a • The Movilab open data platform collects and publishes data from external parties through established alliances.
Data Standards	<ul style="list-style-type: none"> • Data standards not specified.
Data Infrastructure	<ul style="list-style-type: none"> • Financing for data sharing communications and technology infrastructure not specified.
Governance and Accountability	<ul style="list-style-type: none"> • MoviLab is run by the Secretariat of Mobility, the local government agency in charge of leading the development and implementation of mobility policies in the city. With eight strategic objectives, the Secretariat of Mobility aims to become a worldwide benchmark in sustainable mobility by 2038. • The vision for the future of mobility and data are documented in the Mobility Master Plan.^b
Use and Analysis	<ul style="list-style-type: none"> • The Movilab open data platform is a centralized repository for open data. Data can be shared through APIs or downloaded directly. • The Movilab open data platform provides three types of data licenses including an open data license and a custom data license.^c

Notes:

- [https://one.oecd.org/document/DAF/COMP/WD\(2020\)42/en/pdf](https://one.oecd.org/document/DAF/COMP/WD(2020)42/en/pdf)
- <https://www.movilidadbogota.gov.co/web/mision>
- <https://datos.movilidadbogota.gov.co/>

Policy best practices

- Create a centralized hub that provides access to support and resources, financial and nonfinancial, in addition to mobility data.
- Host complementary idea competitions and start-up incubation programs to discover, grow, and fund go-to-market mobility data innovations.
- Generate specific calls to promote the generation and opening of data that generate public value for mobility, after identifying and prioritizing the required information (see "DataJam MoviLab"²).

Notes

- 1 <https://movilab.co/en/home/>
- 2 <https://movilab.co/convocatoria-data-jam-mobility/>

Case Study 4: Finland – MaaS Global Leading the Disruption in Mobility

The Finnish Act on Transport Services spurred the creation of MaaS Global, the world’s first Mobility-as-a-Service operator.¹ Finland’s laws to integrate all transport modes and enable user-oriented transport services created a fertile environment for MaaS to grow.² Through the Act, the government wanted to encourage a new innovative market for mobility services. The Act mandated all mobility service operators, public and private, to give access to essential data to make their systems interoperable and to cooperate on reasonable and fair terms.

MaaS Global operates the MaaS platform Whim in the Helsinki capital region, Turku, Antwerp, Vienna, the Netherlands, and is piloting in Japan. Whim users can find their optimal route using the multimodal journey planner, then book and pay for the route immediately through an online transaction or an existing subscription. Transport modes available on the app include trains, buses, taxis, rental cars, ride hailing, bikeshare, e-scooters, among others. To date, more than 16 million trips have been completed with Whim.

Policy Framework	Relevant Projects and Policy Measures
Data Collection and Merging	<ul style="list-style-type: none"> • Privacy in Finland is regulated by the EU General Data Protection Regulation. • As stated in Whim's privacy policy, the personal data collected by Whim is pseudonymized and encrypted. MaaS Global also uses industry standard security practices to protect personal data. • The Act on Transport Services, which entered into force in 2018, requires all transport providers in Finland to provide access via open APIs to data on timetables, routes, ticket prices as well as real-time location data. • Smart Mobility Finland provides innovation funding to support Finnish companies in developing business models in 3 key areas: seamless transport chains, emission reduction, and big data. • Whim's business model is partnership based, and all cooperation with mobility providers is based on contractual agreements and are primarily based on the possibility to reach more customers and on economic gain.
Data Standards	<ul style="list-style-type: none"> • Whim does not use any specific data standards. It integrates data from various sources using APIs.
Data Infrastructure	<ul style="list-style-type: none"> • Communications infrastructure developed by Whim has been funded by private investors. • Whim uses APIs to manage data in a decentralized manner.
Governance and Accountability	<ul style="list-style-type: none"> • The Finnish Transport and Communications Agency is the main authority overseeing the Act on Transport Services. • Finland's first 12-year National Transport System Plan will provide the long-term strategy for Finland's transport system as a whole including directives on state funding and required legislation. The plan is expected to be completed in spring 2021. • The Nordic Innovation Platform aims to enable seamless and standardized mobility more broadly across the Nordic countries. • MaaS Global is a business, and as such it has the governance structure of a private company. Investors include Transdev, BP Ventures, Mitsubishi Corporation, Nordic Ninja, and others.^a
Use and Analysis	<ul style="list-style-type: none"> • In the Whim app, access and use of data are governed by contractual data sharing agreements.

Notes

a. https://movinon-lab.michelin.com/lab/s/article/Whim-the-Little-MaaS-App-That-Could?language=en_US

Policy best practices:

- Mandate public and private mobility providers to make critical datasets for sustainable mobility use cases available as open data.
- Support private sector leadership in the development of mobility solutions such as mobility-as-a-service.

Notes

- 1 <https://www.theagilityeffect.com/en/case/helsinki-pioneers-maas/>
- 2 <https://futuremobilityfinland.fi/vision/mobility-as-a-service/#::-:text=Finland%20is%20the%20first%20country,the%20development%20of%20new%20services>

Case Study 5: London – Datastore and Cross Sector Partnerships Driving the City Data Strategy

The Greater London Authority (GLA) published the *Data for London: A City Data Strategy* in 2016, recognizing that although the London Datastore had been a trailblazer for open data, open data are only the tip of the iceberg, and that city hall could not deliver the digital solutions to the desired social, economic and environmental outcomes alone.¹ Therefore, the vision was to transform the London Datastore into a data sharing platform to the benefit of all—business, government, and citizens. London has since developed strong institutions toward this purpose and furthered collaborations between the private, academic, and public sectors.

Policy Framework	Relevant Projects and Policy Measures
Data Collection and Merging	<ul style="list-style-type: none"> In London, privacy is regulated by the Data Protection Act and the EU General Data Protection Regulation (GDPR). However, post Brexit, the UK may no longer be covered by GDPR regulations. The London Datastore is a data sharing portal holding both open data and secure, private data. Most of the data providers in the London Datastore are government agencies, and the GLA uses its connections and influence to request other public organizations to release their data. The London Data Commission has found that the private sector’s willingness to share data depends on several considerations such as corporate social responsibility, commercial sensitivity, and competitive advantage. The London Datastore City Data Analytics Programme offers resources to support projects including data science expertise, project management functions, and a documentation library. Academic institutions such as University College London and Imperial College are close collaborators. The London Office of Technology and Innovation (LOTI) was created to help London boroughs work together to improve public services through data. LOTI supports sharing knowledge, building partnerships, advocating for standards, and executing pilot projects.^a
Data Standards	<ul style="list-style-type: none"> The London Datastore does not require specific data standards, but rather focuses on data quality controls.^b
Data Infrastructure	<ul style="list-style-type: none"> The Open Data Institute published their report and roadmap Discovering the future of the London Datastore in 2019. The proposed London Datastore 3.0 Development project lays out the technology transformations required to evolve the Datastore platform into a data service.
Governance and Accountability	<ul style="list-style-type: none"> The 2016 GLA City Data Strategy recognized the need to go beyond open data, to capture the value from other types of data such as private, commercial, sensory, and crowd-sourced data. The Mayor of London’s 2018 Transport Strategy also emphasized sharing data and knowledge with TfL and GLA to improve monitoring, operations, and planning of the transport network. On the London Datastore platform, the five main data providers have voluntarily implemented the UK Statistics Authority’s Statistics Code of Practice. London First created the London Data Commission to work with the public sector to help solve some of the key challenges facing the city, while also providing a coherent voice for London’s private sector data leaders. Its first report presented plans for a Data for London framework including a Data for London Board and a London Data Charter. Several other organizations and formal roles share authorities and responsibilities to enable data sharing such as the London Chief Digital Officer, London Office of Data Analytics, and Centre for Data Ethics and Innovation.
Use and Analysis	<ul style="list-style-type: none"> The London Datastore, as stated in its Terms and Conditions, is not responsible for the quality or accuracy of the data. Each dataset has its own license conditions for access. The impact of data sharing, as defined by the City Data Strategy, can be measured by critical success factors, namely institutional, social and innovation capability. Furthermore, the Mayor of London tracks Economic Fairness measures, which allows tangible analysis of how fair and inclusive London’s economy is.

Notes:

- a. <https://www.londoncouncils.gov.uk/our-key-themes/london-office-technology-and-innovation-loti>
- b. <https://data.london.gov.uk/about/data-quality-standards/>

Policy best practices:

- Engage and support data sharing experts at local academic, research, and nonprofit organizations.
- Develop an ecosystem of organizations that provide a broad range of support to accelerate data sharing between public and private mobility stakeholders.

Notes

- 1 <https://smartlondon.medium.com/10-years-of-the-london-datastore-thinking-on-city-data-for-the-next-decade-b634ae62dc3c>

Case Study 6: Los Angeles – Managing Micromobility using the Mobility Data Specification

When e-scooters appeared on the streets of Los Angeles in 2018, the Los Angeles Department of Transportation (LADOT) took unprecedented action. Earlier in the year, LADOT partnered with the LA Information Technology Agency (ITA) and consultants to create the open-source Mobility Data Specification (MDS). Starting in October 2018, micromobility operators were required to share six data points from their fleet through MDS to obtain a permit to operate in LA.¹ Since then, more than 100 cities across the globe have adopted MDS in part or in whole. The Open Mobility Foundation was established by LA and 14 cities internationally in June 2019 to govern MDS and support a wide group of stakeholders in shaping digital mobility management tools.² One of the ways LADOT uses MDS, includes establishing a geofence for e-scooters during special events to prevent overcrowding and promote safety on the public right of way for all users.³

The decisive action from LADOT reflects a generally progressive approach in California, the state with the most rigorous and comprehensive privacy legislation in the US. With the fifth largest economy in the world by GDP, California is characterized by its strong technology sector, high digital maturity, and diverse demographics.

Policy Framework	Relevant Projects and Policy Measures
Data Collection and Merging	<ul style="list-style-type: none"> • The California Consumer Privacy Act establishes privacy rights for California consumers, allowing more individual control over the personal information collected by businesses. The Act is enforced by the California Department of Justice. • The Data Protection Principles developed by LADOT defines the data protection standards that apply to data obtained through MDS. • The Dockless Mobility Pilot Program, launched in 2019, was governed by the Dockless On-Demand Personal Mobility Rules & Guidelines in which MDS was a requirement. Operating permits under this pilot program were issued to 8 companies for a total of 37,000 scooters. The pilot structure allowed LADOT to quickly understand to the dynamics of an emerging market, test various management tools to align dockless vehicles to the city's goals, and explore the effect on different communities.
Data Standards	<ul style="list-style-type: none"> • MDS was created by LADOT in 2018. MDS is comprised of a set of application programming interfaces that create standardized two-way communications for cities and private companies to share information about their operations. MDS allows cities to collect data that can inform real-time traffic management and public policy decisions.^a • Open Mobility Foundation, created in 2019, is a global nonprofit organization that shapes open-source urban mobility management tools to help public agencies accomplish their mobility policy goals. It is governed by a Board of Directors consisting of representatives from 13 cities across the US and convening 29 public members and 10 nonpublic members to date. In the long term, MDS is viewed as a solution for additional forms of transportation from ride hailing and car sharing to delivery drones and autonomous vehicles.
Data Infrastructure	<ul style="list-style-type: none"> • MDS is comprised of a set of APIs, which are used to share data.
Governance and Accountability	<ul style="list-style-type: none"> • The LADOT 2016 Urban Mobility in a Digital Age strategy recognized the need for data to inform decision making and future policies to optimize services and protect public safety, accessibility, and equity. Building a solid data foundation was identified as a key priority.
Use and Analysis	<ul style="list-style-type: none"> • When accessing data, LADOT follows the Guidelines for Handling of Data from Mobility Service Providers that addresses confidential data and refers to the City of Los Angeles Information Handling Guidelines.

Notes:

a. <https://ladot.lacity.org/sites/default/files/documents/ladot-dockless-year-one-report.pdf>

Policy best Practices:

- Develop regulations for new mobility in a timely manner by adopting an experimental approach through pilot programs.
- Set requirements for mobility operators tied to operating permits as a mechanism to manage compliance.
- Establish a neutral third-party organization to govern and develop data standards and disseminate best practices.

Notes

- 1 <https://cities-today.com/how-los-angeles-took-control-of-its-mobility-data/>
- 2 OMF website <https://www.openmobilityfoundation.org/>
- 3 <https://airtable.com/shrPf4QvORkjZmHIs/tblzFfU6fxQm5Sdhm>

Case Study 7: Lyon – New Mobility, Data, and Innovation Initiatives Supporting a Smart City Strategy

Lyon, known as the first smart city in France, introduced the Lyon Metropole Intelligent Strategy in 2014. Under the new mobilities and innovation workstreams, three projects in particular have secured Lyon’s position as a European benchmark for governance and collaborative projects in the mobility sector.¹ These three projects were very much connected and integrated in the same strategic framework.

The Optimod’Lyon project worked with thirteen partners from public and private sectors from 2012 to 2015 to establish a central intermodal travel control station providing three main services: a multimodal GPS application, 1-hour traffic predictions, and optimized freight and urban logistics.²

Data Grand Lyon is a public-data platform, launched in 2013, with the most comprehensive set of open data in France, and possibly in Europe. Twenty million data points are compiled each day from public and private data sources, attracting more than 100 re-users including SMEs, IT companies, and research centres. An innovative open data licensing policy was used that comprised three types of licenses to ensure a fair, competitive ecosystem as well as consistency of services using data with public common goods such as public space.³ Finally, Lyon Urban Data (TUBA) is an innovative public-private partnership in the form of an innovation lab that provides support for developing new products and services, with access to the city’s public and private data as a central feature. It also serves as a meeting, activity, and promotional site for collaborative projects.⁴

Policy Framework	Relevant Projects and Policy Measures
Data Collection and Merging	<ul style="list-style-type: none"> Privacy and data protection in France is legislated by the GDPR and the French Data Protection Act. The 2019 Mobility Orientation Law requires all municipalities to open up data on all existing transport modes. Data must be shared either statically or dynamically on the National Access Point. Moreover, municipalities will be required to offer a multimodal route calculator.
Data Standards	<ul style="list-style-type: none"> The Data GrandLyon platform uses an Extract, Transform, Load (ETL) software to make data available, where possible, in open and standardized formats to facilitate its interoperability and reuse.
Data Infrastructure	<ul style="list-style-type: none"> The Greater Lyon built the central Data GrandLyon platform, designing its architecture, technology, and functionalities from open source software, as planned in its 2018 decision.
Governance and Accountability	<ul style="list-style-type: none"> The Lyon Metropole Intelligente Plan defines Lyon’s ambitions to become a more agile, balanced, humane, and creative city. The municipality’s goal is to create economic, social and societal value for the city and its inhabitants. Today, Lyon Smart City is comprised of 104 innovative projects and 289 diverse partners including 13 European cities. Administratively, the Lyon Smart City Unit and Unit for Data Dissemination and Geo-Services report to the Delegation for Economy, Employment and Knowledge of Grand Lyon. Nationally, Etalab is the inter ministerial department that coordinates the design and implementation of France’s data strategy. Lyon was the first city in France to appoint a Chief Data Officer in 2015.^a Data providers retain ownership of their data on the Data GrandLyon platform. The platform also does not make any guarantees on the quality of the data.

Policy Framework	Relevant Projects and Policy Measures
Use and Analysis	<ul style="list-style-type: none"> • The Data GrandLyon platform uses three types of data access licences to ensure a fair and competitive ecosystem and to boost volume of data shared • Open license, which covers most of the data • Authenticated license, for screened users to ensure re-use of data aligns with public interest • Restricted license, which limits data access to a specific group of users^b • When the reuse of the data is contrary to the general interest, the Métropole de Lyon or the data provider may revoke access to the data, as stated in the Data GrandLyon terms of service.

Notes:

- a. <https://www.frontiersin.org/articles/10.3389/frsc.2020.00020/full>
- b. <http://www.business.greaterlyon.com/news/greater-lyon-smartdata-new-data-release-and-licence-types-in-december-2013-1585.html>

Policy best practices:

- Adopt multiple types of data access licenses to encourage data sharing while ensuring a fair, competitive ecosystem.
- Create an innovation lab to support the reuse of data toward the development of new products and services.

Notes

- 1 <https://www.aderly.com/2019/08/lyon-is-more-committed-than-ever-to-improving-transport-and-mobility/index.html>
- 2 <http://governinginfomobility weblog.tudelft.nl/optimod/>
- 3 https://cerre.eu/wp-content/uploads/2020/05/cerre_report_shared_mobility_maas.pdf
- 4 <http://www.business.greaterlyon.com/innovation-in-greater-lyon-53.html>

Case Study 8: Netherlands – Mobility-as-a-Service Regional Pilots Enabled by New Technologies

The Dutch Ministry of Infrastructure and Water Management initiated a call for tenders for national mobility-as-a-service (MaaS) pilot projects in 2018, as a result of interest from both public and private parties to understand better the opportunities for both businesses and public policy. The objectives are to prove that MaaS can contribute to improved mobility products, social inclusion, congestion reduction, accessibility, and sustainability. Following successful pilot projects, national-scale initiatives could be subsequently realized.

Seven national MaaS pilot projects were established with different regions, each pilot focusing on a different use case and policy goal; for example, focusing on commuter traffic in Amsterdam, cross border transport in Limburg and carbon neutral travel in Eindhoven.¹ The data from the 7 national apps will be available in a learning environment dataspace to help optimize the total mobility system. The Dutch Ministry of Infrastructure and Water Management initiated a blockchain challenge in 2019 to explore new solutions to the exchange of sensitive data on MaaS pilots. Blockchain may be particularly suitable for transactions that contain financially sensitive information between competing stakeholders with high levels of trust.²

Policy Framework	Relevant Projects and Policy Measures
Data Collection and Merging	<ul style="list-style-type: none"> • Privacy in the Netherlands is governed by the EU General Data Protection Regulation. Necessary measures have been taken to anonymize data and ensure data privacy and protection in the National Learning Environment for MaaS. • Public and private actors voluntarily formed consortia and bid for the MaaS pilot tenders where data sharing was obligatory. There was no need to further motivate or incentivize data sharing between the stakeholders through policy. Each bid was driven by its unique value proposition.
Data Standards	<ul style="list-style-type: none"> • The Transport Operator to Mobility Provider API (TOMP-API) was developed in 2018 as an initiative of bikeshare companies and supported by the Dutch Ministry of Infrastructure and Water Management. It broadened the open GBFS-standard to other transport modes. TOMP defines the standard data interface between MaaS platforms and transport operators. TOMP-API was developed by an open working group with public and private stakeholders. • The Dutch Ministry of Infrastructure and Water Management defined a standardized data string to represent both planned and executed trips, register and process data on transactions in a MaaS ecosystem and also for use in the National Learning Environment for MaaS.
Data Infrastructure	<ul style="list-style-type: none"> • As part of the blockchain challenge, in 2020, Sony developed the Blockchain Common Database to record and share anonymized large-scale movement history and revenue allocation for MaaS based on the datastring. It is aligned with the decentralized architecture described by the international dataspace.³ • Sony was not compensated for participating in the blockchain challenge. However, Sony demonstrated its capabilities for a potential future deployment of the blockchain solution.
Governance and Accountability	<ul style="list-style-type: none"> • The Dutch Digitalization Strategy, published by the Ministry of Economic Affairs and Climate Policy, outlines the Dutch vision on data sharing between businesses, with concrete government actions defined. • Control of data in the MaaS pilots is governed by individual data sharing agreements and service level agreements (SLAs).

Policy Framework	Relevant Projects and Policy Measures
	<ul style="list-style-type: none"> The MaaS pilots were orchestrated and governed by the Dutch Ministry of Infrastructure and Water Management. However, private sector input and partnerships were welcomed and subsequently developed. MaaS initiatives may adopt a consortium-type governance structure leveraging decentralized data management, with collaboration through public-private partnerships. Either public or private actors may take the lead in MaaS development depending on the local requirements.
Use and Analysis	<ul style="list-style-type: none"> The Data Ethics Decision Aid is a toolkit to help policy makers to assess ethical issues and risks in data projects. It was developed by the City of Utrecht and the Utrecht Data School. It has been used by the Association of Dutch Municipalities for data ethics trainings at more than 50 municipalities. It could also serve as a useful framework for future MaaS projects.^b

Notes:

- a. <https://dutchmobilityinnovations.com/spaces/1105/maas-programma/files/32237/20200423-blockchain-challenge-engels-docx>
- b. <https://www.uu.nl/en/news/the-urgency-for-data-ethics-in-public-administration>

“As the outcomes of the Blockchain Common DB feasibility pilot with the Netherlands Ministry of Water Management and Infrastructure demonstrate, collaboration between public authorities and private mobility stakeholders can realistically optimize the mobility system for social good via sharing transaction records transparently among MaaS stakeholders in a secure and trusted way, which enable the execution of business rules in MaaS industry.”

- Takashi Togame
Incubation Manager, Sony.

The Ministry’s intention is for the pilots to go on in 2021 and then transition into real life business cases, without financial support. Besides the regional pilots, several other pilots and proofs of concept have and will be tendered by the Ministry.

Policy best practices

- Implement pilot projects with the aim of proving feasibility, developing best practices, and scaling to nationwide deployments.
- Use a simple datastring as a base for the data exchange within MaaS.
- Minimize regulations in emerging, early-stage industries or use cases to foster critical private sector engagement in research and development.

Notes

- 1 <https://dutchmobilityinnovations.com/spaces/1105/maas-programmafiles/32237/20200423-blockchain-challenge-engels-docx>
- 2 <https://dutchmobilityinnovations.com/fileattachment?file=HGIC0fPiTb6OS6D10qZeRQ%3D%3D&v=1&zip=true>

Case Study 9: Singapore – Smart Urban Mobility and Smart Nation Sensor Platform

Singapore’s Smart Nation strategy seeks to develop a leading economy powered by digital innovation, where all segments of society are able to harness digital technologies and benefit from them. Two of Singapore’s Strategic National Projects are particularly relevant to mobility data—Smart Urban Mobility (Open Data and Analytics) and Smart Nation Sensor Platform (Smart Lamp Posts).¹ Smart mobility can help Singapore overcome some of the country’s constraints such as limited land area and manpower resources, and achieve sustainable mobility objectives such as reduced congestion, cleaner air, and better access to public transport.

Policy Framework	Relevant Projects and Policy Measures
Data Collection and Merging	<ul style="list-style-type: none"> • Under the Open Data and Analytics initiative, static and dynamic open transport data are shared via the Land Transport DataMall, a platform governed by the Land Transport Authority.^a • In addition, Singapore’s Open Data Portal, launched in 2011, gathers data from across 70 public agencies and 9 domains including transport.^b • In the Smart Lamp Posts project, Singapore is also collecting new types of data that did not exist before. Sensors and cameras on streetlamps are now capturing environmental data such as air quality and noise as well as street-level video.^c • Privacy in Singapore is regulated by the Personal Data Protection Act. However, personal data are not shared on the open data platforms.
Data Standards	<ul style="list-style-type: none"> • The Open Data Portal uses standardized data formats. The specific formats are not been specified.^d
Data Infrastructure	<ul style="list-style-type: none"> • The Government Technology Agency (GovTech) is responsible for digital government objectives. In 2019, - 60% of the procurement budget was spent toward Smart Nation projects including the Smart Nation Sensor Platform. Small- and medium-sized enterprises can participate in 80% of the tenders—to support them, GovTech worked to streamline procurement methods and contracts.^e • In the Smart Lamp Post project, lampposts nationwide are to be fitted with a network of connected sensors and cameras. The sensors gather environmental data and the cameras will enable video analytics. In the future, light beacons can also be mounted on lampposts to guide autonomous vehicles. AI will be used to analyze data from lampposts to improve public safety, incident response, and urban planning.^f • In 2017, GovTech built APEX, a self-service centralized API gateway for government agencies. APEX contains a searchable API catalogue of APIs published by various agencies.^{g,h}
Governance and Accountability	<ul style="list-style-type: none"> • Singapore’s Smart Nation strategy is led by the Smart Nation and Digital Government Group. • The Personal Data Protection Commission, an organization part of the Infocomm Media Development Authority, also supports data sharing by providing resources such as the Trusted Data Sharing Framework and administering programs such as the Data Regulatory Sandbox. • In the Land Transport DataMall, according to the API Terms of Service, data users are not granted rights over any intellectual property found in content accessible through the APIs. All IP rights subsisting in or used in connection with the APIs are the property of the government.

Policy Framework	Relevant Projects and Policy Measures
Use and Analysis	<ul style="list-style-type: none"> • Use of data on the Land Transport DataMall is governed by the Singapore Open Data License and the API Terms of Service. The authorities may suspend access to the APIs and underlying data for any reason. There are also no warranties on the quality of the data. • Under the Smart Lamp Post project, there are plans to share sensor data with the industry and public by 2022. No details have been released on the form and method of data access.¹ • Concerns have been raised about the use of facial recognition technology in Smart Lamp Posts, where cybersecurity threats such as hacking and data breaches are also risks. In October 2020, the Cyber Security Agency of Singapore released Singapore's Safer Cyberspace Masterplan.¹

Notes:

- <https://www.smartnation.gov.sg/what-is-smart-nation/initiatives/Transport/open-data-and-analytics-for-urban-transportation-1>
- <https://data.gov.sg/>
- <https://www.tech.gov.sg/scewc2019/laap>
- https://medium.com/@DamiOludumila_/open-data-initiative-in-singapore-an-introduction-37c3e05d96d
- <https://www.todayonline.com/singapore/singapore-offer-secure-identity-verification-service-companies-q3>
- <https://opengovasia.com/updates-on-smart-nation-sensor-platform-connecting-all-110000-lampposts-in-the-city-video-analytics-pilot-in-2nd-half-of-2017/>
- https://disruptivetechasean.com/big_news/singapore-government-launching-centralised-api-exchange-for-convenient-and-secure-inter-agency-data-sharing/
- <https://www.developer.tech.gov.sg/technologies/data-and-apis/apex.html#!>
- <https://www.tech.gov.sg/files/media/media-releases/2019/May/Annex%20D%20Factsheet%20-%20Smart%20Nation%20Sensor%20Platform.pdf>
- <https://www.scu.edu/ethics/focus-areas/internet-ethics/resources/smart-lampposts-illuminating-smart-cities/>

Policy best practices

- Invest in new technologies in sensors and communications infrastructure to collect new data and enable innovative use cases.
- Ensure intellectual property derived from public open data remains public and cannot become private intellectual property rights.

Notes

- <https://www.smartnation.gov.sg/what-is-smart-nation/initiatives>

Case Study 10: Switzerland – Federal Roads Office’s Open Data Platform for Mobility

The Swiss Federal Railways (SBB) and the Swiss Federal Roads Authority (FEDRO) collaborated to extend the open data platform for mobility in 2019, which initially contained real time public transportation data. In April 2020, motorized individual traffic data (e.g., count and type of cars and trucks collected from street-level sensors) became available. Switzerland has generally adopted a forward-looking approach in its digital strategy, especially about anticipating automated vehicles and managing traffic and innovation to enhance efficiency and safety and reduce carbon emissions on the road network.¹

Policy Framework	Relevant Projects and Policy Measures
Data Collection and Merging	<ul style="list-style-type: none"> The Open Data Platform for Mobility was initially developed in 2016 to centralize and publish public transportation data. In 2019, FEDRO decided to include data from the individual motorized traffic to provide a single access for mobility data. At the time, there was a match of demand (interest from Zurich and cantons) and supply (enforcement of the delegated acts of the European Commission). The Open Data Platform for Mobility does not contain any personal data. However, user registration data are subject to the Federal Data Protection Act. Opendata.swiss is the nation’s central catalogue for open government data, a core component of Open Government Data Strategy in Switzerland 2019 – 2023. FEDRO’s metadata are published here.
Data Standards	<ul style="list-style-type: none"> FEDRO provides technical support to standardize data before publication on the Open Data Platform for Mobility, which assists cities who do not have the capacity. Any relevant data standards are used such as internationally recognized standards or those selected by the data platform.
Data Infrastructure	<ul style="list-style-type: none"> The Open Data Platform for Mobility provides access to data through APIs. The development and operations of the technology platform has been outsourced to the IT service provider SBB.^a The opendata.swiss portal was developed using open-source software.^b
Governance and Accountability	<ul style="list-style-type: none"> The Digital Switzerland Strategy 2020-2022 defines a vision for intelligent, networked, and efficient mobility. The partial strategy on Intelligent Mobility from FEDRO describes the intentions and steps to be taken in the next four years. It will be soon available on FEDRO’s website. The opendata.swiss portal is a joint project of the Confederation, cantons, communes and other organizations with a mandate from the state, operated by the Federal Statistical Office. The Swiss Data Steward manages the joint storage of metadata, with decentralized data storage managed by local data custodians.^c The Open Data Platform for Mobility is governed jointly by the Federal Office for Public Transportation and FEDRO. The platform does not guarantee any data quality, and neither the platform nor the data providers assume liability for any damages from the use of the platform.^d However, a mandatory quality assessment using absolute quality levels is planned. The rights attached to the delivered data remain the property of each data supplier. However, data providers are required to identify the source and origin of data.

Policy Framework	Relevant Projects and Policy Measures
Use and Analysis	<ul style="list-style-type: none"> • The Open Data Platform for Mobility offers conditional open access to data, as described in the Provision and exchange of data for automated driving in road traffic. For the time being, it is implemented as such: after 6 months of usage, two options maintain access to the data: <ul style="list-style-type: none"> ◦ Data exchange: User publishes its own data on the platform and gains unlimited access to data. ◦ Extension request: Users provide a statement on how they are using the data, and justify why they are not themselves able to publish data on the platform.^e • In the Open Data Platform for Mobility, if the user does not respect the terms and conditions or misuses the data, FEDRO can suspend access and the user will lose the right to use the data.^f

Notes:

- a. <https://www.mentz.net/en/articles/mentz-develops-data-platform-for-swiss-road-transport-and-traffic/>
- b. <https://opendata.swiss/en/legal-framework/>
- c. https://www.unece.org/fileadmin/DAM/stats/documents/ece/ces/2020/S8_Switzerland.pdf
- d. <https://opentransportdata.swiss/en/terms-of-use/>
- e. <https://opentransportdata.swiss/en/road-traffic/>
- f. <https://opentransportdata.swiss/en/terms-of-use/>

Policy best practices

- Adopt the conditional open data principle, where the user, wishing to access data, is required to
- supply their own data in exchange, in the appropriate circumstances to incentivize data sharing among mobility stakeholders in the public as well as the private sectors.
- Develop forward-looking policies in anticipation of new trends or technologies in the mobility market such as automated vehicles and 5G networks.
- Use open-source software where possible to build platforms and technologies for data sharing to reduce costs and competition barriers.

Notes

- 1 https://www.astra.admin.ch/dam/astra/en/dokumente/abteilung_strassennetzeallgemein/Data_AD_Road_Traffic.pdf.download.pdf/dataadroadtraffic.pdf

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This list indicates the substance and range of works and sources consulted in the making of this report, and are listed alphabetically.

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