

# Shaping the next generation of urban mobility and logistics guidance for cities

# Foreword

That connected places are successful places is a truth so widely acknowledged that we consider it self evident. From the dawn of time to the present day, the cities and communities that have thrived and succeeded are those that can move their goods and people quickly, easily and reliably within their boundaries and between themselves and their neighbours.

London is a case study in this enduring truth. Founded at a fording point that connected communities across a river, it's global growth has marched in lock-step with advances in connectivity. It is no co-incidence that the world's greatest city boasts five international airports, the world's first underground rail network and a strategic transport authority which is held up as a model for the world. This focus on connectivity has transcended the analogue age and embraced the digital with a congestion charging system, a contactless payment model and a digitally enabled ultra-low emissions zone that led the world.

Whilst urban connectivity is a topic as old as time, in the globally competitive world of the twenty first century, no wise city will leave the issue to chance. The decisions required to ensure competitive advantage through connectivity are coming at civic leaders fast. The technology that can support their decision making is coming equally fast. This can be confusing & distracting and, at worst, will impede the very progress that they seek to accelerate.

Arcadis, driven by it's enduring mission of '**Improving Quality of Life**', has long pioneered innovation in connectivity. From it's iconic bridge engineering, through it's ground-breaking technologies in road, rail and ports to it's focus on transit-led urban regeneration such as that seen at St Pancras and London Bridge, Arcadis remains restless in it's pursuit of better, more effective urban connectivity.

Our work in the field of urbanism has long left us surprised that the interplay between a city's performance and the technology it uses to optimise it's connectivity is so ad hoc. Too often the connection between the two is based on perception, personal preference or essentially uninformed, distress selection. We know that we can be better than that; that is why we developed FAIR-GO.

FAIR-GO is a simple, easy to use and reliable framework that has been developed in order to harness the multiple technology options to make them a force-multiplier for optimised urban mobility rather than an impenetrable web of often mutually exclusive options. It's adoption enables city planners to combine the clear-headed purpose of antiquity with the digitally enabled sophistication of the mid 21st century.



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# Introduction

**As global population growth continues and urbanisation advances, cities are becoming the dominant spatial, economic and social environments in which daily life unfolds [1]. A growing proportion of the world's population already lives in urban areas, and this share is projected to increase further in the coming decades. This demographic shift places significant pressure on urban systems, including transport networks, public space, service provision and governance structures. At the same time, cities are expected to respond to a wide range of interconnected challenges, such as climate mitigation, air quality improvement, social inclusion, public health, economic competitiveness and spatial equity [2]. Within this context, urban mobility is no longer understood solely as the movement of people and goods between geographical points. Rather, it must be conceptualized as a broader enabler of access, participation and opportunity, closely linked to the social, economic and environmental performance of cities [3].**

**Contemporary urban mobility therefore extends beyond transport efficiency and infrastructure provision. It increasingly encompasses questions of accessibility, affordability, environmental responsibility, social justice and institutional capacity..**

In parallel, cities and local governments are being presented with an expanding set of innovative mobility and urban logistics solutions (for example electric vehicle fleets, shared mobility systems, autonomous shuttles, delivery robots, artificial intelligence-based traffic optimisation, smart curb management, Mobility as a Service (MaaS) platforms, urban freight innovations and other emerging technologies). These interventions may offer significant opportunities to reduce greenhouse gas (GHG) emissions, improve accessibility, optimise infrastructure use, strengthen urban logistics and enhance the quality of public space. However, without careful consideration of how they are implemented and integrated into the existing system, they may also generate new risks and trade-offs, including social exclusion, uneven spatial impacts, increased public expenditure, safety concerns, labor market disruption, data governance challenges and long-term dependency on private vendors or proprietary systems.

As cities navigate this increasingly complex landscape, technology alone will not determine the success of the mobility transition. Equally important are questions of trust, equity, governance and public acceptance. The most successful mobility solutions will be those that not only deliver operational and environmental benefits, but also respond to people's needs, aspirations and lived experiences.

This guidance therefore adopts a human-centered perspective on future mobility. Rather than focusing solely on technological innovation, it seeks to support decision makers in identifying solutions that create lasting value for communities, strengthen accessibility and inclusion, and contribute to healthier, more resilient and more sustainable cities. Ultimately, the goal is not simply to move people more efficiently, but to **improve quality of life** through better mobility and logistics choices and better urban outcomes.



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# What is the purpose of this guidance?

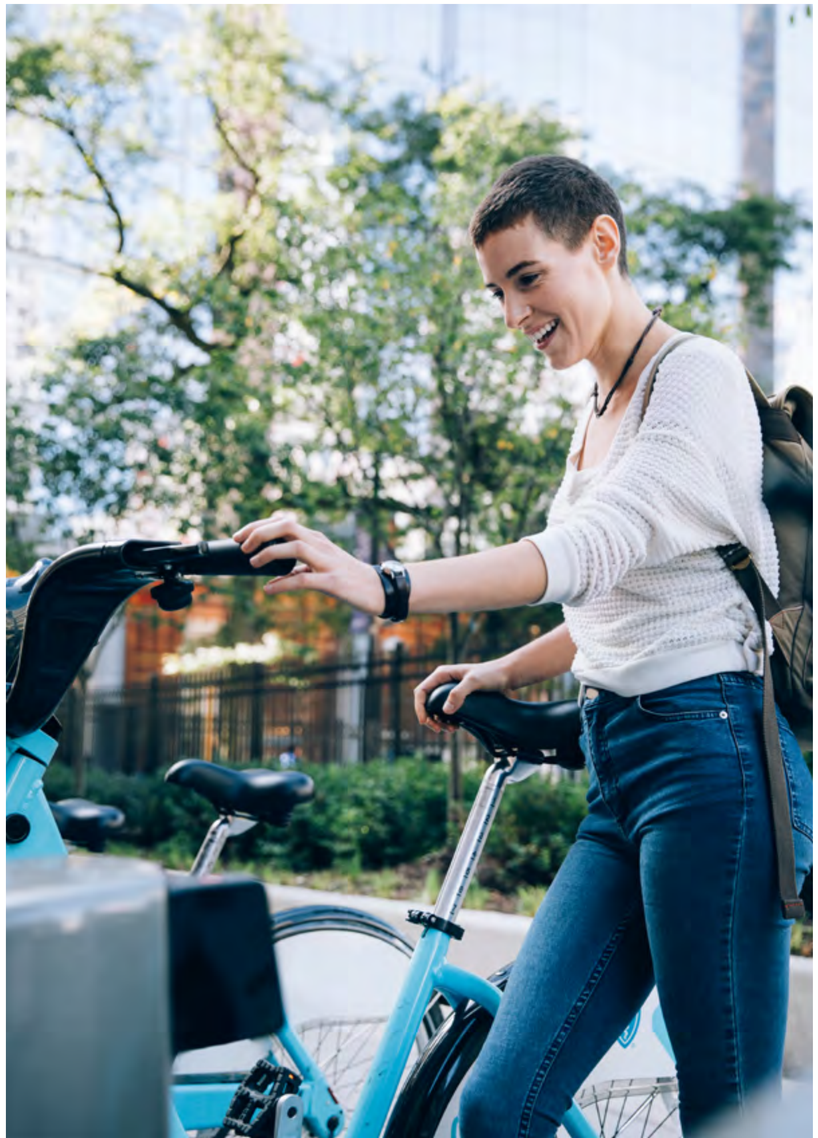
**Against this background, there is a growing need for structured, evidence-based, and context-sensitive guidance that enables cities to critically assess the applicability of emerging mobility and logistics solutions within their specific local conditions. The relevance of a technology cannot be determined solely by its degree of novelty, technical sophistication, or market maturity. Rather, its value depends on whether it can contribute to broader societal objectives and be implemented in ways that are equitable, sustainable, affordable, governable, and responsive to local priorities and needs.**

At the same time, cities and local governments are being confronted with a rapidly expanding range of innovative mobility and logistics solutions. These include electric and automated vehicle fleets, shared mobility services, autonomous shuttles, delivery robots, Mobility-as-a-Service (MaaS) platforms, AI-enabled traffic management systems, smart curb management applications, urban logistics innovations, connected vehicle ecosystems, and other emerging technologies. Advances in artificial intelligence, big data analytics, the Internet of Things (IoT), autonomous vehicles (AVs), and unmanned aerial vehicles (UAVs) are further accelerating the pace of innovation and fundamentally reshaping urban mobility systems. [4]

Many of these innovations offer considerable opportunities. They may contribute to the reduction of GHG emissions, improve accessibility and connectivity, increase the efficiency of transport operations, strengthen urban logistics, enhance the management of public space, and support more sustainable patterns of movement and consumption. Nevertheless, technological innovation does not automatically result in positive societal outcomes. Emerging mobility solutions may also generate unintended consequences, including new forms of social exclusion, increased public expenditure, labor market disruptions, safety concerns, data governance challenges, cybersecurity risks, vendor lock-in, or unequal distributions of benefits and burdens across different population groups and neighbourhoods.

These challenges are particularly relevant in rapidly growing urban areas. While maintaining connectivity between cities remains important, growing urbanisation is increasing the need for efficient movement within cities themselves. Rising congestion, competing demands for public space, and increasing logistics activity place significant pressure on existing urban transport systems [4]. As Rode [5] observes, “Public transport requires urban density whilst car use requires space. In most cities, this has led to extraordinary tensions as a result of the inefficient use of scarce urban space by private vehicles.” The emergence of automated and digitally enabled mobility solutions has the potential to either alleviate or exacerbate these tensions, depending on how they are deployed and governed.

For this reason, cities require robust assessment approaches that move beyond technology-centred evaluations. New mobility planning demands integrated policy frameworks, cross-sectoral coordination, and planning practices that support innovation while ensuring socially inclusive, environmentally responsible, and economically efficient outcomes [6]. The central challenge is therefore not whether an emerging technology works, but whether it contributes to wider urban objectives and can be successfully embedded within existing institutional, spatial, and governance systems.



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This guidance has been developed to support public authorities in navigating an increasingly complex mobility and urban logistics landscape. It provides a systematic framework for evaluating whether a proposed intervention is appropriate for a particular urban context and helps identify the institutional, regulatory, financial, spatial, technological, and social preconditions required for successful implementation. In doing so, the guidance encourages a shift in perspective: away from asking whether a technology is innovative in itself, and towards assessing whether it can create meaningful public value and deliver tangible benefits for people, communities, and urban systems.

Such a perspective is increasingly important as urban mobility is undergoing a profound transformation. Contemporary mobility extends far beyond the traditional notion of moving people and goods between geographical locations. Increasingly, mobility is understood as a mechanism for providing access to opportunities, services, employment, education, social participation, and essential urban functions, while simultaneously contributing to environmental sustainability and quality of life [7]. Consequently, mobility interventions should be evaluated not only on the basis of transport performance, but also in terms of their wider social, environmental, and economic impacts.

This guidance seeks to address precisely this challenge. It helps decision-makers understand whether a particular solution is suitable for their local context and what conditions should be established before it can be responsibly piloted, procured, implemented, scaled, and monitored over time. The objective is not to promote specific technologies, but to support informed and transparent decision-making regarding their applicability, readiness, and potential public value.

Accordingly, the guidance encourages city officials to move from the question:

“Is this technology innovative?”

to the more relevant decision-oriented question:

“Is this solution
**F** air,
**A** ffordable,
**I** mplementable,
**R** esponsible,
**G** overnable and
**O** ptimal in/for our city?”

**Key-takeaways:**

- **From innovation to impact**
  Evaluate solutions by outcomes, not novelty.
- **Trust enables transformation**
  Technology succeeds when people trust it.
- **Improving quality of life**
  Mobility should create healthier, more inclusive, and liveable cities.

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# Why another guidance?

**While a growing body of research, frameworks and policy reports exists on future mobility, many of these resources focus on describing technological developments, forecasting future scenarios, or promoting specific innovations. Relatively few provide practical support for local decision makers facing the day-to-day challenge of evaluating whether a solution is appropriate for their city, neighborhood, governance structure or community.**

The real world success of a solution rarely depends on technology alone. It depends on a complex combination of local circumstances, including institutional capacity, financial resources, political priorities, regulatory readiness, public acceptance, spatial characteristics and social needs. A solution that performs well in one city may prove ineffective, inequitable or inancially unsustainable in another.

This guidance seeks to bridge the gap between technological possibility and practical implementation. Rather than offering another catalogue of innovations or predicting future mobility trends, it provides cities with a structured decision-making framework for assessing when, where, why and under which conditions mobility solutions should be deployed. The emphasis is therefore placed not on technology adoption itself, but on informed decision-making and responsible implementation.

A second differentiating feature of this guidance is its explicit focus on people. While many existing frameworks evaluate mobility solutions primarily through technical, operational or economic performance indicators, this guidance considers broader societal outcomes. It recognises that mobility interventions shape access to opportunities, participation in everyday life, and perceptions of fairness. The most valuable innovations are those that improve access, strengthen trust, foster inclusion and enhance quality of life for current and future generations. Technological innovation alone does not guarantee positive outcomes. Cities must therefore assess not only whether a solution is feasible, but whether it contributes to more inclusive, accessible, equitable and liveable urban environments.

Finally, this guidance acknowledges that the future of mobility is characterised by uncertainty. Rather than prescribing specific technologies or promoting a single vision of the future, it supports adaptive and context-sensitive decision-making. By combining technological, institutional, spatial, financial and social considerations within a single framework, it enables cities to navigate complexity while keeping people, progress and prosperity at the centre of mobility transformation.

Ultimately, this guidance is based on a simple principle: successful mobility transitions are not defined by the technologies cities adopt, but by the outcomes they create for people.



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# Who should use this guidance?



**This guidance is intended for local and regional authorities, public sector decision makers, and practitioners responsible for shaping the planning, governance, delivery, and evaluation of mobility and logistics systems. It is particularly relevant for actors involved in assessing, procuring, regulating, implementing, or monitoring interventions that influence the movement of people and goods and, consequently, affect broader urban development outcomes. The need for such guidance arises from the increasingly complex and cross-sectoral nature of contemporary mobility challenges. Emerging mobility and logistics solutions rarely affect transport systems alone. Instead, they intersect with a wide range of policy domains, including climate mitigation and adaptation, economic development, social inclusion, digital transformation, public health, land-use planning, energy systems, and urban resilience. As a consequence, decisions regarding the adoption and deployment of new mobility technologies increasingly require coordination across multiple departments, governance levels, and stakeholder groups.**

The guidance is particularly valuable when cities and regions are confronted with decisions regarding whether and how to engage with emerging mobility and logistics solutions. Such situations may include the evaluation of novel technologies, the development of pilot projects, the procurement of innovative services, the design of regulatory approaches, the assessment of implementation risks, or the determination of scaling strategies following initial deployment. In these contexts, decision makers are often required to balance innovation objectives against broader societal, environmental, financial, and institutional considerations.

Importantly, the guidance is not intended to function solely as a technical assessment tool. Rather, it supports a more comprehensive evaluation of whether a proposed intervention is capable of generating public value within a specific local context. This requires consideration not only of technological performance, but also of governance capacity, affordability, social acceptance, environmental impacts, operational feasibility, and long-term sustainability. The guidance therefore provides a structured basis for integrating diverse perspectives and objectives into a coherent decision-making process. The guidance is especially relevant in institutional environments where responsibilities for mobility are distributed across multiple departments or agencies. In such settings, it can facilitate interdepartmental coordination by providing a common assessment language and a shared analytical structure. This can support improved communication among transport planners, environmental specialists, digital governance teams, procurement officers, infrastructure managers, elected officials, and external stakeholders, thereby contributing to more transparent and evidence-based decision-making.

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At the same time, many public authorities face significant capacity constraints when evaluating highly innovative and rapidly evolving mobility solutions. Technologies such as autonomous vehicles, AI-driven mobility services, digital platforms, connected infrastructure, automated logistics systems, and advanced data ecosystems involve complex technical, regulatory, organisational, financial, and ethical considerations. Municipal administrations often possess substantial contextual and operational knowledge but may not have access to the specialized expertise required to comprehensively assess all dimensions of these emerging systems. For this reason, the use of independent external expertise should be considered an important component of the assessment process, particularly for projects characterised by high levels of complexity, uncertainty, or innovation. Specialist consultants, academic institutions, research organisations, legal experts, and technical advisors can provide valuable support in areas such as technology assessment, business case evaluation, regulatory analysis, stakeholder engagement, risk management, procurement strategy, data governance, cybersecurity, and implementation planning.

External expertise can further contribute to the objectivity and robustness of assessments by providing independent evidence, comparative benchmarking, and insights from international best practice. This is particularly important where public authorities must assess technologies or business models promoted by private vendors, navigate rapidly changing markets, or anticipate long-term impacts that may not yet be fully understood. Independent review can therefore strengthen decision quality while reducing implementation risks and avoiding technology-driven decision-making. However, external expertise should complement rather than substitute local knowledge. While specialist advisors can provide technical and methodological support, public authorities remain best positioned to understand local priorities, spatial conditions, institutional structures, political objectives, and community needs. The most effective evaluation processes therefore combine local knowledge, stakeholder perspectives, and independent expert input within a shared analytical framework.

Ultimately, this guidance is intended for all actors seeking to make informed and accountable decisions regarding the future of urban mobility and logistics. By providing a structured and evidence-based assessment framework, it enables decision makers to move beyond technology-centered evaluations and towards a more comprehensive understanding of implementation success. In doing so, it supports the identification of solutions that are not only technically feasible, but also socially desirable, environmentally sustainable, economically viable, institutionally feasible, and capable of generating long-term public value for cities and communities.



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# Methodology and development approach

This section outlines the rationale and methodological foundation behind the development of the guidance. It explains why the guidance was created, which challenge it is intended to address, and how its overall approach supports more informed, transparent, and implementation-oriented decision-making. In doing so, it provides the context for understanding the guidance not simply as an assessment tool, but as a practical bridge between innovation providers and public authorities navigating complex urban mobility and logistics decisions.



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# Why this guidance was developed

**Cities are increasingly required to make decisions regarding innovative mobility and logistics solutions that seek to address complex urban challenges, including decarbonisation, accessibility, congestion, public space management, economic competitiveness, and urban resilience. At the same time, rapid advances in automation, electrification, artificial intelligence, digital platforms, and connected mobility are generating an expanding range of technologies, services, and business models available for deployment. While these innovations present significant opportunities, cities often face a fundamental question: not whether a solution is technologically advanced, but whether it is appropriate for their specific context. Public authorities must determine whether a proposed intervention can deliver meaningful benefits, align with local policy objectives, and be implemented within existing institutional, regulatory, financial, and operational conditions. At the same time, solution providers frequently struggle to understand the broader evidence requirements that shape public sector decision-making, including considerations of equity, affordability, governance, long-term sustainability, and public value.**

As a result, a disconnect often emerges between innovation supply and implementation demand. Technologies may demonstrate strong technical performance yet not be the best suited to address local priorities, generate public acceptance, or fit within existing governance and delivery structures.

The guidance is founded on the principle that successful implementation depends on more than technological readiness alone. Mobility interventions must also be **Fair**, **Affordable**, **Implementable**, **Responsible**, **Governable**, and ultimately **Optimal** in their ability to address identified challenges and create sustainable public value. These dimensions form the basis of the **FAIR-GO** Framework and provide a structured approach for assessing whether a solution is appropriate, feasible, and beneficial within a given urban context.

The purpose of this guidance is therefore not to identify the most innovative technology, but to support evidence-based decisions regarding which solutions are most likely to deliver equitable, sustainable, affordable, and scalable outcomes. By linking technological innovation to broader societal, environmental, economic, and governance objectives, the guidance helps cities move beyond technology-centered decision-making and towards a more holistic assessment of implementation readiness and long-term public value.



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# Development approach




*Figure 1: stages of the development approach*

**The guidance has been developed through a multi-stage process, as can be seen on Figure 1.**

## Stage 1 — understanding the provider perspective

The first phase of the research process centred on qualitative interviews and structured discussions with WBCSD implementation partners, defined here as organisations engaged in the development, operation, and commercialisation of innovative mobility and logistics solutions. This phase was designed to generate an empirically grounded understanding of implementation from the perspective of solution providers and to identify recurring patterns, constraints, and enabling conditions relevant to city-level deployment.

The goal of these interviews was to explore how private- and market-facing actors understand the implementation process, how they navigate engagement with public authorities, and where key tensions emerge in the interaction between solution supply and public-sector demand. In particular, we wanted to understand the types of information, evidence, and institutional conditions that shape the feasibility of deployment and scaling in urban contexts. The partners we have interviewed can be seen on Figure 2.

## Our implementation partners

**Insights from leading organisations across the mobility and logistics ecosystem**

We interviewed a diverse group of organisations to capture a range of strategic and operational perspectives across the mobility and logistics ecosystem.

**People. Places. Progress.**

**Private-sector implementation partners**

Companies bringing innovative solutions and operational experience to urban mobility and logistics.

amazon · FUJITSU · CLYDEWAYS · LA POSTE · MOIA · Port of Rotterdam · Royal Mail · wattsy

**City networks and innovation catalysts**

Organisations supporting cities through knowledge exchange, collaboration and innovation.

ICLEI — Local Governments for Sustainability

SOLARIMPULSE FOUNDATION — Efficient Solutions for a Sustainable Future

UITP ADVANCING PUBLIC TRANSPORT — Advancing Public Transport Together

**Towards more sustainable inclusive and liveable cities.**

*Figure 2: partners interviewed in the scope of the preparation of this guidance.*

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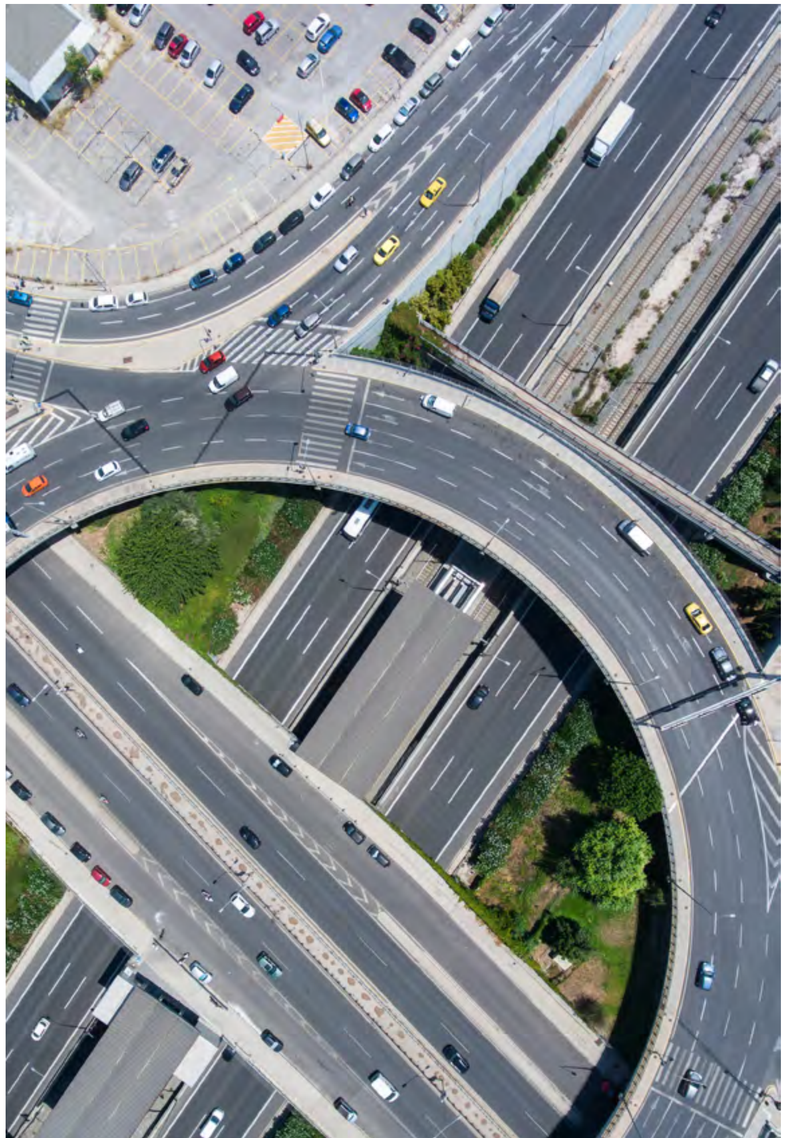
Via these interviews we have explored:

- how providers approach implementation;
- what barriers they encounter when engaging with cities;
- what information cities most frequently request;
- where uncertainty arises in market-city collaboration;
- what evidence providers can realistically produce;
- what conditions are necessary for successful deployment and scaling.

The interview sample consisted of a diverse group of senior executives drawn from WBCSD partner organisations operating in or connected to the mobility sector. The selection of participants was intended to capture a range of strategic and operational perspectives across different segments of the market, as well as city networks, and innovation support organisations. Engaging senior-level participants enabled the research to incorporate both high-level strategic considerations and practical implementation experience.

A semi-structured and predominantly open-ended interview format was adopted in order to support exploratory inquiry and allow participants to articulate their perspectives in depth. This methodological choice was made to avoid overly constraining responses and to create sufficient space for participants to reflect on their experiences, identify emergent issues, and elaborate on context-specific challenges and opportunities. The open-ended nature of the interviews was particularly important given the complexity and evolving character of the mobility innovation landscape, where many relevant implementation issues are not easily captured through closed or standardised questioning alone.

This approach yielded rich qualitative material, enabling the identification of recurring themes and cross-cutting insights related to city provider interaction, evidence expectations, implementation barriers, and deployment conditions. The findings from this phase informed the development of the guidance by ensuring that its structure and content were grounded in practitioner experience and responsive to the realities of implementation as understood by market actors.



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## Stage 2 — understanding the city perspective

The second phase of the research focused on understanding implementation from the perspective of cities. While the first phase explored how solution providers approach deployment and engagement with cities, this phase sought to better understand how cities evaluate, govern, and ultimately decide whether and how innovative mobility and logistics solutions should be implemented.

To achieve this, a series of qualitative interviews and structured discussions were conducted with Arcadis City Executives across Europe, Brazil, China, and North America (see Figure 2). The City Executives selected for the study brought a particularly valuable perspective, as they combine extensive international experience with deep local knowledge. Through their work, they maintain broad professional networks within cities and municipal administrations and, in many cases, have themselves spent many years working for cities, public authorities, or within local government. This enabled the research to draw not only on formal city perspectives but also on insights from professionals with first-hand experience of urban governance, policy development, and implementation challenges.

The objective of this phase was to identify how cities make decisions regarding emerging mobility and logistics solutions, what information they require, how risks and opportunities are assessed, and which factors influence whether a solution progresses from experimentation to long-term implementation.

More specifically, this phase explored:

- how cities make decisions about innovative mobility and logistics solutions;
- what types of evidence, performance data and business cases cities require before taking action;
- which information cities frequently find missing when evaluating new solutions;
- how cities assess implementation risks, public value, political feasibility and operational readiness;
- how local context influences decision-making priorities;
- what enables productive collaboration between cities and solution providers; and
- what distinguishes a solution that is ready for deployment at scale from one that is only suitable for a pilot project, regulatory sandbox, demonstration programme or monitoring watchlist.




*Figure 3: cities within Arcadis' executives' expertise.*

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A semi-structured interview approach was adopted to allow participants to reflect on both strategic priorities and practical implementation experiences. This facilitated a deeper understanding of the institutional, political, financial and organisational factors that influence decision-making within cities. Given the diversity of urban contexts represented in the research, the open-ended interview format also enabled participants to highlight locally specific opportunities and challenges while at the same time revealing common patterns across cities and regions. The findings from this phase provided a critical counterbalance to the provider perspective gathered in Stage 1. By comparing and synthesizing insights from both groups, the study was able to identify areas of alignment and divergence between cities and solution providers. These insights directly informed the development of the guidance, ensuring that it reflects both the realities of innovation development and the practical considerations that shape urban decision-making and implementation.

This comparative perspective became particularly important for identifying information gaps, evidence requirements, governance considerations and deployment criteria that can help both cities and providers engage more effectively throughout the implementation process.

### Stage 3 — understanding the scope and setting the standards for implementation in the five impact areas

Insights from providers and cities have allowed us to narrow the themes to be addressed down to five impact areas:

**Environmental sustainability;**

**Accessibility, equity and social inclusion;**

**Economic sustainability and funding;**

**AI, data and digital governance;**

**System integration and implementation readiness**

Our aim is to provide an overview of the thornier issues pertaining to these impact areas and distinguish between two levels of performance that potential solutions can be assessed against.

- **The first one, minimum standard – do no harm –,** whereby a solution should not create negative impacts.
- **And a second one, additional public value – net positive contribution –**, whereby a solution may go further and actively contribute to goals the city has concerning that impact area.

The idea is that while not every solution must deliver transformational gains in every impact area, they should not create avoidable harm, further worsening the situation at the start of the intervention.

### Stage 4 — designing the FAIR-GO framework of public value assessment

In the final stage, the evidence and standards developed across the five impact areas were translated into the FAIR-GO Framework. The framework provides six dimensions, through which cities can interpret the assessment findings, identify trade-offs and determine whether a solution should proceed, be adapted, piloted, monitored or rejected.

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# Scope of action and underlying principles

**The purpose of this methodology is not to determine whether a technology is innovative. Its purpose is to help cities understand whether a solution can create public value in a particular local context, what evidence is required to support that conclusion, and what conditions must be in place to move from ambition to successful implementation. The guidance applies to both market-ready and pipeline solutions. Figure 4 displays some examples of future urban mobility and logistics solutions divided into three groups for easier understanding, even if some solutions may combine several categories, for example a shared electric micro vehicle system that serves both passenger mobility and light logistics.**



**Passenger mobility solutions**

- autonomous shuttles;
- ridepooling;
- shared mobility;
- demand-responsive transport;
- Mobility-as-a-Service platforms;
- micromobility;
- public transport optimisation tools;
- unmanned aerial vehicles (UAV).



**Urban logistics solutions**

- cargo-bike logistics;
- e-vans and electric freight fleets;
- parcel lockers;
- urban consolidation centres;
- smart loading zones;
- delivery robots;
- drone logistics;
- autonomous freight vehicles;
- digital freight platforms;
- unmanned aerial vehicles (UAV).



**Enabling systems**

- AI traffic management;
- digital twins;
- curb-management platforms;
- charging infrastructure;
- IoT and sensor systems;
- fleet-management platforms;
- data-sharing systems.

*Figure 4: examples of urban mobility and logistics future solutions*

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Before applying the guidance, cities should keep four overarching principles in mind.

## Focus on public value

The starting point should not be whether a solution is new, digital, automated, or technologically advanced. Instead, the key question is whether the solution addresses a genuine urban challenge and creates value for people, communities, the environment, and the wider mobility system.

Innovation matters, but its ultimate relevance depends on its ability to support local priorities and contribute to better outcomes.

## Minimize negative impacts and maximise positive outcomes

Not every solution will deliver benefits across all assessment areas, and different cities may prioritise different outcomes. However, every solution should, at a minimum, avoid creating significant negative impacts and, where possible, contribute positively to broader public objectives.

The assessment therefore considers two complementary questions:

- **Do no harm:** Does the solution avoid creating unacceptable environmental, social, operational, financial, or governance risks?
- **Creating additional value:** Does the solution contribute to public goals such as improved accessibility, reduced emissions, greater inclusion, enhanced affordability, stronger governance, or increased system resilience?

This distinction enables cities to evaluate solutions in a balanced and transparent manner, recognising both potential risks and potential benefits.

| Assessment Outcome | Interpretation |
|---|---|
| **Significant negative impacts** | Reconsider, redesign, or mitigate before implementation |
| **No significant negative impacts** | Suitable for further consideration |
| **Clear positive contribution** | Strong potential to deliver public value |

While not every solution is expected to generate benefits across all Impact areas, all solutions should meet the relevant minimum expectations and demonstrate a clear pathway towards delivering value within the local context.



## Find what works best for your city

There is no “one-size-fits-all” solution. What works well in one city may be unsuitable in another due to differences in geography, governance structures, infrastructure, demographics, financial resources, or policy priorities. The objective of this guidance is therefore not to identify a “best” technology, but to help cities determine which solutions are most appropriate, feasible, and beneficial within their specific local circumstances.

| Result | Interpretation |
|---|---|
| **Causes harm** | **Not acceptable or requires redesign** |
| **Neutral / no significant harm** | **Potentially acceptable** |
| **Net positive contribution** | **Preferred or higher public value potential** |

Not every solution will actively contribute to every impact area. However, every solution should meet the relevant minimum standards.

Taken together, these principles encourage cities to move beyond technology-led decision-making and towards a more holistic assessment of how mobility innovations can create lasting value for people, places, and the planet.

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Economic sustainability and funding

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# The five impact areas

Cities face increasingly complex decisions when assessing innovative mobility and logistics solutions. New technologies and business models rarely affect only a single aspect of urban life. A solution introduced to address one challenge, such as congestion, freight efficiency or accessibility, may also influence environmental outcomes, public finances, social inclusion, data governance, infrastructure requirements and long-term city operations.



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**As a result, effective decision-making requires a holistic perspective. Focusing too narrowly on a single objective can overlook unintended consequences and lead to solutions that perform well in one area while creating challenges in another. For example, a solution that improves operational efficiency may inadvertently exclude certain user groups; a solution that reduces emissions may prove financially unsustainable; or a technologically advanced system may create governance, privacy or interoperability concerns that limit its long-term value.**

For this reason, the framework is organised around five impact areas:

- Environmental sustainability
- Accessibility, equity & social inclusion
- Economic sustainability & funding
- AI, data & digital governance
- System integration & implementation readiness

These areas were selected at the outset of the project to provide a balanced assessment framework covering the environmental, social, economic, governance and implementation dimensions of innovative mobility and logistics solutions. Together, they reflect key areas that cities frequently need to consider when deciding whether a solution should be deployed, piloted, monitored, scaled or rejected.

The purpose of selecting these five areas was not to create a rigid assessment framework or a pass-fail checklist. Instead, they provide a structured way of examining whether a solution can create public value while avoiding unintended consequences in other parts of the urban system.

The interviews with WBCSD implementation partners and city officials were subsequently structured around these five impact areas. The objective of those conversations was not to determine which impact areas should be included, but rather to better understand:

- how solution providers approach each area;
- how cities evaluate and prioritise each area;
- what evidence is typically available;
- what information is often missing;
- which implementation barriers arise most frequently;
- what conditions enable successful deployment.

The resulting framework therefore combines a predefined public value structure with practical implementation insights gathered from both market actors and city decision-makers.

Together, the five impact areas address two fundamental questions that cities must answer before supporting innovation:

- Does the solution meet minimum public interest standards?
- Does the solution have the potential to create additional public value?

The following sections examine each impact area in more detail. For each area, the guidance outlines why the topic is important, the public value standard against which solutions can be considered, common implementation watchpoints, the information cities may wish to collect, and practical guidance for implementation and decision-making.



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## Impact area 1:

# Environmental sustainability

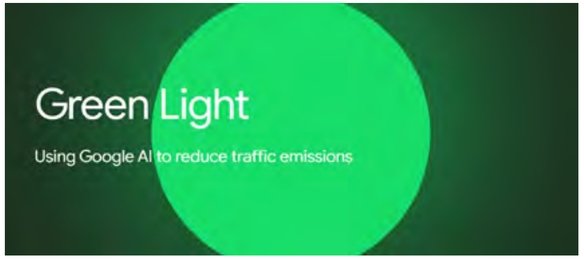
**Edward Glaeser claimed in his book "Triumph of the City", that we maximize our damage when we insist on living surrounded by greensward, as lower densities inevitably mean more travel. That is why compact city planning and development has been the preferred response to the challenges of sustainable development , over the last 30 years or so.** [8] **Approaches trying to promote proximity and therefore reduction in distance travelled, such as the 15-Minute city, have gained a lot of traction, even so far as being championed by cities as the city of Paris. According to Carlos Moreno, the main defender of this approach, when we move closer together geographically, we create the conditions for a more balanced, sustainable, and humane life.** [9]

## But if surrounding ourselves with green spaces is not the solution to fostering environmental sustainability, then what is?

It is clear to us that under environmental sustainability a vast array of challenges can be identified. In the scope of this guidance, we are limiting ourselves to broader and bigger factors such as GHG emissions, land use and road congestion, air and noise nuisance, and energy efficiency.

In Europe, more than 70% of citizens live in urban areas, and these cities, towns and suburbs generate around 23% of all transport GHG. [10]. In these urban areas these emissions are felt and have a direct negative impact on quality of life of urban dwellers: it hits them in their everyday life, while walking their children to school, going for a bike ride or waiting for the bus to work. Given the prevalence of this issue, starting 1992 with the first international Treaty on climate change from the United Nations Framework Convention on Climate Change (UNFCCC), there have been several agreements, attempting to bring relevant stakeholders together to commit to reducing GHG emissions. In 2015, the Paris Agreement, asked every nation to set its own emission reduction goals. Its overarching target: hold the increase in global average temperature to well below 2°C above pre-industrial levels, while pursuing efforts to limit warming to 1.5°C. [11] To achieve the goals of the Paris Agreement, a significant reduction in transport emissions is needed by 2050 [12]

- **Avoid:** Minimizing unnecessary travel, for instance by fostering the 15-Minute city, as well as incentivising telework and carpooling.
- **Shift:** Moving toward lower emission alternatives, for example, incentivizing electrification as well as the use of lower-emission fuels, using public transport instead of private cars, encouraging active travel.
- **Improve:** Enhancing efficiency and performance of existing systems, such as retrofitting fleets, or supporting fuel-efficient routing.




### *Green Light by Google*

*An excellent example of an "Improve" measure, this AI-powered traffic-signal optimisation tool that helps cities reduce stop-and-go traffic, lowering fuel consumption, emissions and congestion by improving the performance of existing road infrastructure.*

Another common issue is urban congestion, which is what happens, when the number of motorized vehicles on roads exceeds the capacity of the latter, leading to increased travel times and from stop-and-go driving patterns. It is a pressing challenge, driving up emissions and compromising transport efficiency [14] , as well as generating waste of time, waste of energy and deterioration of air quality, health and climate.

The resulting traffic slowdowns can have a wide range of negative impacts on people and on the business economy, including impacts on air quality (due to additional vehicle emissions), quality of life (due to personal time delays and noise), and business activity (due to the additional costs and reduced service areas for workforce, supplier and customer markets) [15] As Melissa Bruntllet so eloquently puts it "People who live in big cities are used to the churning sounds of passing cars. But just because we don't perceive it, doesn't mean our body isn't having a physiological response to what's happening." [16]

The issue of parking in urban areas, is also a relevant contributor to congestion. Cruising for parking can account for between 15% and 75% of traffic volume in downtown Los Angeles, and in 2024, Istanbul was at the top of the list of surveyed cities worldwide with the most hours lost due to congestion (105 hours per driver per year), followed by New York City and Chicago (102 hours each) as well as London (101 hours). Congestion in the European Union (EU) cost nearly an estimated 110 billion EUR annually, or 1% of the region's GDP, in 2019. [17] It is therefore clear that traffic congestion influences economy and environment due to its manifold interactions with economic, social and environmental issues. [18]

[1] Issues such as fauna and flora conservation, biodiversity, resource efficiency and circularity will not be considered in this guidance.

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Where the sheer amount of private motorised transport (PMT) cannot be immediately reduced, advances in big-data collection and processing, as well as AI technologies, now enable adaptive traffic signals, offering a promising strategy for congestion mitigation (see “Green Light by Google”).

However, the main goal shall be to reduce the usage of PMT at all costs, especially when considering that most vehicles don’t use their occupancy to their full capacity, and many carry only the driver. This reality reduces the capacity of our roads (considering number of travellers per kilometre of paved road) greatly. Again, the concept of the 15-Minute city can support the creation of secondary and satellite centres, relieving pressure from “the” centre, allowing socio-economic dynamics to be developed that can reduce distances travelled and congestion and allowing for a modal shift towards public transport or active travel modes.

For instance, a study from Fan and Harper [18] indicates that replacing short private vehicle trips with micromobility is a feasible solution to mitigate traffic congestion. Similarly, replacing short car trips with more active modes such as walking or cycling could be a quick win in everyday life [19], positively contributing to the reduction of emissions and congestion, as well as promoting health and wellbeing. One of the upsides of active and accessible transport is that, aside from contributing to GHG emission reductions, it promotes social interaction, as well as engagement and collective responsibility with shared spaces. [20]

Energy consumption and sources are also a pressing subject, as not only they will have an impact on GHG emissions, but also on air and noise nuisance, [20] and therefore reducing GHG emission and congestion as a whole also leads to improvements in regard to air and noise pollution, which are directly correlated with a higher quality of urban life.

Active travel modes such as cycling and walking, in combination with public transport can act as a catalyst into relieving cities from the intensive use of PMT. However, these have to be perceived as attractive alternatives: clean, comfortable, direct, dignified and inclusive (more on inclusivity when we elaborate on impact area 2). Many cities lack the necessary pedestrian paths, bike lanes and traffic-calming measures that ensure safe and convenient travel for walkers and cyclists. Compact land-use planning – particularly transit-oriented development (TOD) that is designed to be compact, walkable and mixed-use to reduce the need for car ownership and use – has a large impact on reducing emissions, in addition to improving health and equity. Prioritising inclusive, mixed use, walkable, cyclable and TOD increases access for all, including vulnerable and marginalised groups. [20]

*“The local infrastructure for charging will have to become a commodity.”*

***Christian Guénod, Wattsy***



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When it comes to energy efficiency, most solutions aimed at reducing congestion will indirectly have a positive impact on energy efficiency. In Europe, many Member States have come up with tax exemptions, purchase grants, scrappage schemes, and corporate tax benefits to promote EV adoption. Electric vehicles reduce fossil fuel consumption and emissions, especially if electricity is generated using renewable resources. This may be however partly offset if their low operating costs induce additional vehicle travel. [6]

Still, despite diversification efforts and recent rapid increases in electric vehicles, fossil fuels still accounted for 95.4% of the transport sector's energy consumption in 2023 [21] Also, their subsidies tend to be regressive, (lower income people's taxes tend to subsidise wealthy motorists) [6], therefore benefitting those who are in a better place financially from the get go, and who are usually the culprits of higher GHG emissions in the first place. Eliminating the remaining internal combustion engines and replacing them with brand new electric vehicles is not an ideal option from an ecological and economic perspective (consumption of non-renewable resources, greenhouse gas emissions, waste).

However, electric vehicles are particularly beneficial when used for high annual mileage such as taxis, buses, service vehicles and freight trucks. [6]



***La Poste*** *and* ***Royal Mail*** *are both advancing the electrification of large operational fleets as part of their decarbonisation strategies. Their experience highlights the value of prioritising high-utilisation vehicles, where environmental benefits are maximised and fuel savings can be realised most quickly. Both organizations stressed that successful fleet electrification requires more than replacing vehicles: charging infrastructure, depot operations, energy supply and workforce adaptation must be planned as part of an integrated transition.*

*Large fleets such as postal vehicles, delivery vans, buses and service vehicles are often among the most effective early candidates for electrification.*

**Key-takeaways:**

- Sustainability starts with reducing the need to travel. Compact urban development, proximity and the 15-minute city can reduce distances travelled and support more efficient mobility systems.
- Congestion is both an environmental and economic challenge. It increases emissions, energy consumption, travel times and costs for people, businesses and cities.
- Walking, cycling and public transport deliver multiple co-benefits. They reduce emissions and congestion while improving health, accessibility and quality of life.
- Electrification is necessary, but not sufficient. Environmental gains depend on how vehicles are used, how energy is generated and whether overall dependence on private motorised transport is reduced.
- Environmental performance should be assessed from a system and lifecycle perspective. The key question is not whether a solution is electric or digital, but whether it delivers a measurable net environmental benefit in the local context.

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# Standards for implementation

**A solution does not need to generate transformational environmental. However, some solutions may go beyond avoiding harm and make a positive contribution to environmental objectives, even when environmental sustainability is not their primary purpose. Such additional benefits represent an important source of public value.**

**Minimum standard — do no harm**

**This includes avoiding:**

- increases in greenhouse gas emissions;
- deterioration of air quality;
- increased noise exposure;
- increasing energy consumption and/or reducing energy efficiency;
- increased congestion;
- increasing kilometers traveled;
- excessive resource consumption;
- rebound effects that offset environmental benefits.

**Additional public value — net positive contribution**

**This includes:**

- reducing greenhouse gas emissions;
- improving air quality;
- reducing noise exposure;
- improving energy efficiency;
- reducing congestion;
- reducing vehicle kilometers traveled;
- supporting modal shift to public transport, walking and cycling;
- supporting circular economy principles;
- reducing resource consumption.

Environmental performance should be assessed according to the widely recognized 'Avoid-Shift-Improve' hierarchy. Priority should be given to solutions that reduce the need for travel, vehicle use or freight movements.

- **Avoid –** Priority should be given to solutions that reduce the need for travel, vehicle use or freight movements.
- **Shift –** Priority should be given to shifting passengers and goods towards lower-impact modes.
- **Improve –** Technological improvements remain important but should not substitute for Avoid and Shift measures.



| Avoid | Shift | Improve |
|---|---|---|
| compact urban development; | walking; | vehicle electrification; |
| transit-oriented development; | cycling; | cleaner fuels; |
| 15-minute city approaches; | public transport; | more efficient routing; |
| freight consolidation; | shared mobility; | intelligent traffic management; |
| digital alternatives to physical trips where appropriate. | rail freight; | vehicle efficiency improvements. |
| | low carbon parcel-distribution systems; | |
| | urban consolidation systems | |

*Figure 5: measures under the avoid – shift – improve hierarchy (examples)*

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Cities should be cautious of solutions that focus exclusively on **Improve** measures while leaving travel demand and mode choice unchanged.

Environmental performance should be evaluated at the system level rather than at the level of a single vehicle, technology or trip.

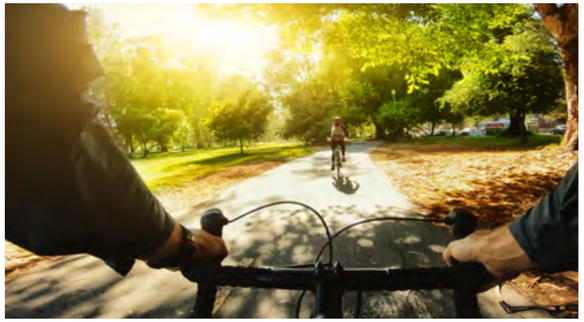
Cities should consider:

- induced demand;
- modal shift effects;
- congestion impacts;
- occupancy and load factors;
- impacts on public transport ridership;
- impacts on walking and cycling;
- freight movement patterns;
- interactions with land use.

Solutions that improve the performance of one component while worsening overall system outcomes should not automatically be considered environmentally beneficial.

## Leave no one behind

Environmental sustainability and social inclusion should be mutually reinforcing. Environmental measures should not disproportionately burden groups that already experience transport disadvantage. Aspects such as affordability, accessibility, impacts on vulnerable users, as well as distribution of environmental benefits and burdens need to be carefully considered. Environmental improvements should contribute to healthier, more liveable and more inclusive urban environments for all residents.



### *Amazon – E-Cargo Bikes and Urban Micro-Hubs*

*Amazon's e-cargo bike delivery model uses urban micro-hubs to transfer parcels from larger vehicles to electric cargo bikes for the final delivery stage. By replacing van trips in dense urban areas, the approach helps reduce emissions, congestion and pressure on public space.*



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# Implementation watchouts – what to look out for

**Environmental sustainability is often presented as a straightforward objective, yet environmental impacts can be surprisingly difficult to assess. Cities should therefore approach environmental claims with a healthy degree of scrutiny. Promised reductions in emissions, congestion or energy use should always be supported by transparent methodologies, realistic assumptions and clearly defined baseline scenarios. A solution that appears sustainable in principle may perform very differently once deployed in a specific urban context.**

Particular attention should be paid to initiatives that focus exclusively on tailpipe emissions.

Cities should also be cautious when assessing electric, automated, shared or digitally enabled solutions. These technologies can contribute meaningfully to sustainability objectives, but only under the right conditions. Replacing private car trips with cleaner alternatives may reduce emissions and congestion; replacing walking, cycling or public transport with those same solutions may achieve the opposite outcome. Environmental performance should therefore be **evaluated at the level of the transport system** rather than at the level of an individual vehicle or technology.

Another important consideration concerns rebound effects. Improvements in efficiency and convenience can sometimes generate additional travel demand. Lower operating costs may encourage more kilometers traveled, while logistics optimisation can result in more frequent deliveries rather than fewer unnecessary vehicle movements. Similarly, efforts to reduce congestion may induce new traffic demand over time, recreating the very pressures they were intended to alleviate.

### Red flags for environmental sustainability

- Solution claims large emissions reductions but provides no methodology
- Environmental assessment focuses only on operational emissions
- New mobility services attract only users from public transport, walking or cycling
- Lower operating costs create additional travel demand
- Infrastructure impacts are excluded from calculations
- Biodiversity and land-use impacts are not assessed
- Delivery optimisation results in more trips rather than fewer

Finally, cities should be careful not to reduce environmental sustainability to climate impacts alone. Air quality, noise exposure, biodiversity, land consumption, loss of green space and resource use are equally relevant considerations. A solution that reduces GHG emissions but increases impermeable surfaces, consumes large quantities of scarce materials or causes environmental degradation elsewhere may not deliver a genuinely positive environmental outcome. Environmental sustainability should therefore be understood as a system-wide objective that balances climate goals with broader environmental quality and long-term urban livability.

**Cities should evaluate environmental outcomes, not technological labels. The key question is not whether a solution is electric, digital or shared, but whether it delivers a measurable net environmental benefit in the local context.**



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# Information cities should seek




**Environmental benefits should be demonstrated rather than assumed. Cities should therefore seek sufficient information to understand whether a solution is likely to deliver a genuine environmental improvement in the local context and whether potential negative impacts have been adequately considered.**

At a minimum, cities should request information on:

- the methodology used to calculate environmental impacts and emissions reductions;
- expected effects on travel behavior, modal shift, vehicle kilometres traveled and logistics activity;
- energy consumption and energy sources;
- potential impacts on air quality, noise and public space.

Particular attention should be paid to the assumptions underlying environmental claims and to the baseline against which improvements are measured. Where possible, cities should seek evidence based on the expected local use case rather than on generic or theoretical performance estimates. A model checklist that can be used by interested cities, to check which information to look for (available upon request).

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## Impact area 2:

# Accessibility, equity and social inclusion

**According to Curl [22], improving accessibility has long been an aim of transport planners and is generally seen as a normative policy goal within transport planning. Depending however on context and framing, what one means when discussing accessibility can vary widely. Accessibility can refer to physical mobility, social or digital inclusion, availability of services, economic opportunities, and participation in society. [23] In the past, small improvements such as ramps for accessing pedestrian crossings or getting on a bus, were already met with enthusiasm, as if the right way forwards towards a fairer world, but our common understanding of the wide range difficulties experienced by public transport users has raised the bar when it comes to what users expect from urban transit systems nowadays.**

**Yet one could ask to which extent accessibility to urban transit systems plays a role in society as a whole? As cities grow and mobility becomes increasingly intricate, ensuring fair access to transportation resources is a crucial concern of last decade. [24]**

Accessibility to goods and services is an important aspect of quality of life and inability to access basic services such as employment, education and healthcare can result in transport related social injustice and inequality. [22] In times defined by a rapid transition towards a smart technology paradigm, accessibility remains a key prerequisite for social inclusion, equity and quality of life, especially for populations who are already at a disadvantage, such as those with special mobility needs, like older adults and people with disabilities. [25]

Hence, covering accessibility is a challenge of relevant proportions, because we first need to acquire a common understanding of what accessibility entails.

**In-person testing conducted by Glydways with members of the disabled community highlighted the importance of independence and autonomy:**

*"People with restricted mobility want to be able to do everything on their own. They don't want to be a burden."*

***Zachary Zeliff, Glydways***



### Physical accessibility and universal design

Changes in ability are an inevitable part of the human life cycle. Every single individual is one mishap (or at best a couple of decades) away from experiencing some form of reduced mobility (temporary or permanent) in their lifetime, and it is important that all people can continue to fully participate in society. [21] When it comes to the elderly, this age group is commonly associated with a decline in physical and cognitive abilities, retirement and legal driving restrictions, which are proved to lead to difficulties and limitations in mobility, loss of transport independence and shift in mobility patterns because of aging. [25] Yet, often the elderly, together with people with mobility constraints (including people pushing prams, which, more often than not, are able-bodied, temporarily restricted, women) are still regarded as oddities or exceptions and often considered as an afterthought.

According to Reuters [26], more than 50 percent of all persons with disabilities live in cities, and if millions of people with disabilities or reduced mobility remain unable to participate in everyday activities such as riding a bus to reach their jobs and healthcare services, or visiting friends [27], the inclusion of persons with disabilities in urban development is of utmost importance and urgency.

Physical accessibility encompasses measures that require different degrees of intervention and investment. The most obvious ones, and nowadays those which are the most often implemented, depending on the requirements needed to do so, include step-free access to platforms and vehicles, to wheelchair compatibility before, after and during rides, to barrier-free interchanges between different modes. This group includes among other, people with mobility impairments like wheelchair users, people with visual or hearing impairments, people with cognitive, learning or mental health issues and people with chronic diseases. [25]

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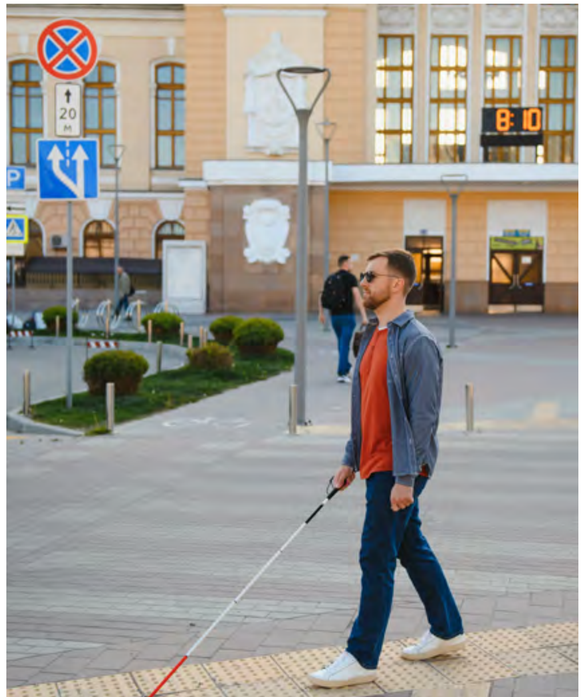
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Much more has to be done to ensure universal design standards. Providing support to users who are visually impaired requires for instance, tactile guidance systems, adequate lighting and visibility standards, whereas providing support to the hearing impaired requires audible signals and clear announcements. Those experiencing cognitive impairment, (which includes aging population) can benefit from clear signage and wayfinding as well as intuitively understandable information. Similarly, inclusion should imply the implementation of accessible apps and websites but also simple ticketing and booking processes, that can be perceived and understood by as many users as possible. Moreover, the use of plain language and consistent user interfaces can significantly improve ease-of-use for the less digitally literate, but still alternative booking channels and non-smartphone access options should be available to ensure non-discrimination of users who cannot access these technologies. Also, providing ease of access of support to one kind of user, shouldn't constitute an impediment to others: ramps should be designed to accommodate wheelchair users without hindering accessibility for individuals with other disabilities, such as those who are visually impaired. [25]

Inadequate and inappropriate transport infrastructure and services create significant psychological and social barriers that prevent vulnerable groups, especially older adults and people with disabilities, from traveling independently. [25] According to Leslie Kern [28], women with disabilities face some of the highest levels of physical and sexual abuse everywhere and are hence at a much higher risk of harassment in public transport, for which there is a pressing need to create safeguards that can improve passenger safety.

Making environments accessible through universal design benefits people with reduced mobility, pregnant and older people, and caregivers with young children, but it also makes shared public spaces, and the transport system work better for everyone. [21]

**Much of older transportation infrastructure, such as the Paris Metro, face key accessibility challenges (f.e., lack of elevators and ramps) due to their historic nature. While the ongoing 'Metro for All' program is improving barrier-free access, significant gaps remain across the network. Nevertheless, newer developments demonstrate a more inclusive approach, particularly Line 14, which was designed with accessibility features from the outset and serves as a model for future expansions.**




### Accessibility as spatial equity and access to opportunities and innovation

Rode stated in 2017, that "access to people, goods, services and information is the basis of economic development in cities." The better and more efficient this access, the greater the economic benefits through economies of scale, agglomeration effects and networking Throughout history, cities have been magnets to those who are looking for a better life. Cities offer more jobs, as well education and networking opportunities, compared to the countryside. Yet, those who are at an economic disadvantage, often experience the negative externalities of a transport system disproportionately [25], as they are pushed out to the fringes, that is, to the outskirts, facing longer travel times, as well as high costs for travel.

Because of that, they often see their opportunities curtailed, as they find themselves spending time en route that could otherwise be used more productively, advancing their education, or tending to their families. Also, people who are less financially comfortable, often have to work odd hours, in jobs related to cleaning or security, for instance, which are often overlooked in timetable planning.

While it is theoretically possible to increase accessibility by adding services and infrastructure, achieving equitable configurations across population distributions, infrastructure, and services is much more challenging. [23] Often, the populations that are most at risk for disenfranchisement are those who have less opportunities and choice in the first place, and who have less leverage to demand such opportunities from public administration. Lack of transport can translate into difficulties for access to social life, education and health facilities and economic opportunities [29] widening the gap between the privileged and the underprivileged even further. Addressing the gaps in urban mobility, considering the needs and travel patterns of all users is a must for ensuring equitable access, that is, to ensure that uptake of services, such as employment, healthcare and education materializes for disadvantaged groups. [22]

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Metro lines, bus rapid transit, and expansive bicycle networks are essential to reducing car dependency, simplifying remote connections, and improving distant accessibility,[23] providing simultaneously an opportunity for inclusion of disadvantaged groups and for reduction of negative externalities of private vehicle use. Dense, well -managed urban development and the provision of accessible, affordable public transport can have a positive direct effect on the poor and other disadvantaged groups by increasing their ability to access goods, services, and economic opportunities.[5] Similarly, on-demand and flexible route microtransit can reduce the distances that passengers in less dense urban areas must walk to stops, resulting in more convenience, but Litman[6] warns against the danger of such technologies negatively impacting ridership of traditional networks (such as buses) which can reduce transit system efficiency and lead to reduced transit service over the long-term.

The transportation sector experiences a significant technological transformation, incorporating innovations such as automated vehicles (AVs), electric transport solutions, and advanced information and communication technologies. While these advancements hold transformative potential, ensuring equitable distribution remains a critical challenge. Historically, affluent communities have often been the first to benefit, leaving socially disadvantaged groups marginalized,[24] and therefore scholars engaging in transportation equity research and practice are fundamentally concerned with who benefits from and who is burdened by transportation infrastructure or transportation planning activities.[30] For instance, a review revealed that bicycle -related benefits are unevenly distributed, often favouring privileged areas, and that equity concerns are frequently neglected during bicycle planning and decision-making, exemplified by imbalances in the growth of cycling networks in urban areas.[24] Data-driven approaches could support more equitable and economically viable micromobility infrastructure investments by using mobility patterns and user behaviour to inform where new infrastructure should be located.[31]

The same has widely been the case with promotion of electric vehicles, where often subsidies are regressive, that is, taxpayer contributions of the disadvantaged are used to fund incentives for those already well-off, to swap their fossil fuel running vehicle, for an electric one instead. On a different note, the more moderate running costs of electric vehicles can turn out to be an incentive to travel more and further, eventually contributing to less ridership of traditional systems (in addition to, as we've seen under impact area 1, negatively contributing to congestion and emissions). Dingil[24] points out as well that the success of transportation electrification depends on widespread deployment of charging infrastructure and equitable distribution to prevent new imbalances and the commercialization of public space. Data-sharing initiatives involving mobility and logistics operators, combined with data-driven modelling, can help guide long-term electrification infrastructure investment based on demonstrated demand and need, potentially supporting a fairer distribution of charging infrastructure while improving the efficiency of investment.[32]



Similarly, AVs could widen or narrow accessibility gaps among different demographics (such as varying income levels or urban vs. rural residents), and the outcomes will depend on factors such as system design, pricing models, and implementation strategies. The introduction of AVs can be premature in contexts where public transport coverage and metropolitan development are still underdeveloped and shall therefore be tested against local priorities. Precisely in such contexts, when new networks or technologies are introduced, that only the privileged can comfortably access, the gap between privileged and underprivileged widens further. That means that two people living in the same location may experience very different levels of accessibility because accessibility is not only a geographical but also a social phenomenon.[22]

The disproportionate leverage held by the privileged in comparison to the underprivileged, often leads to NIMBY (Not In My Back Yard) phenomena, whereas those who are at an advantage often hold positions that due to reputation or access to information and knowledge put them in a better position to either understand the negative impacts of measures or exert influence in pushing back at having such measures implemented in their vicinity, relegating them to areas, where the population is less likely to resist. Most marginalized groups lack agency and the ability, knowledge, and negotiation techniques to participate in political processes. This is an example on how sometimes there is little room for the technologically illiterate, the poor, the elderly, persons with disabilities, and generally those who are traditionally marginalized to participate in the city discourse and decision-making processes.[26]

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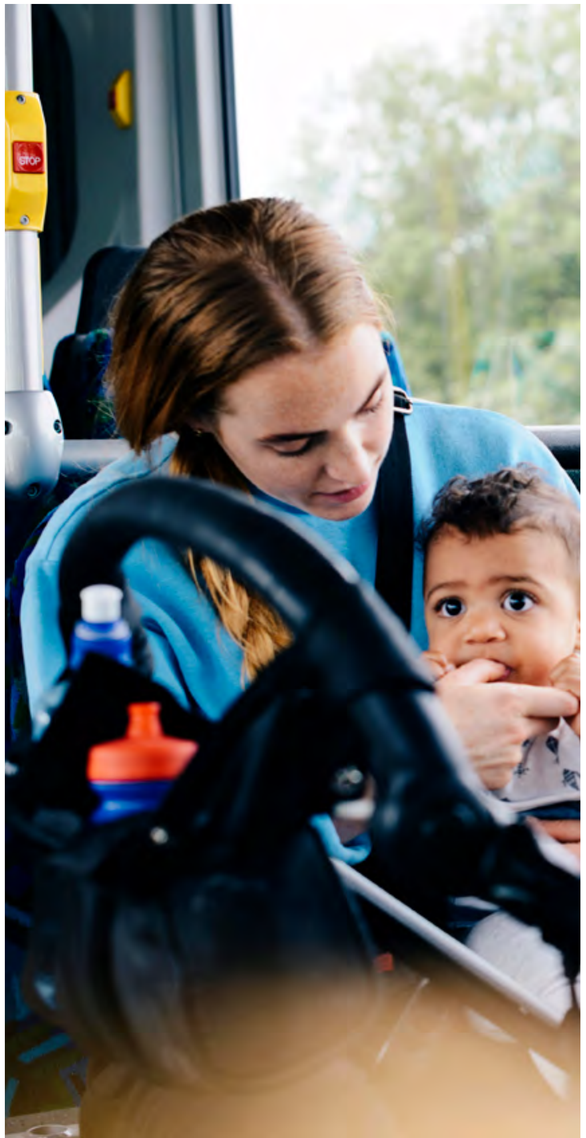
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### Affordability, i.e., economic accessibility

Affordability refers to a household's ability to cover the costs of transport (to access essential goods and activities) in relation to income, [31]. The costs of transport comprise the actual expenses a household incurs in everything mobility, but it also comprises the opportunity cost of missed opportunities to climb the social ladder, by accessing education, services or job opportunities. Research has shown that transport costs can represent a heavy burden for household expenditures, particularly in low -income households, thereby restricting disposable income for other travel purposes and activities. At the same time, transport fares tend to become too expensive for the city's poor. [29] Unaffordable transportation is therefore inefficient and unfair: it forces lower -income families to forego desired travel, use inconvenient, uncomfortable, and sometimes dangerous travel options, or spend more than they can afford on travel. [32]

The European Commission itself states that, whereas the European single market in transport has increased connectivity, mobility remains expensive for people with low disposable income [12]. This reality occurs not only at regional level, but also within the urban realm, where there is a high level of correlation between the use of different transport modes and social class, with the poorer populations mainly (in the developed world) or almost entirely (in the developing world) reliant on public transport, non-motorised transport and walking [5].

In their research, Guzman and Oviedo [29] have found that improvements in coverage resulting from the integration of public transport and the affordability benefits from subsidies, are intermediate requirements for enabling low -income communities to access more and better opportunities for health, education and employment. Their results suggest a relevant potential of pro-poor transport policies, particularly in relation to improving affordability and closing the gap between rich and poor.



### Gender specific accessibility

In cities, public transport schedules are, more often than not, planned around the able-bodied male-oriented formal work economy and traditional gender roles; that is, prioritizing trips made between peripheral areas and the city/business centers [21], with no stops in between, being that the timetables are reinforced to serve specific and traditional peak times. [28] This kind of planning disregards the stops needed in between that are essential to household management, child-rearing and care-taking roles, which, regardless of current participation rate in the workforce, still falls mostly on women (commonly referred to as the "second shift"). This results in women taking more, but shorter, trips and practicing "trip-chaining", in which different travel purposes are combined. [28] As such, women more than men tend to travel with children, the elderly, people with disabilities, and with goods. This type of mobility requires a greater degree of accessibility, flexibility, and reliability in the relevant modes of transport, as it is often associated with the use of prams, wheelchairs, and/or other mobility aids, [33] as well as the accompanying of vulnerable users, which can be an additional burden as the connections as well as the infrastructure, from sidewalks to buses, may not easily facilitate that. [21]

Sadly, even in this current era in which active and micromobility is heavily brought forward to fill-in the gaps of traditional systems and encourage healthier travel modes, these aspects are often disregarded. Shared vehicles often don't allow for carrying bags and/or children and parking infrastructure is often inadequate to accommodate vehicles with these characteristics. Same goes for interfaces between different modes of transport.

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Also, women are a lot more likely (48% compared with 19% of men) to avoid using public transport at night [34], especially when they are on their own, for the fear of violence and harassment. The situation is even more dire for disabled women. In a study on mobility conducted by Beadle-Brown et al. [35] which looks at a sample of 116 people with disabilities in the UK, those interviewed said they had experienced unpleasant situations, 25% of which having happened in public transportation. Because women often do not feel safe in public spaces or on public transport, they can also end up more limited when it comes to their economic participation. This leads to additional costs (a mobility "pink tax") related not only with resorting to taxi-like services, but also to opportunity costs for not accessing education or job opportunities, for absence of safe transportation options. Therefore, women develop different strategies to avoid areas perceived as unsafe [33], such as grouping to avoid facing dangers as an individual or aligning their schedules with male family members.

At New York University [36], Sarah Kaufmann calls for a series of measures to tackle the pink tax in mobility such as designing shared mobility to meet women's travel needs, accounting for safety considerations in trip planning and developing family fares to ease the burdens on caregivers.

**Key-takeaways:**

- Universal design should be the default, not the exception.
- Accessibility extends beyond physical barriers to include affordability, digital inclusion, geographic coverage and safety.
- Accessibility is about access to opportunities, just as much as it is about freedom of movement.
- Unequal access to mobility can reinforce social and economic disadvantage.
- Innovation can either reduce or widen accessibility gaps, depending on how it is designed and deployed.
- Mobility systems should reflect diverse travel patterns and user needs, including those of caregivers, women and vulnerable groups.

### *Fujitsu's Social Digital Twin*

*Fujitsu has created a technology to uncover hidden mobility dynamics and translate them into actionable intelligence for urban planners, operators, and local authorities. These data-driven algorithms can be used to prioritise fair and sustainable investment in public transportation and other mobility alternatives.*

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# Standards for implementation

**A solution should not introduce new barriers or make existing barriers more difficult to overcome. It should avoid reinforcing social, economic, digital or physical inequalities and should not disproportionately disadvantage populations that already experience transport-related challenges. Accessibility should be evaluated across the full user journey, from obtaining information and planning a trip through to travel, transfers and arrival.**

At the same time, cities should recognize that accessibility is not only about preventing exclusion. Well -designed solutions can actively improve access to opportunities, strengthen participation in society and contribute to a more equitable mobility system.



## Minimum standard — do no harm

**At a minimum, solutions should avoid:**

- creating physical barriers for people with disabilities or reduced mobility;
- excluding users through digital requirements alone;
- reducing access to essential services, employment, education or healthcare;
- increasing affordability barriers for lower -income households;
- creating unequal access between neighbourhoods or user groups;
- overlooking gender -related barriers to mobility;
- worsening safety or perceived safety;
- concentrating benefits among already privileged groups while shifting burdens to vulnerable populations.

## Additional public value — net positive contribution

**Examples of additional public value include:**

- improving accessibility for people with disabilities;
- foreseeing alternative services for those with low digital literacy;
- increasing access to employment, healthcare, education and public services;
- improving affordability, especially for low income households, and/or reducing transport poverty;
- improving access in underserved neighborhoods and/or rural and peripheral areas;
- reducing gender related barriers to mobility;
- increasing perceived safety;
- allowing for a fair distribution of benefits and burdens;
- enhancing participation of marginalized groups in planning and implementation processes.

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## Universal design as the default, not the exception

As discussed in the literature review, accessibility should not be understood as a specialized feature designed for a small group of users. Changes in ability are part of the human lifecycle, and virtually all individuals will experience some degree of reduced mobility, whether temporary or permanent, at some stage of their lives. Cities should therefore encourage solutions based on universal design principles wherever possible.

Infrastructure, vehicles, information systems and digital interfaces should be designed to be usable by the widest possible range of people without requiring specialized adaptations. Accessibility measures that benefit one user group should, wherever possible, improve conditions for all users. The objective should be to create systems that function effectively for people with disabilities, older adults, caregivers, people travelling with children, occasional users and digitally excluded populations alike. Accessibility should also not be understood solely as the ability to travel. Its ultimate purpose is to enable participation in economic, social and civic life.

Cities should therefore assess solutions not only according to how efficiently people move, but also according to whether people are better able to access employment opportunities, education, as well as healthcare and other public services.

Improvements in accessibility should ultimately translate into improvements in **people's ability to participate in society.**



***Human-centered logistics by Amazon***

*Amazon described how delivery innovations are assessed not only for efficiency but also for ergonomic impacts on workers. Factors such as physical strain, safety and usability are incorporated into the design of delivery systems and equipment.*

## Leave no one behind

Digitalization, automation and new service models can simplify mobility and logistics systems, reduce administrative complexity and improve efficiency. Cities should encourage these benefits, while ensuring that alternative access channels remain available whenever access to essential mobility, goods or services is at stake. Innovation should not create new barriers or exclude people who already face disadvantages in accessing mobility, goods, services or opportunities. Essential mobility and logistics services should remain accessible to people who may not have access to smartphones, credit cards, bank accounts, constant internet connectivity, high digital literacy or standard service interfaces. Similarly, solutions should not assume the same physical, sensory, cognitive or financial capabilities across all users.

Particular attention should be paid to people who are **disproportionately affected** by accessibility barriers, including persons with disabilities, older adults, low income households, caregivers, women, residents of underserved areas and digitally excluded populations. Accessibility should not be treated as a specialized feature for a small minority of users, but as a fundamental characteristic of a well functioning mobility and logistics system.

The objective is not merely to enable movement, but to ensure that all people can access opportunities, participate in economic and social life, and benefit fairly from mobility and logistics systems regardless of their age, income, gender, ability or digital literacy.

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# Implementation watchouts – what to look out for

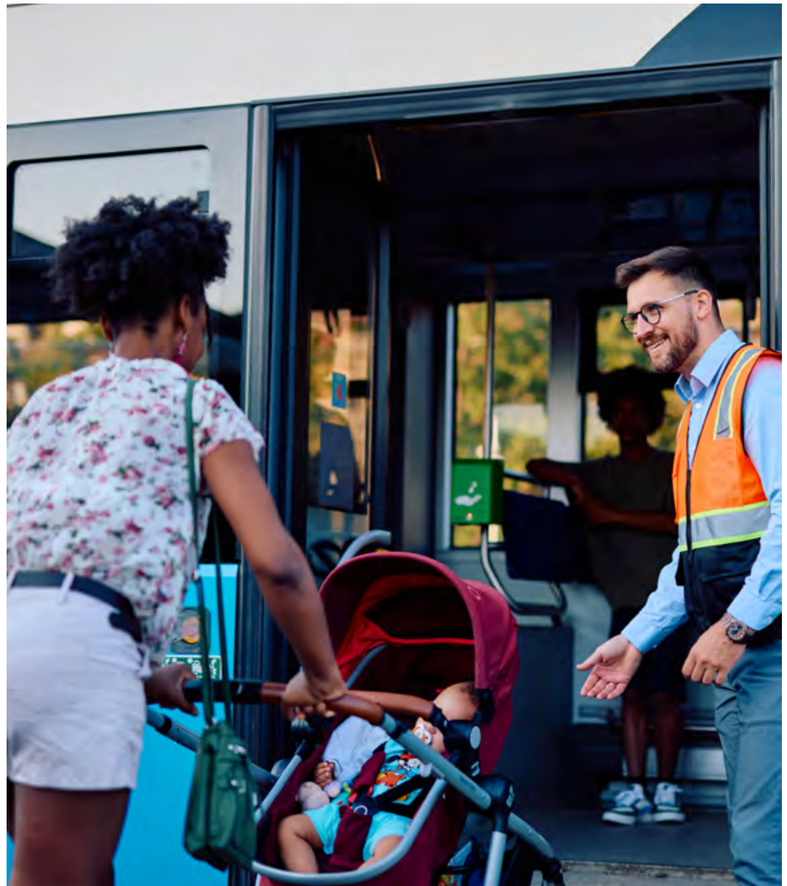
**Accessibility is often reduced to physical barriers, but exclusion can arise from many different sources. A service may be physically accessible while remaining unaffordable, digitally inaccessible, poorly connected to opportunities or perceived as unsafe. Similarly, improvements measured at city level may conceal unequal benefits across neighborhoods and population groups.**

Cities should therefore pay particular attention to who benefits from a solution, who may remain excluded and whether accessibility gains translate into meaningful improvements in access to opportunities and participation in society.

**Red flags for accessibility, equity and social inclusion**

- Accessibility is discussed only in terms of physical barriers or wheelchair access.
- Essential services can only be accessed through smartphones, apps or digital payment systems.
- New services primarily benefit users who already enjoy high levels of accessibility.
- Affordability considerations are missing or insufficiently analyzed.
- Improvements are measured only at city level without understanding distributional impacts across neighborhoods and population groups.
- Solutions require levels of digital literacy, physical ability or financial resources that cannot be assumed across most users.
- Consultation processes fail to involve affected or underrepresented groups.
- Safety assessments consider only objective risks while overlooking perceived safety.
- Technological innovation is assumed to be inherently inclusive without examining who can actually benefit from it.
- Accessibility gains for one group create new barriers for another.

**Cities should evaluate accessibility outcomes, not accessibility features. The key question is not whether a solution is available, but whether people are genuinely better able to access opportunities, participate in society and benefit fairly from the mobility system.**



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# Information cities should seek

**Accessibility, equity and social inclusion should be demonstrated rather than assumed. Cities should therefore seek information that helps them understand who benefits from a solution, who may face barriers to its use, and whether it is likely to improve access to opportunities for different groups of users.**

At a minimum, cities should request information on:

- the user groups expected to benefit from the solution;
- physical accessibility features and compliance with relevant accessibility standards;
- digital accessibility and availability of non-digital access channels;
- affordability, including fares, subscriptions, equipment requirements and other user costs;
- expected impacts on access to employment, education, healthcare, public services and other essential opportunities;
- expected impacts on underserved neighborhoods, peripheral areas and vulnerable populations;
- anticipated effects on women, caregivers, older adults, people with disabilities and other groups with distinct mobility needs;
- safety and perceived safety considerations, as well as harassment reporting mechanisms;
- stakeholder engagement activities undertaken during design and implementation;
- evidence on the distribution of benefits and burdens across different population groups.

Cities should consider who may be excluded from using a service, intentionally or unintentionally. Where possible, cities should seek evidence based on actual users and local conditions rather than assumptions about average travel behaviour.

The checklist referring to this impact area is available upon request as a support tool to this kind of assessment.



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## Impact area 3:

# Economic sustainability and funding

**"Development of efficient, long-term financing for transportation systems is essential for the wellbeing of cities, either for investment in new infrastructure or for the long-term operation and maintenance of existing systems." (37)**

**Cities understand the importance of managing challenges connected with congestion and emissions, and sustainable transport investments have been identified as a strategic element of the transition to a zero-emission, safe and smart mobility network. Future infrastructure investments should therefore focus on measures to reduce carbon consumption, shift from fossil fuels to renewable energy sources (RES), encourage cleaner and greener construction methods, and promote environmentally friendly meansof transport." (38)**

Simultaneously, it is clear, how important it is to make improvements to the existing systems to make them more welcoming to as many users as possible. Sustainable, inclusive, low carbon modes, from mass transit to nonmotorized transit measures, promote a more compact urban form that facilitates efficient use of scarce resources such as land, promoting articulated densification processes that can have positive impacts on economic vitality, access to opportunities, and overall prosperity of the city. (39) It is therefore unsurprising, that in recent years the European Union's interest in urban issues has grown considerably, and it has directed most of the funding dedicated to urban development projects to the transport sector. (40)

Yet despite the best intentions and wishes many cities are faced with the next obstacle: how can cities afford it? For as blunt as this question may seem, how cities fund such measures and projects, or how they ensure economic feasibility and sustainability can often constitute a considerable challenge. We would prefer however to ask a different question: can cities afford not to? The unanimity of views on the important role of infrastructure in the processes of economic growth and development is accompanied by an increasing awareness of the change in the perception of transport infrastructure as a result of the impact of the main trends in socioeconomic development. (38) That is, not investing enough in an urban transport system can decelerate a city's rate of economic growth. (39) Investing in major infrastructure alone, however, is likely to be ineffective unless accompanied by actions at the local scale. (37)

Economic sustainability is hence an enabling condition for mobility systems, which support economic development in their stead, providing access to opportunities and the transition to low carbon, resilient urban development, contributing therefore to further economic growth and stability. The development of efficient, long-term financing for transportation systems is essential for the well-being of cities, either for investment in new infrastructure or for the long-term operation and maintenance of existing systems. (37)



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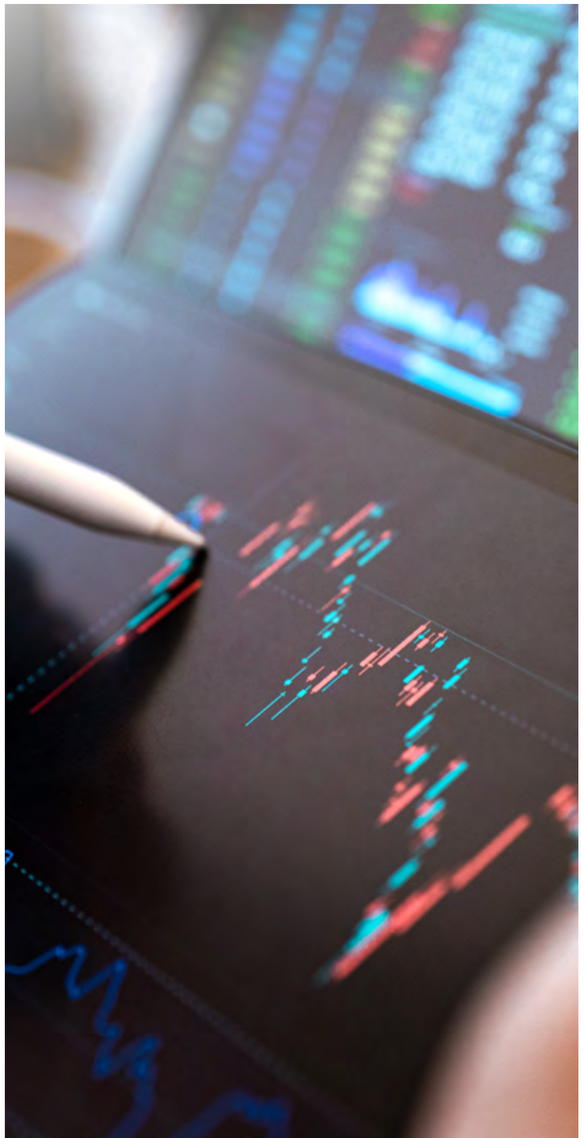
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**To establish affordable as well as high-quality transport systems, cities must ensure their transport systems are financially sustainable: revenue must be enough to pay for new investments in infrastructure while also funding maintenance and operation of existing facilities and services.** [39]

Notwithstanding, for instance in the EU, the scale and complexity of challenges in terms of investment and advisory needs in relation to the development of sustainable transport infrastructure exceeds the existing financial and organizational capabilities. [38]



The most recurrent implementation obstacles as identified both in the literature and by our interviewed city executives are:

- insufficient national or local legal authority;
- shortage of municipal expertise and staff capacity;
- limited awareness of financing options;
- political and public opposition;
- uncertain or volatile revenue;
- high setup, transaction, monitoring or enforcement costs;
- lack of a political champion;
- weak coordination between municipal departments and levels of government;
- difficulty demonstrating project viability and longer-term financial sustainability.

In many cities there is a serious financing in addition to an institutional gap. Urban transport systems do not have the financial resources to cover capital, operating and maintenance expenditure required to develop and sustain urban mobility systems. This large and increasing financing gap for urban transport is currently seen as the main difficulty faced by cities trying to improve their transport systems. [39]

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*"It is important to show the cost of investing relative to the cost of not investing."*

***Claire Baritaud, La Poste***

Financing shapes whether solutions can be implemented, shaped and scaled. Financing options can generally be divided in three categories:

- **Direct benefit financing,** which refers to funding mechanisms in which the users or immediate beneficiaries of a transport service, facility or network contribute directly to its funding. Payment is linked to the actual use of infrastructure or services, following the principle that those who benefit most should bear at least part of the cost.
- **Indirect benefit financing,** which refers to funding mechanisms in which contributions are collected from individuals, businesses or property owners who benefit indirectly from improved accessibility, increased land values, enhanced economic activity or greater connectivity, even if they are not the direct users of the transport system, and
- **general or complementary financing,** which refers to funding sources that are not directly linked to transport use or specific accessibility benefits but are used to supplement transport funding. These mechanisms typically provide capital, grants, borrowing capacity or alternative revenue streams that support transport investment and service provision.

Figure 6 presents a non-exhaustive list of examples of these three kinds of financing options. It is not our intention to dive deeper into all the ups and downsides of them all, but for information purposes a more comprehensive list is made available under Annex 3.

**Direct-benefit financing**

- ☐ farebox revenue;
- ☐ parking charges;
- ☐ road pricing;
- ☐ congestion charges;
- ☐ HGV charging;
- ☐ toll roads;
- ☐ fuel taxes or surcharges;
- ☐ vehicle taxation;
- ☐ toll-funded PPPs for urban roads.

**Indirect-benefit financing**

- ☐ advertising, sponsorship and naming rights;
- ☐ employer contribution and workplace parking levies;
- ☐ betterment levies and land-value capture;
- ☐ stamp duty-related capture;
- ☐ tax increment financing;
- ☐ special assessments;
- ☐ transportation utility fees;
- ☐ community infrastructure levies;
- ☐ development impact fees;
- ☐ planning obligations;
- ☐ negotiated exactions;
- ☐ voluntary capture
- ☐ joint development;
- ☐ air rights;
- ☐ development or sale of public land and property.

**General or complementary financing**

- ☐ municipal green bonds;
- ☐ crowdfundingl
- ☐ lottery funding;
- ☐ research and private-sector collaboration;
- ☐ citizen cooperatives;
- ☐ emissions trading and climate finance;
- ☐ sales-tax increases;
- ☐ sales of expertise and technical know-how;
- ☐ private foundation grants;
- ☐ donations linked to consumer purchases.

*Figure 6: financing options divided in three categories.*

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Most commonly at the hand of cities are direct benefit forms of financing, that is, based on traditional revenue sources such as investments from the general tax base, public transport user fees, and farebox revenue. Considering the huge and sunk costs of capital investments and the high expenses for operation and maintenance, these traditional sources are insufficient. In Chicago, for instance, as in many other cities of the Global North, aging infrastructure and budget constraints force innovation to compete with essential maintenance and reconstruction. When public funds are not available to the extent, they are, it results in a funding gap, that is, the difference between revenue and the city's ideal or 'aspirational expenditure'. The urban transport financing gap can be further widened by implicit subsidies, for instance, for the use of private cars, which represent only a minority of trips but contribute huge costs in terms of congestion, sprawl, accidents, and pollution. (39)

For operations and maintenance, as well as some capital costs such as those for fleet, efficient pricing should lead to covering costs. Financial instruments funded by direct beneficiaries are recurrent, given that they are directly related with the use of the system. As a result, it then seems both politically and administratively correct that these instruments are mainly managed from a local level and used for recurrent expenditures such as operation and maintenance. (39

In a world where funds are not endless, assessing whether to invest or not is key. For a public investment to be justifiable, it has to deliver public value. Projects should thus produce benefits exceeding their costs, support coherent urban development, address externalities and remain aligned with long-term policy objectives. According to Ortegon-Sanchez and Ardila-Gomez (39) only public transport projects, not those for private vehicle infrastructure, generate sufficient benefits to justify society paying for them.

On the other hand, politically relevant flagship projects, such as the Grand Paris Express, show how major ongoing commitments structure the opportunity set for other investments. That is, when substantial financial, political and institutional resources have already been committed to a project with such visibility, decision makers are naturally inclined to prioritise solutions that complement, enhance or leverage these investments rather than introduce entirely separate mobility systems.

The best financing for a specific transport investment will, of course, always depend on the specific investment project, the local context, stakeholders, and the required funding periodicity.



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## User charges, pricing and subsidies

An ideal financing strategy should aim at setting financial instruments at prices that charge users for the total costs of using a given infrastructure or transport service. This is based on the **"Who benefits, pays" principle**, according to which those who benefit from a transport service or urban transport improvement should pay for its costs. [39] Efficient pricing should, in principle, be based on social marginal costs and requires the 'internalization of external costs', or the polluter-pays principle, including congestion and environmental costs. Social efficiency requires that users pay both the marginal private or internal and external costs that they impose on society. Therefore, an efficient structure of charges confronts users with the marginal social costs of their decisions." [41] For services with private good characteristics, governments should charge user fees when beneficiaries can easily be identified. Conversely, where user fees are difficult to estimate, taxes and transfers would be more appropriate. As it is nearly impossible to make fares both affordable and financially sustainable, transport fares tend to become too expensive for the city's poor. [29]

With regard to pricing criteria, it is important to distinguish between: fares which maximize the proceeds for the managers or constructors of infrastructures, as these kinds of fares maximize the capacity for self-financing; and efficiency fares, which take into consideration the social surplus and also consider the external costs, including congestion as well as environmental and safety costs. [41] Because political acceptability of user charges is low, a gradual introduction of user charges has to be considered, as well as appropriate combinations with other instruments and a provision of good public transport services as alternative to private car use. Fuel taxes earmarked for use in the transport system are a good way to prompt a more equitable distribution of externalities. [39]

While targeted subsidies are an effective way to redress longstanding social and spatial inequalities in cities with high socioeconomic segregation [29], charging indirect beneficiaries, such as developers and landowners, is found to be not the most efficient in terms of transport sustainability, but a generally stable and convenient way to raise a large sum up front for capital investments. [39]

When planning for an urban transport investment, the project's benefits should be identified and measured so that they can be paired with specific financial instruments to capture the added value that is created and ensure the main beneficiaries pay for it. This way, urban transport financing can be based on an efficient revenue scheme in which charges, fees, and taxes reflect prices that cover the costs of using any specific infrastructure. [39]




## Multi-level funding and integrated financing

The ability to develop successfully efficient and stable funding for transportation relies much on the establishment of an appropriate governance structure. [37] City governments however may lack the financial autonomy to pay for the services they are required to provide.

Some experts argue for the involvement of levels of government above the city level, such as the national government, and defend the importance of strengthening the institutional capacity required to support an innovative financing strategy. [39]

In most Member States, national funds for transport and mobility are spent in accordance with national investment strategies that set out the priorities for investment in this area. [42] National governments must contribute if the benefits of having a good urban transport system go beyond the city itself. International funding however can play a strong role when it comes to investing in projects that contribute to the global benefit of reducing emissions from the transport sector.

Still, local authorities can address these cultural and administrative shortcomings by creating framework conditions that favour innovation and allow bringing ideas to practice. They can provide support to innovation through initiatives and actions aimed at providing financial support to R&D programs, cooperation between their staff and other national and international local authorities. [42] For instance, in New York, economic capacity includes the administrative resources required to design, supervise and evaluate experimentation, and thus there are staff resources focused on innovation and on adopting best practices in innovation policymaking.

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Financial long-term viability also depends on **long-term vision** and **stability**. A way to achieve that is through a combination of blended financing (matching different revenue streams) and long-term governance strategies, going beyond electoral cycles, and harnessing public engagement and community involvement.

A great example of this is the city of Aalborg. This Danish city is about to become the first true sustainable city in the world. It has undergone a remarkable transformation in recent years, embracing its history while moving forward with innovation and progress. [43] Aalborg's success is rooted in long-term planning horizons combined with strong public participation and shared ownership of the sustainability agenda. [44]

Financing shapes whether solutions can be implemented, sustained and scaled. It should not be treated as a secondary consideration that follows technology selection. In Aalborg, an integrated approach to finance has allowed for more flexibility and stability, not only allowing for the city to gradually develop its plans over the years, but also quickly react when conditions have changed and the need to switch gears and change course arises.

According to the Aalborg Conditions [45] integrated finance consists of a set of conditions including the alignment and coordination of public, private, local, national and external funding sources to support **long-term sustainability objectives** across sectors and policy areas, rather than financing individual projects in isolation. Integrated finance doesn't answer the question "how is it going to be paid?" but instead encompasses a series of elements needed for success:

- shared governance and institutional collaboration – mobilizing expertise across different levels of government;
- blended finance – combining national with Municipal investment, business investment, EU programs, local partnerships as well as innovation funding.
- long-term visions – initiatives span across horizons beyond electoral cycles requiring public rather than partisan commitment;
- local climate action focused on implementation rather than merely target setting. [44]

The challenge is therefore not simply to secure funding for individual projects, but to establish financing systems that can support implementation over the long term. By combining appropriate financing instruments, applying efficient pricing principles, leveraging multiple levels of government and aligning investments with broader public value objectives, cities can close financing gaps and create the conditions for sustainable, resilient and inclusive mobility systems to flourish.

***A note on Public-Private Partnerships: Cities can struggle to find private developers willing to cooperate with in developing significant transport projects, such as mobility hubs, since the private sector often doesn't perceive the business case as positive.***

***According to Kennedy et al. [36], the private sector can bring several benefits, including the timely completion of projects, access to financing when public funds are unavailable, higher degrees of expertise, cost effective service delivery, and the development of innovative service delivery options. Yet there are risks relying too heavily on private funding, as lending rates will be automatically higher and when the private partner happens to be the operator, it can lead to an increase in service charges during the operational phases of projects for the sake of a higher profit. This dynamic has led to poor performance of PPPs in the past, as is still the reason why both public and private sector often refrain from cooperating. However, innovative approaches, such as the Regulatory Asset Base (RAB) seem to be breathing fresh air into the way private and public partners cooperate, making way for future opportunities.***

**Key-takeaways:**

- Economic sustainability is an enabling condition for mobility transformation.
- Financing should be considered from the outset, not after technology selection.
- Revenue must support capital investment, operation and maintenance throughout the lifecycle.
- Projects should create public value, not simply attract funding.
- The "who benefits, pays" principle can help align costs with beneficiaries.
- Long-term success depends on blended financing, institutional capacity and multi-level cooperation.



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# Standards for implementation

**Cities should ensure that mobility initiatives are supported by a realistic and transparent financing strategy covering capital, operation and maintenance costs over the expected lifecycle of the intervention. A solution should not be considered economically sustainable simply because funding has been secured for its initial implementation. Cities should also understand how the intervention will be operated, maintained and financed throughout its expected lifecycle.**

Leading cities go beyond project level funding and develop integrated financing approaches that support long-term transformation. This distinction allows cities to differentiate between solutions that merely avoid creating unsustainable financial commitments and those that actively strengthen the long-term capacity of the mobility and logistics system.



**Minimum standard — do no harm**

**Financing arrangements should:**

- demonstrate how the proposed solution will remain financially viable beyond initial implementation;
- identify anticipated revenue sources, funding partners and financial risks;
- avoid creating unsustainable long-term financial burdens for future administrations;
- consider both affordability for users and the financial sustainability of the system;
- assess whether costs and benefits are distributed fairly among beneficiaries;
- align investment decisions with broader mobility, climate and development objectives rather than pursuing isolated projects;
- establish clear governance arrangements and responsibilities for financial management, monitoring and accountability.

**Additional public value — net positive contribution**

**They:**

- combine multiple financing sources and mechanisms to increase resilience and reduce dependency on a single revenue stream;
- apply pricing and subsidy schemes that promote sustainable travel behavior while protecting vulnerable groups;
- systematically assess public value, ensuring investments generate social, environmental and economic benefits that outweigh costs;
- leverage contributions from direct and indirect beneficiaries where appropriate, following the “who benefits, pays” principle;
- align local, national, private and external funding streams around shared long-term objectives;
- build institutional capacity for innovative financing, investment planning and financial governance;
- use financing strategically to support implementation, scaling and long-term system transformation, rather than treating funding as a separate exercise after technology or project selection.

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## Applying the standards in practice

Economic sustainability should be considered from the earliest stages of planning rather than after a solution has been selected. Cities should assess not only whether a project can be funded initially, but also whether it can be operated, maintained and adapted throughout its lifecycle. This requires funding sources, governance arrangements and investment priorities to be aligned with long-term mobility objectives.

No single financing model will be suitable for every context. Cities will generally need to combine complementary funding streams, select financing instruments that reflect local circumstances and beneficiaries, and establish governance arrangements that provide stability beyond individual political and budget cycles. Financing decisions should support **wider mobility, climate and development objectives**, ensuring that projects deliver lasting public value rather than short-term outputs.

The type and timing of expenditure also matter. Large capital investments require substantial upfront funding, whereas operation and maintenance generate recurring financial needs. Cities should therefore **match financing mechanisms** to the costs they are expected to cover and avoid relying on temporary funding sources for services or obligations that must be sustained over time.

Financing should ultimately be viewed not merely as a mechanism for covering costs, but as a strategic tool that shapes which mobility solutions can be implemented, sustained and scaled. It can also influence travel behavior, determine how costs and benefits are distributed, and create incentives for more sustainable forms of mobility.

## Leave no one behind

Economic sustainability should not be pursued at the expense of accessibility, affordability or social inclusion. At the same time, insufficient investment in public transport, walking and cycling can reinforce existing inequalities in access to employment, education, healthcare and other opportunities.

Cities should therefore examine who benefits from mobility investments, who contributes to their financing and whether costs and benefits are distributed fairly. User charges, congestion pricing and other demand management instruments can support financial sustainability and encourage more sustainable travel behavior. Their introduction should, however, be accompanied by accessible and affordable alternatives, as well as targeted support where necessary.

Subsidies should be designed to improve inclusion and access to opportunity rather than simply lowering fares across the board. Targeted affordability measures and demand side subsidies can help protect those most in need, while investments in reliable and high quality public transport can improve the value that users receive from the system.

When evaluating financing strategies, cities should consider:

- the distribution of costs and benefits between direct and indirect beneficiaries;
- the effects of pricing mechanisms on vulnerable users and transport dependent groups;
- opportunities to reinvest revenues in more sustainable and inclusive mobility alternatives;
- intergenerational equity, ensuring that financing arrangements do not transfer disproportionate costs or risks to future administrations and residents.

Economically sustainable mobility should also be socially sustainable. Financing arrangements should expand access to opportunities, support inclusive urban development and ensure that the benefits of mobility investments are shared broadly across society.



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# Implementation watchouts – what to look out for

**Securing funding for implementation does not automatically make a mobility initiative economically sustainable. Cities should therefore look beyond initial capital availability and examine whether sufficient resources remain available for operation, maintenance and adaptation throughout the solution's lifecycle.**

Revenue assumptions, subsidy arrangements and financing mechanisms should be assessed carefully. Financial sustainability, affordability and public value should be considered together rather than separately.

**Cities should evaluate long-term viability and public value, not initial fundability. The key question is not whether a solution can be launched, but whether it can remain affordable, operational and financially sustainable throughout its lifecycle.**

### Red flags for economic sustainability

- Capital funding is secured, but operation and maintenance costs remain unfunded.
- Temporary grants or pilot funds are expected to support recurring expenditure.
- Financial viability depends on optimistic demand or revenue assumptions.
- The financing model relies heavily on a single revenue source or funding partner.
- Future administrations are expected to assume substantial obligations without clearly identified funding.
- Subsidies are introduced without defined objectives, performance expectations or monitoring arrangements.
- The costs and benefits experienced by different beneficiaries have not been assessed.
- Transaction, administration or enforcement costs relative to its expected revenue are not addressed.
- Financial risks and responsibilities are unclear or disproportionately transferred to the public sector.
- Funding opportunities determine the project, rather than supporting established mobility, climate and development objectives.
- Financing is considered only after a preferred technology or solution has already been selected.



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# Information cities should seek



**Financial viability should be demonstrated rather than assumed. Cities should seek sufficient information to understand whether a proposed solution can be implemented, operated and maintained throughout its expected lifecycle, without creating unaffordable services or unsustainable obligations for future administrations.**

At a minimum, cities should request information on:

- expected capital, operation and maintenance costs;
- the anticipated timing and recurrence of expenditure;
- projected revenue sources and funding contributions;
- the assumptions underlying demand, costs and revenue forecasts;
- the financing mechanisms proposed and the costs they are intended to cover;
- the allocation of financial risks and responsibilities;
- estimated user charges;
- the distribution of costs and benefits among direct and indirect beneficiaries;
- anticipated subsidies, their objectives and their intended beneficiaries;
- the public value expected from the investment;
- governance, monitoring and accountability arrangements;
- the strategy for maintaining financial viability beyond initial implementation.

Cities should also understand whether the proposed financing sources are **sufficiently stable and complementary**. One-off grants or temporary programs may be suitable for initial investment, but they should not be relied upon to cover recurring obligations unless a credible continuation strategy is in place.

Cities should seek evidence of long-term viability and public value rather than evidence of initial fundability. The relevant question is not only whether a solution can be launched, but whether it can remain affordable, operational and adequately maintained over time.

The checklist referring to this impact area is available upon request.

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## Impact area 4:

# AI, data and digital governance

**Cities have always relied on information to understand themselves. Month long traditional surveys and censuses, conducted manually by public employees and civil society volunteers using paper forms, aimed to collect data on population, transport, infrastructure, public health and economic activity. In the 19th century, this effort was intensified, as part of the wider movement towards modern means of governing the nation state [46], and during the last decades it has evolved into collecting fast and exhaustive data sets, enabled by the roll-out of a raft of new networked, digital technologies embedded into the fabric of urban environments that underpin the drive to create smart cities. [47]**

The already mentioned rampant spread of urbanisation together with the remarkable rise of information and communication technologies (ICT) play a significant role in shaping today's urban systems [48], especially in the way that they contribute to one another, as the past two decades have seen rapidly developing connections between smart technologies, digital governance and associated processes. [49] What has changed is not the relevance of data itself, but its **scale, speed, continuity and granularity**. Data is increasingly complemented by real-time information generated through sensors, cameras, smart cards, mobile devices, connected vehicles, digital platforms and other networked infrastructure, allowing (urban) services and infrastructure to become increasingly engineered, invisible, predictable, and automatic. [48]

This development forms the foundation of what has become known as the smart city. In a smart city, ICT-infused infrastructures enable the extensive monitoring and steering of city services, such as maintenance, mobility, air and water quality, energy usage, etc. [46] Digital technologies can improve decision-making, streamline public services and support more responsive urban administration. Artificial intelligence (AI) can further support this process by analyzing large volumes of information, identifying patterns and supporting decisions that would be difficult or time-consuming to make through conventional methods alone. [50]

Hence, the underlying promise regarding urban mobility and city logistics is compelling: the use of AI can enable intelligent and efficient transportation solutions, integrating technology to enhance mobility, reduce congestion, and improve accessibility. It can potentially support traffic management, route optimisation, predictive maintenance, public transport operations, multimodal journey planning, infrastructure monitoring and road safety applications. In city logistics, similar methods can be used to optimise vehicle routing, anticipate demand, manage supply chains and coordinate urban operations. [50] The possibilities are virtually endless, and some concepts are already being implemented, and can be found in different stages of development.

Yet, smarter does not automatically mean better and despite including the word "intelligence", cities should remain aware of AI's limitations. While it has the potential to change how urban governance is practiced, if its systems are trained on biased datasets, it can just as well exacerbate existing inequalities and exclusionary patterns [51; 50] It may equally struggle to reproduce subtleties of urban reality, for example, the unpredictable behavior of pedestrians [49], simplifying characteristics or generalizing patterns with the aim of reducing the complexity of the urban realm. This in turn could produce a reductionist and limiting understanding of cities and overly technocratic forms of urban governance. [47]

Other concerns related to digitalisation as a whole, refer to how data is handled, that is acquired, analyzed and produced, by the systems in place. According to van Zonnen's [46] extensive literature review, there are serious concerns among citizens as the same data that enables better services can be used for purposes that citizens did not anticipate. People's concerns about their privacy also depend on who is dealing with their personal data. Simultaneously there is a tangible risk that a technology introduced as a decision support tool may gradually acquire greater influence over decisions without a corresponding increase in transparency or democratic oversight.

The debate is therefore not whether cities should use smart data and AI. Rather, it is how they can make use of digital intelligence without undermining privacy, fairness, human agency, democratic accountability and public trust.



***Port of Rotterdam – Virtual Queuing***

*The Port of Rotterdam uses digital scheduling to replace physical truck queues with virtual queues. By coordinating arrivals through data-driven systems, the port can reduce waiting times, improve operational efficiency and make better use of existing infrastructure.*

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## Bias, privacy and security

Aside from the obvious advantage in being able to collect, analyze and categorize data on an unseen scale, AI can offer significant public value, allowing for information from different systems to be brought together and cross-analyzed, allowing cities to understand interaction and correlations that would usually not be visible “to the naked eye”. (52) Hence, by leveraging AI’s ability to analyze vast amounts of data and identify patterns, cities and governments are in a better position to make more informed decisions than ever before. (50)

Data nevertheless does not provide a neutral window onto urban reality. What is measured, where sensors are installed, which groups use digital services, and which indicators are selected all influence the picture that emerges. Moreover, systemic bias is common, either due to hidden prejudice or due to data scarcity from poorer urban areas. (53) Areas with extensive digital infrastructure may generate large quantities of information, while less affluent or less connected neighborhoods remain data poor. People who cannot or do not use digital services may be absent from the datasets on which decisions are based, resulting in serious gaps.

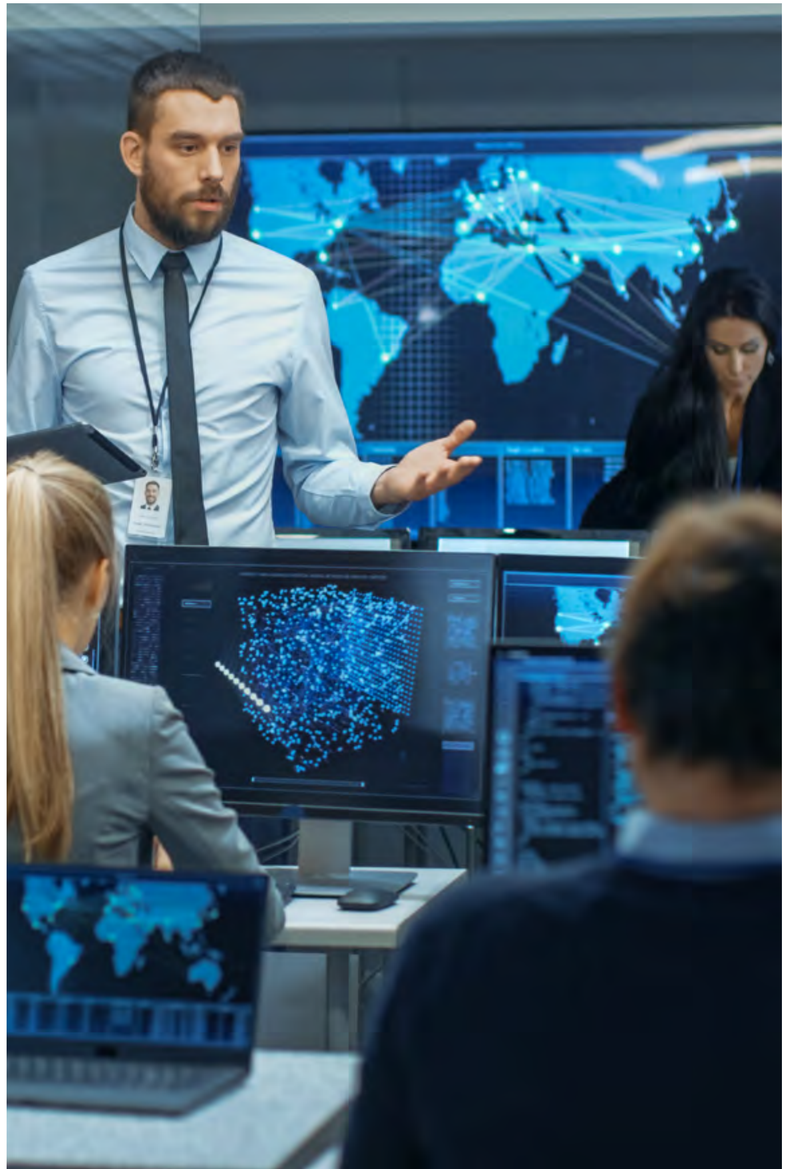
Data are shaped by the ideas, instruments, practices and systems through which they are produced, while analytics similarly reflect particular technical and political choices. Data-driven insights should therefore complement rather than displace professional experience, local knowledge, deliberation and other ways of understanding urban life. (52)

This is especially relevant in urban mobility and city logistics, where data may describe movements efficiently without fully capturing why people travel, what barriers they experience, how working conditions affect delivery patterns or which communities bear the burdens of transport and freight activity. An optimisation model may identify the fastest movement through a city, but it cannot decide by itself whether that outcome is fair, desirable or aligned with wider public goals.

One of the most persistent concerns surrounding data-driven cities relates to privacy. Smart city technologies can generate detailed information about where people travel, how they use services, whom they interact with and how their routines develop over time. As data from smart cards, apps, cameras, connected vehicles and other sources are combined, patterns that once remained private or difficult to observe can become increasingly visible. (46)

### EU AI ACT:

The EU AI Act is the world's first comprehensive legal framework for artificial intelligence. It establishes a risk-based approach to AI governance, requiring higher levels of transparency, accountability, human oversight and risk management for applications with greater societal impact. These principles are particularly relevant for smart city technologies, urban mobility systems and data-driven planning, where AI can improve decision-making while also raising concerns related to privacy, bias, fairness and democratic accountability. The Act therefore provides an important regulatory foundation for the responsible deployment of AI in urban governance. (European Union, 2024)



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Privacy concerns depend not only on the sensitivity of the information collected, but also on the purpose for which it is used. Data and services are used to perform a wide variety of tasks for which the data were never intended. [52] The collection, storage, and processing of such data raise questions about the protection of citizens' privacy rights. [50] Mobility data are particularly sensitive because location and movement can reveal much more than a route. Repeated travel patterns may disclose places of work, healthcare visits, social relationships or other aspects of personal life. While many citizens are not particularly alarmed about their mobility data being collected and processed per se, some do express concerns related to the purpose for which data is collected and who is handling it. [46] Also, where in the world, that is under which jurisdiction, their data is stored and processed, is often mentioned as a reason for scepticism.

Digital and software innovations have added another layer to these data, for instance, the use of facial recognition software to analyse the images captured by CCTV cameras [46], further contributing to the already increased comprehensiveness, accuracy and granularity of urban data. [47] The volume and diversity of these interactions is so onerous that it's not realistic for individuals to track all data collected about themselves. There is thus no possibility of opting out, and therefore this intensive surveillance happens without active consent. [47]

As mobility and logistics systems become more digitally interconnected, data security becomes inseparable from operational safety and continuity, as data diversify and multiply at unprecedented and unplanned speed. [46] The result is a complex data landscape in which ownership, responsibility and accountability can become difficult to trace. Data may move between public authorities, operators, technology providers and other third parties, while the original data may be combined, repackaged or used to create additional derived information. Such complexity can make it difficult for individuals to access, correct or delete information about themselves, and equally difficult for cities to determine who will be held accountable when something goes wrong. On the other hand, less digitally literate citizens may struggle with understanding that their rights are being infringed upon and may even consent to sharing data due to lacking understanding of the implications thereof.

Cybersecurity should therefore not be treated merely as an IT function. In mobility and city logistics, failure affecting traffic management systems, public transport, connected vehicles or logistics platforms may have consequences in the physical world. Responsible digital governance requires **clear security responsibilities**, effective oversight of vendors and partners, appropriate safeguards throughout the data lifecycle, and **contingency arrangements** that allow essential urban services to continue when digital systems fail.

City managers need to consider the potential pernicious effects of the roll out of smart city technologies and that notice and consent are all but impossible in many cases and take a proactive role in brokering privacy and security arrangements on behalf of citizens through contracting procedures and parameters. [47]

### Urban development in the age of AI and autonomous systems

Urban automation takes several forms and the impending use of robotic and automation systems (RAS ) is swiftly moving from science fiction and R&D to reality. [51]

It may be embodied in AVs, service robots and delivery systems, or operate less visibly through software agents, predictive tools and digital platforms. So-called city brains seek to bring together information from cameras, sensors and other urban systems to manage traffic or coordinate infrastructure. [54] Generative AI, on a different note, adds another dimension by producing text, images, scenarios and planning alternatives from patterns learned within extensive datasets. [53]

The introduction of RAS into urban systems changes the relationship between technology and urban governance. Digital tools are no longer limited to presenting evidence to human decision-makers. These technologies can supplement human capabilities, more than they can replace them. RAS can process a scale of information that would overwhelm individual decision-makers, assist in identifying spatial deficiencies and support the comparison of alternative interventions. They can support more responsive public transport, identify accessibility gaps, optimize traffic and delivery operations, anticipate infrastructure needs, model environmental risks and help cities compare possible courses of action. [50] [55] The use of RAS however, comes with certain risks, as they can be glitchy, cause accidents, and make new demands on humans as well as the design of cities. [49] City officials should use such tools to support the complex analytical and design tasks involved in urban development, while avoiding overreliance on their predictive or prescriptive capacities. [53] Data and AI therefore have considerable potential to improve urban mobility and city logistics, building on and in tandem with the real-life experience and competences already in place.

Still, the opacity of algorithms and decision-making processes in digital and AI governance can lead to a **lack of trust** among citizens. **Promoting transparency** in AI systems is crucial for accountability, fostering public trust, and ensuring that decisions are explainable and justifiable. [50] If an algorithm influences public decisions, those affected should be able to understand, at least in meaningful terms, how the result was reached. Still many RAS systems rely on complex processes, which are difficult for residents, planners and sometimes even technical experts to interpret.

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Transparency should be encouraged with the aim to enable meaningful scrutiny. Decision-makers need to understand the purpose of the system, the data on which it relies, its known limitations and the circumstances in which human intervention is required. Residents need accessible information about how systems influence services or decisions that affect them. Processes for collecting feedback, reporting glitches, challenging outputs, correcting errors and seeking redress are therefore as relevant as technical explainability.

Does a city become intelligent simply by automating its systems? Not really. Urban intelligence emerges when technological capability is combined with human judgement, public accountability, local knowledge and democratic choice. According to [50], "determining who is responsible when an AI system makes an erroneous decision or causes harm is a complex issue." This does not mean that every automated action requires prior approval from an individual officer. Rather, cities should determine **where automation is appropriate**, where and how supervision is necessary and which decisions should never be delegated without direct human judgement. The objectives, performance criteria and acceptable outcomes of an RAS system must still be defined. Even when a machine chooses an action autonomously, the parameters within which it acts reflect prior decisions concerning what the system should optimise and whose interests it should serve. Governments need to establish **clear lines of accountability**, define responsibilities for RAS system outcomes, and develop mechanisms for addressing unintended consequences. [50] The greater the potential effect on rights, access to services, safety or public resources, the stronger the case for **meaningful human review**. Therefore, autonomy should not be confused with independence from human choices and decisions.

The objective is not merely to create cities that collect more data, automate more processes or deploy more advanced technologies. It is to ensure that digital intelligence strengthens public value while preserving privacy, fairness, accountability, human agency and democratic control.

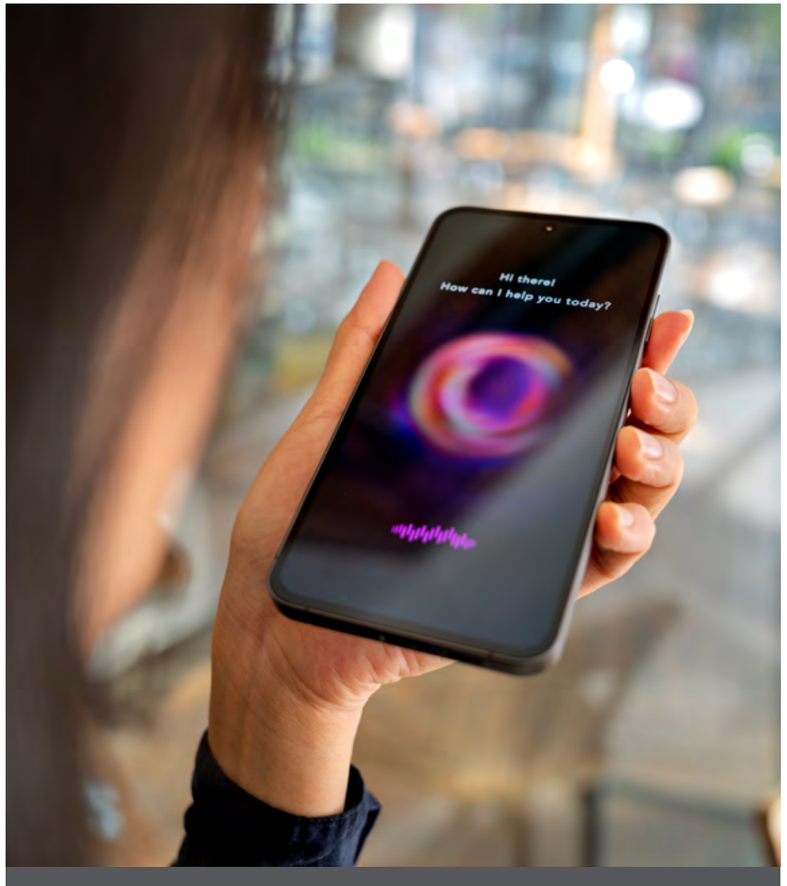
In this sense, the central challenge of urban RAS is not whether machines can help cities make decisions. It is whether cities can create human-centric systems to govern those machines, and the data on which they depend, in a way that produces urban futures people can understand, influence and trust.

The ultimate objective is trusted, human-centered digital governance that strengthens public value while protecting rights and democratic accountability.

**Key-takeaways:**

- Data is not neutral. What is measured, who is represented and how information is interpreted all influence the outcomes produced.
- AI can improve decision-making, but it cannot replace human judgement.
- Bias, privacy and security risks must be managed from the outset, not after deployment.
- Transparency, accountability and explainability are essential for maintaining public trust.
- Data-driven systems should support public value, not become ends in themselves.
- Cities should govern technology, rather than allowing technology to govern cities.

***A note on etymology: RAS (Robotics and Autonomous Systems) is broader than AI. AI is one of the enabling technologies that may be embedded within a RAS, but not every RAS necessarily relies on AI. Similarly, Federico Cugurullo distinguishes between automation and autonomy. A system may be highly automated without being intelligent in the AI sense. Therefore, RAS is here to be perceived as the umbrella term encompassing automated systems, robotics and AI-enabled autonomous systems.***



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# Standards for implementation

**Data, digital technologies and RAS in general should not create unacceptable risks for citizens, businesses or public authorities. At a minimum, solutions should avoid causing harm through inappropriate collection or use of data, inadequate security, discriminatory outcomes, opaque decision-making processes or the erosion of public trust. Cities should ensure that responsibilities remain clearly assigned. The introduction of data analytics or RAS should never obscure who is accountable for decisions, actions or consequences.**

Beyond avoiding harm, digital technologies and RAS can actively contribute to better urban outcomes. This distinction allows cities to differentiate between solutions that merely avoid digital harms and those that actively generate public value.

## Human oversight before automation

Cities should treat AI primarily as a decision support tool rather than a decision-maker. That means that while AI can support decisions, responsibility for them should remain human. Algorithms cannot determine public priorities, resolve value-based trade-offs or define what constitutes a desirable outcome for society. The greater the potential impact of a decision on rights, opportunities, public services or public resources, the greater the need for meaningful human oversight.

Automation should therefore be accompanied by clearly defined responsibilities, mechanisms for review and challenge, transparent governance arrangements and opportunities for human intervention where necessary. The objective is not to slow innovation, but to ensure that RAS remain aligned with public objectives and democratic accountability.

### Minimum standard — do no harm

**This includes avoiding:**

- opaque “black-box” decision-making;
- algorithmic bias and discriminatory outcomes;
- cyber security vulnerabilities;
- breaches of privacy and confidentiality;
- unnecessary or disproportionate data collection;
- overreliance on automated systems where human judgement remains necessary;
- unclear accountability for decisions and outcomes;
- loss of public trust resulting from poor data governance or transparency.

### Additional public value — net positive contribution

**Examples include:**

- improving evidence-based decision-making;
- increasing the efficiency and responsiveness of mobility and logistics systems;
- identifying service gaps and emerging challenges;
- supporting safer and more resilient urban operations;
- improving coordination across organisations and systems;
- enabling better monitoring of environmental, operational and social outcomes;
- improving the quality and consistency of public services;
- supporting long-term planning through better analysis and forecasting.



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## Data governance and stewardship

The value of digital systems depends on the quality, integrity and governance of the data on which they rely.

Cities should encourage data management practices that support public objectives while respecting privacy, security and legitimate commercial sensitivities. Also, citizens are generally more willing to share information when the purpose behind data collection is clear and when tangible public benefits can be demonstrated. Conversely, unclear practices, excessive collection of information or perceptions of surveillance can undermine confidence in both the technology and the institutions deploying it. The collection of more data should not be considered an objective in itself. Instead, cities should focus on ensuring that data is **relevant, reliable and suitable** for the decisions it is intended to support, and data collection should be governed through clear arrangements regarding ownership, access, storage, retention and use.

Care should also be taken to understand the limitations of available data. Incomplete, outdated or unrepresentative datasets may create distorted views of urban realities and lead to unintended consequences when used to inform decisions. The successful deployment of digital technologies depends not only on functionality, but also on confidence that information is being used responsibly.

Trust should be treated as an outcome that requires continuous attention rather than a one-time achievement obtained through legal compliance alone, and trust depends on understanding. Cities should hence favor digital systems that provide transparent methodologies, understandable outputs and clear information regarding how recommendations or decisions are generated. This is particularly important when data analytics or AI influence planning, service delivery, resource allocation or operational decisions. Decision-makers should be able to understand:

- what data are being used;
- how information is being processed;
- what assumptions underpin the analysis;
- what limitations exist;
- who remains accountable for decisions.

Transparency is a prerequisite for trust, legitimacy and public acceptance.



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# Implementation watchouts – what to look out for



**Data and AI can support better decisions, but they do not remove uncertainty, bias or governance responsibilities. Cities should avoid treating algorithmic outputs as objective facts and remain attentive to how data is collected, interpreted and used.**

Successful digital governance depends not only on technical performance, but also on transparency, accountability, security and public trust.

**Cities should evaluate public value, not digital sophistication. The key question is not whether a solution is data-driven, connected or AI-enabled, but whether it improves decision-making and urban outcomes while preserving transparency, accountability, privacy and public trust.**

### Red flags for AI and data governance

- Large benefits are claimed without explaining the underlying data, assumptions or methodology.
- AI outputs are presented as objective facts rather than recommendations requiring interpretation.
- Decision makers cannot explain how a system reaches its conclusions.
- Responsibility becomes unclear once automated systems are introduced.
- Data collection and analytical capability are treated as objectives in themselves, exceeding what is necessary for the intended purpose.
- Privacy, security and governance arrangements are addressed only after deployment.
- Important decisions are made without meaningful human oversight.
- Public concerns are dismissed as communication problems rather than governance issues.
- Trust is assumed instead of being actively maintained through transparency and accountability.

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# Information cities should seek



**Cities should seek information that helps them understand how a solution functions, what information it relies upon, how decisions are generated and how risks are managed.**

At a minimum, cities should request information on:

- the public problem the solution is intended to address;
- the role of data, analytics and AI within the solution;
- data sources, ownership arrangements and governance structures;
- privacy, security and data protection measures;
- the level of automation and human oversight involved;
- methodologies, assumptions and limitations underlying analytical outputs;
- bias testing, fairness assessments and model validation processes;
- accountability arrangements and decision-making responsibilities;
- monitoring, auditing and performance reporting mechanisms;
- evidence from pilots, previous deployments or operational experience.

Cities should also seek to understand the quality and representativeness of the data being used. Information that does not adequately reflect the populations, areas or activities affected by a solution may create misleading results or unintended consequences. Where possible, evidence should be based on real-world experience rather than theoretical performance estimates.

The checklist pertaining to AI, data and digital governance is available upon request.

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## Impact area 5:

# System integration and implementation readiness

**Automation is often discussed as a vehicle technology challenge, yet real world deployment depends far more on ecosystem integration. The successful deployment of automated mobility depends not only on the maturity of individual technologies, but on the ability to integrate them within existing urban systems. As automation, electrification, and digitalisation converge, mobility increasingly relies on interconnected transport, energy, data, and governance ecosystems. Consequently, implementation readiness must be understood as a broader measure of system maturity, encompassing the capacity of infrastructure, institutions, and stakeholders to support innovation at scale.** (56; 57)

A key prerequisite for this transition is interoperability across vehicles, infrastructure, digital platforms, and energy networks. However, despite rapid technological progress, large-scale implementation continues to be constrained by legacy infrastructure, fragmented data ecosystems, and institutional inertia. The literature therefore suggests that the main challenge lies not in the development of automated mobility technologies themselves, but in establishing a viable deployment pathway that enables their integration into complex urban environments. (56; 58) Against this background, five interrelated barriers emerge as critical determinants of system integration and implementation readiness: infrastructure readiness, energy system integration, data interoperability, cybersecurity and resilience, and governance fragmentation. Together, these dimensions define the conditions under which automated and electrified mobility systems can move from experimentation to large-scale deployment.

Automated mobility services must operate within complex urban ecosystems that combine transport infrastructure, energy systems, digital platforms, public services, governance arrangements and user behavior.

A technologically mature vehicle will not create public value if charging infrastructure is insufficient, data systems are fragmented, regulatory frameworks are unclear, or user trust does not exist. (58)

The transition toward automated mobility is also occurring alongside two other transformative trends: electrification and digitalisation. As a result, future mobility systems will become increasingly interconnected with renewable energy networks, vehicle-to-grid services (V2G), intelligent transport systems, and real-time data platforms. These interdependencies create opportunities for greater efficiency, lower emissions, and improved accessibility, but they also introduce new vulnerabilities and implementation challenges. (59) (56)

For cities, implementation readiness therefore extends beyond testing vehicles. It requires readiness across infrastructure, energy, governance, data, and organisational capabilities. A city's ability to **absorb, adapt and scale innovation** may ultimately be more important than the sophistication of any individual technology solution. (57) (56)

Before transitioning from isolated pilot projects to large-scale implementation, cities should establish a robust evidence base across multiple dimensions of system readiness. First, operational readiness should be assessed through **real world testing**, focusing on system reliability under diverse operating conditions, performance during adverse weather events and periods of peak demand, interactions between automated and conventional vehicles, and the compatibility of new mobility technologies with existing urban infrastructure. Evidence from the literature suggests that the successful deployment of automated mobility depends not only on technological maturity but equally on the ability of urban systems to accommodate and integrate these innovations within existing transport networks. (56) (58)

*"Innovation is investing in ecosystem collaboration and finding the right partners."*

***Renée Schoonbeek, Arcadis City Executive for Amsterdam***



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Second, cities should evaluate the potential energy and infrastructure implications associated with large-scale deployment. Particular attention should be paid to electricity demand profiles, charging infrastructure utilisation patterns, opportunities arising from V2G services, and potential requirements for grid reinforcement. As mobility systems become increasingly electrified, transport and energy systems are becoming deeply interconnected, requiring coordinated planning to ensure grid stability, operational resilience, and effective integration of renewable energy sources. [59] Verde et al. [56]

Third, the transition towards automated mobility necessitates a clear understanding of **data governance and interoperability requirements**. This includes establishing frameworks for data ownership and sharing, adopting standardized communication protocols and interfaces, ensuring robust cybersecurity protections, and defining long-term responsibilities for data stewardship. The literature consistently identifies fragmented data ecosystems and insufficient interoperability as major barriers to scaling smart mobility beyond pilot environments. [56] [58] A further consideration relates to user acceptance and societal trust, which may ultimately determine the long-term viability of automated mobility services. Cities should therefore seek evidence on citizens' perceptions of safety, trust in automated decision-making processes, acceptance of data sharing practices, and willingness to adopt emerging mobility services. Public trust is increasingly recognised as a critical enabler of deployment, particularly in contexts characterised by extensive data exchange and AI-supported decision-making. [56] [58]

Finally, municipalities should assess their overall innovation readiness, reflecting their capacity to absorb, implement, and scale innovation. Relevant dimensions include stakeholder collaboration capabilities, the availability and accessibility of mobility data, innovation financing mechanisms, institutional coordination capacities, as well as workforce skills and organisational competencies. Existing research demonstrates that cities with mature governance structures, strong cross-sectoral collaboration, and adequate technical capabilities are significantly better positioned to support the successful integration of complex mobility innovations. [56]

**Key-takeaways:**

- System integration matters more than technology readiness
- Operational and infreastructure readiness must be demonstrated under real-world conditions
- Energy and mobility systems must be planned jointly
- Data interoperability and cybersecurity are foundational requirements
- Public trust and innovation capacity are decisive enablers

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# Standards for implementation

### Minimum standard — do no harm

**At minimum, the city should understand:**

- whether existing infrastructure can be reused;
- whether existing infrastructure can be upgraded;
- whether partial integration is possible;
- whether new infrastructure is genuinely necessary;
- whether previous public investments would be made obsolete;
- whether the solution can operate safely and legally in the local context;
- whether the provider can clarify responsibilities, maintenance, insurance and operational limits.

### Additional public value — net positive contribution

**A high-performing solution may:**

- address a clearly identified local challenge;
- complement existing public transport, walking, cycling and logistics systems;
- integrate with existing physical, digital, energy and transport infrastructure;
- make good use of previous public investments;
- avoid unnecessary duplication;
- support interoperability and open standards;
- scale beyond pilot stage;
- define operational limits clearly;
- have regulatory, insurance and liability pathways;
- contribute to long-term system resilience.




### Public value standard

Cities should evaluate automated mobility not only through a technological lens, but through its contribution to broader public value objectives.

First, automated systems should contribute to safer, cleaner and more accessible mobility rather than simply replacing human drivers with automated vehicles. Public value is maximized when automation supports reduced emissions, enhanced accessibility for vulnerable users, improved multimodal integration, and more efficient use of existing transport infrastructure. [58] Second, cities should monitor whether new technologies reinforce or reduce existing inequalities. Research highlights the risk that advanced mobility services concentrate benefits in already well-served urban areas, while peripheral neighborhoods face lower service quality or reduced accessibility. Equitable deployment should therefore remain a central policy consideration. [56] Third, public trust should be treated as a strategic asset. Automated mobility relies heavily on data collection, AI-driven decision-making, and connected infrastructure. Without transparency, explainability and robust data governance, citizen acceptance may become a greater barrier than technical performance itself. [56] [58] Finally, cities should recognize that environmental benefits are not automatic. Automated mobility only contributes to sustainability if integrated with low carbon energy systems, shared mobility models and strategies that reduce overall vehicle dependency rather than increase vehicle kilometres travelled. [59]

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## Leave no one behind

System integration decisions can create unequal outcomes if the benefits of innovation are concentrated in already well-served areas while peripheral communities continue to experience lower levels of access and service quality.

Cities should therefore consider:

- whether new systems improve accessibility across the entire urban area;
- whether benefits are distributed fairly between neighborhoods and user groups;
- whether interoperability enables broader access to services;
- whether investments reinforce existing inequalities or help reduce them;
- whether public trust is being strengthened through transparent deployment processes.

The objective is not simply to deploy innovative technologies, but to ensure that innovation contributes to an accessible, resilient and equitable mobility system.



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# Implementation watchouts – what to look out for

**A growing body of literature suggests that the successful implementation of automated and connected mobility systems is constrained less by technological maturity than by a set of interconnected systemic barriers. While significant advances have been achieved in vehicle automation, connectivity, artificial intelligence, and electrification, the transition from pilots to large-scale deployment remains challenging. Existing urban systems were largely designed for conventional mobility paradigms and are often ill-equipped to accommodate the technological, organizational, and infrastructural requirements associated with automated mobility.**

Consequently, the literature increasingly emphasizes that the scalability of automated mobility depends not only on vehicle performance, but also on the ability of cities to integrate new technologies into existing transport, energy, digital, and governance systems. In this context, five recurring implementation barriers emerge across the literature:

- **Infrastructure readiness:** Many urban transport networks were designed for conventional vehicles and centralized systems. Retrofitting roads, intersections, charging infrastructure, sensor networks and communication systems often require substantial investment and long planning cycles. Technology frequently evolves faster than infrastructure can adapt.
- **Energy system integration:** The convergence of automation and electrification places increasing demands on electricity networks. Large-scale deployment of automated electric fleets may create peak demand challenges, requiring smart charging, local storage and vehicle-to-grid integration.
- **Data interoperability:** Automated mobility depends on seamless data exchange between vehicles, infrastructure operators, mobility providers and public authorities. Fragmented data environments, incompatible standards and proprietary platforms remain major obstacles to scaling.
- **Cybersecurity and resilience:** Connected and automated vehicles increase the attack surface of the urban mobility system. Vehicle-to-everything (V2X) communications, charging infrastructure and mobility platforms must be protected against cyber threats while ensuring service continuity during disruptions.
- **Governance fragmentation:** Many implementation challenges arise from institutional rather than technical barriers. Transport authorities, energy providers, urban planners, mobility operators and digital infrastructure managers often operate with different objectives and planning horizons. Without integrated governance structures, promising innovations remain confined to pilot projects.

**Cities should evaluate ecosystem readiness, not technology readiness alone. The key question is not whether the technology works, but whether the surrounding infrastructure, institutions, governance arrangements and stakeholders are ready to support it at scale.**

**Red flags for system integration and implementation readiness**

- Deployment depends on infrastructure that does not yet exist.
- Energy requirements have not been assessed.
- Data standards and interoperability requirements remain undefined.
- The solution relies on proprietary systems with limited integration potential.
- Governance responsibilities are unclear.
- The pathway from pilot to large-scale implementation is undefined.
- Technology readiness is presented as evidence of implementation readiness.
- A solution performs well in simulations but lacks evidence from real-world conditions.



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# Information cities should seek

**Implementation readiness should be demonstrated rather than assumed. Before transitioning from isolated pilot projects to large-scale implementation, cities should establish a robust evidence base across multiple dimensions of system readiness.**

At a minimum, cities should request information on:

- operational readiness and real world performance;
- interactions with existing transport systems;
- energy and infrastructure requirements;
- charging and electricity demand implications;
- opportunities for vehicle-to-grid integration;
- data governance and interoperability requirements;
- cybersecurity and resilience arrangements;
- stakeholder and organizational responsibilities;
- regulatory and liability arrangements;
- evidence of user acceptance and public trust;
- implementation, scaling and transition pathways;
- the city's own innovation readiness and institutional capacity.

Cities should seek evidence based on operational deployments wherever possible rather than exclusively on simulation studies or laboratory testing. The checklist relative to this impact area is available upon request.



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# Takeaways for implementation

The five impact areas examined in this guidance address different aspects of mobility and logistics systems. Nevertheless, a number of common lessons emerge across all areas. These should be considered throughout the assessment, planning, implementation and monitoring process.

### Focus on outcomes rather than technologies

Cities should avoid evaluating solutions based primarily on their technological characteristics.

A solution is not environmentally sustainable simply because it is electric, nor is it inclusive simply because it is accessible. Obtaining secured funding does not ensure economic sustainability, and the label “data-driven” does not make a solution automatically trustworthy. Likewise, a technology is not implementation-ready simply because it performs well in a pilot environment. The relevant question is always whether the solution contributes to better urban outcomes in the local context.

Successful implementation therefore requires cities to focus on the outcomes a solution creates rather than the technologies it uses.

### Assess solutions as part of a wider system

Mobility solutions rarely affect only one part of the urban system and a solution that performs well in one area while creating significant problems elsewhere should be approached with caution.

Cities should therefore evaluate solutions within the broader context of transport systems, public space, governance arrangements, energy systems and urban development.



***Unexpected behavioral responses: São Paulo***

*To reduce congestion, São Paulo introduced a vehicle rotation scheme restricting road access according to licence plate numbers on specific weekdays. While the measure reduced traffic initially, some households responded by purchasing a second vehicle with a different licence plate to maintain unrestricted travel.*



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### Consider the full lifecycle

Implementation should not be viewed as a one-off event. Cities should consider:

- planning and procurement;
- construction and deployment;
- operation and maintenance;
- monitoring and evaluation;
- adaptation and upgrading;
- eventual replacement or decommissioning.

**Short-term success does not necessarily translate into long-term value.** Cities should therefore assess whether environmental, social, financial, governance and operational objectives can be maintained throughout the lifetime of the intervention.

### Be alert to unintended consequences

Many mobility solutions produce effects that differ from those originally anticipated.

As we have seen, efficiency improvements may increase travel demand, and new technologies may create new

### Prioritize evidence over assumptions

Benefits should be demonstrated rather than assumed. The absence of evidence does not necessarily mean a solution should be rejected, but it may justify additional testing, monitoring or phased implementation.

### Prioritize evidence over assumptions

Benefits should be demonstrated rather than assumed. The absence of evidence does not necessarily mean a solution should be rejected, but it may justify additional testing, monitoring or phased implementation.

### Recognize that context matters

No mobility solution is universally appropriate, and solutions that perform well in one city may not produce the same results elsewhere. Cities should therefore test and if needed adapt solutions to local circumstances rather than attempting to replicate examples directly. The objective is not to identify a universally optimal solution, but to determine what is appropriate for a particular place and moment in time.

### Integration matters

Successful implementation depends on the ability of a solution to integrate with existing systems. Many implementation challenges arise not because a technology fails, but because it cannot be effectively integrated into the surrounding system. Integration should therefore be considered from the earliest stages of planning, as certain coordination and alignment negotiations, may be time-sensitive and impossible to ensure at later stages of implementation.

### Trust Is an enabler of implementation

Trust repeatedly emerges as a prerequisite for successful deployment. Citizens, users and stakeholders are more likely to support change when they understand can contribute to the solution design process and understand why and how a solution is being introduced. **Transparency, accountability and responsiveness** should therefore be treated as core implementation considerations rather than afterthoughts.

### Ensure that no one is left behind

Innovation should expand access to opportunities rather than concentrate benefits among already advantaged groups. Cities should intrinsically and consistently consider a variety of factors such as affordability, accessibility, inclusion, digital participation, geographic equity, intergenerational impacts. The objective is not merely to avoid harm, but to ensure that mobility systems contribute to broader participation in economic, social and civic life.



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**Final Reflection**

Across all five impact areas, a consistent message emerges: the objective is not to deploy innovative technologies, but to improve quality of life through better mobility and logistics outcomes.

**Successful implementation depends not only on whether a solution works, but on whether it is capable of creating lasting environmental, social, economic and governance benefits within the local urban context.**



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# Implementation process: Applying FAIR-GO

The transition towards an automated mobility future requires more than technological innovation. While considerable progress has been achieved in automation, electrification, AI, and connected mobility, experience from cities worldwide demonstrates that technological capability alone does not guarantee successful implementation. The ultimate success of an intervention depends on its ability to **generate public value**, integrate with existing urban systems, **gain societal acceptance**, and remain feasible within local institutional and resource constraints.



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To support decision-makers in navigating this complexity, this guidance adopts the **FAIR-GO Framework**. The framework provides a structured assessment lens through which mobility solutions can be evaluated throughout the entire deployment pathway, from early stage concept development and piloting to large-scale implementation and long-term operation. Rather than focusing solely on technical performance, **FAIR-GO** encourages a holistic perspective that considers social, economic, institutional, and operational dimensions alongside technological maturity. This perspective is particularly important in the context of automated mobility, where implementation frequently depends on factors beyond the technology itself, including infrastructure readiness, interoperability across systems, stakeholder coordination, governance capacity, public trust, and long-term affordability. A solution that performs well technically may still fail if it cannot be effectively integrated into existing urban ecosystems or if the necessary institutional and societal conditions are absent. Conversely, technologies with moderate levels of maturity may deliver substantial public value when deployed within supportive governance and infrastructure environments.

The FAIR-GO Framework therefore seeks to bridge the gap between innovation and implementation by asking six leading questions in Figure 7.

Taken together, these six dimensions provide a practical and decision-oriented framework for evaluating mobility interventions. Rather than treating implementation readiness as an isolated measure, FAIR-GO positions readiness as a broader assessment of system maturity, recognizing that successful deployment requires the alignment of technology, infrastructure, governance, institutions, and people. In this way, the framework supports cities in identifying not only what is technologically possible, but also what is **feasible, desirable, and scalable** within real-world urban environments.

In doing so, **FAIR-GO** shifts the conversation **from technology deployment to public value creation**. It helps cities, mobility providers, and other stakeholders identify not only what is technologically possible, but also what is likely to deliver meaningful, trusted, and lasting benefits for people and communities while remaining feasible and scalable within real-world urban environments. The framework therefore serves as a bridge between innovation and implementation, ensuring that automated mobility contributes not only to smarter transport systems, but also to more inclusive, resilient, and liveable cities.

The **FAIR-GO** Framework translates the complexity of automated mobility implementation into a structured and evidence-based assessment process. While the five impact areas define the substantive dimensions of evaluation, **FAIR-GO** provides the normative lens through which assessment results are interpreted and translated into implementation decisions. This relationship establishes a clear hierarchy that links strategic objectives to measurable outcomes.

At the highest level, **FAIR-GO** defines the principles that should guide decision-making. These principles are operationalised through the five impact areas, which are further disaggregated into assessment criteria, indicators, evidence requirements, and measurable Key Performance Indicators (KPIs). Together, these elements create a consistent and transparent framework for evaluating the readiness, desirability, and long-term viability of emerging mobility solutions.

Importantly, the framework recognizes that implementation success cannot be explained by technological readiness alone. Rather, it emerges from the interaction of technological, environmental, social, economic, institutional, and governance factors. As a result, the assessment process seeks to determine not only whether a solution can be deployed, but whether it is capable of delivering sustainable public value within a specific urban context.

**F**

### Fair

Does the solution contribute to equitable, inclusive, and accessible mobility outcomes?

**A**

### Affordable

Is the solution financially sustainable for users, operators, and public authorities?

**I**

### Implementable

Can the solution realistically be delivered within existing technical, regulatory, and operational contexts?

**R**

### Responsible

Does the intervention support environmental sustainability, resilience, safety, and broader societal well-being?

**G**

### Governable

Are governance structures, institutional responsibilities, and stakeholder arrangements in place to support deployment and long-term operation?

**O**

### Optimal

Does the solution effectively address the identified challenge and deliver measurable benefits compared with alternative approaches?

*Figure 7: FAIR-GO leading questions.*

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# Frame the challenge: define what matters

**Before assessing potential solutions, cities must establish a clear understanding of the context within which decisions are being made. This requires identifying the specific challenge to be addressed, the strategic transition to be accelerated, or the future development for which preparation is required. Rather than treating technological innovation as an objective in its own right, FAIR-GO adopts a public value oriented perspective that positions mobility and logistics solutions as means to achieve broader societal outcomes. The framework is grounded in the assumption that the value of any intervention cannot be determined solely by its technical sophistication or novelty. Instead, its relevance depends on the extent to which it contributes to locally defined policy objectives, responds to contextual needs, and generates tangible benefits for people, communities, the environment and the wider mobility system. Consequently, assessment should begin not with available technologies, but with a clear articulation of the desired outcomes and the conditions under which they are tobe achieved.**

Cities should begin by defining one of the following entry points:

- a **specific urban challenge** requiring intervention, such as congestion, accessibility gaps, transport poverty, emissions, or road safety concerns;
- a **strategic transition objective** that reflects longer-term policy ambitions, such as decarboniszation, modal shift, digital transformation, or inclusive mobility; or
- a **future trend, uncertainty or emerging development** requiring anticipation and preparedness, such as automation, AI, demographic change, climate adaptation, or evolving travel behavior.

This challenge- and outcome-oriented framing ensures that assessment activities remain anchored in societal goals rather than technological characteristics. It establishes a transparent basis for evaluating whether a proposed solution contributes to desired public value outcomes and whether it represents an appropriate response to local needs, priorities and future conditions.



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**Existing urban challenges**

- road congestion;
- freight congestion;
- noise pollution;
- poor air quality;
- road safety concerns;
- curbside conflicts;
- parking pressure;
- high vehicle kilometers traveled;
- poor first- and last-mile connectivity;
- underserved peripheral neighborhoods;
- lack of affordable mobility;
- accessibility barriers;
- public transport capacity constraints;
- inefficient urban freight;
- logistics impacts in residential areas;
- poor access to essential goods and services.



**Strategic transitions**

- reducing fossil fuel dependency;
- decarbonizing passenger mobility;
- decarbonizing urban freight;
- electrification;
- use of renewable energy;
- mode shift towards walking:
- mode shift towards cycling;
- mode shift towards public transport:
- increasing shared mobility;
- reducing private car dependency;
- improving multimodality;
- promoting healthier and more active lifestyles;
- reducing land consumption by transport infrastructure.



**Future pressures and emerging trends**

- population growth;
- ageing population;
- e-commerce growth;
- climate adaptation needs;
- labor shortages;
- digitalisation;
- automation;
- autonomous mobility;
- changes in commuting patterns;
- new delivery models;
- energy system transition.

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# Gather evidence: assess what you know



## Step 1 — Assess the solution accross the five impact areas

The assessment process follows a four stage logic that connects strategic objectives with evidence-based evaluation. The proposed mobility solution is first evaluated against the five impact areas. These domains encompass the principal factors that influence the societal value, operational feasibility, and long-term sustainability of automated mobility interventions.

## Step 2 — Evaluate assessment criteria

Each impact area is composed of a set of assessment criteria that translate broad policy objectives into specific evaluation dimensions. These criteria provide a systematic basis for examining the strengths, limitations, risks, and opportunities associated with a given solution. A series of checklists that can be used as support tools for performing this assessment, have been made available as annexes to this guidance.

## Step 3 — Gather evidence and assess KPIs

For each assessment criterion, Step 2 will reveal gaps in knowledge or data, that will then guide further collection of qualitative and quantitative evidence. Sources may include business cases, technical studies, pilot evaluations, environmental assessments, stakeholder consultations, governance documentation, operational data, and user research. This evidence is used to evaluate predefined KPIs, which provide a transparent and comparable basis for measuring performance and readiness across different solutions and implementation contexts.

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## Step 4 — Interpret findings through FAIR-GO

The results generated within the five impact areas are subsequently interpreted through the six **FAIR-GO** dimensions.



## Interconnected by design

The FAIR-GO dimensions draw on evidence from across all five impact areas. These are evidence relationships, not fixed assignments.

| FAIR GO dimensions | | The five impact areas (sources if evidence) | | | | |
|---|---|---|---|---|---|---|
| | | Environmental sustainability | Accessibility, equity and social inclusion | Economic sustainability and funding | AI, data and digital governance | System integration and implementation readiness |
| F | **Fair** Does the solution contribute to equitable, inclusive, and accessible mobility outcomes? | Supporting | Moderate | Strong | Supporting | Supporting |
| A | **Affordable** Is the solution financially sustainable for users, operators, and public authorities? | Supporting | Moderate | Strong | Supporting | Supporting |
| I | **Implementable** Can the solution realistically be delivered within existing technical, regulatory, and operational contexts? | Supporting | Supporting | Strong | Moderate | Strong |
| R | **Responsible** Does the intervention support environmental sustainability, resilience, safety, and broader societal well-being? | Strong | Supporting | Strong | Moderate | Strong |
| G | **Governable** Are governance structures, institutional responsibilities, and stakeholder arrangements in place to support deployment and long-term operation? | Supporting | Supporting | Strong | Strong | Strong |
| O | **Optimal** Does the solution effectively address the identified challeånge and deliver measurable benefits compared with alternative approaches? | Strong | Supporting | Strong | Moderate | Strong |

Strong · Moderate · Supporting

**Use the matrix as a guide, not a checklist. Each solution is different, and the relevance of each impact area will vary depending on the context.**

*Each FAIR-GO dimension is informed by multiple impact areas, reflecting the interconnected nature of urban mobility challenges and solutions.*

### Examples of key evidence links

**Fair** relies heavily on Impact Area 2 (Accessibility, Equity & Affordability), but may also require evidence from affordability, digital governance and system integration.

**Affordable** requires both user affordability from Impact Area 2 and lifecycle viability from Impact Area 3.

**Implementable** draws on evidence from regulatory, technical and operational readiness (Impact Area 5), as well as funding, data and infrastructure considerations.

**Responsible** may draw on all five impact areas, not only environmental sustainability and digital governance.

**Governable** requires evidence from funding (Impact Area 3), digital governance (Impact Area 4) and institutional readiness (Impact Area 5).

**Optimal** compares the integrated findings across all impact areas against the original problem and credible alternatives.

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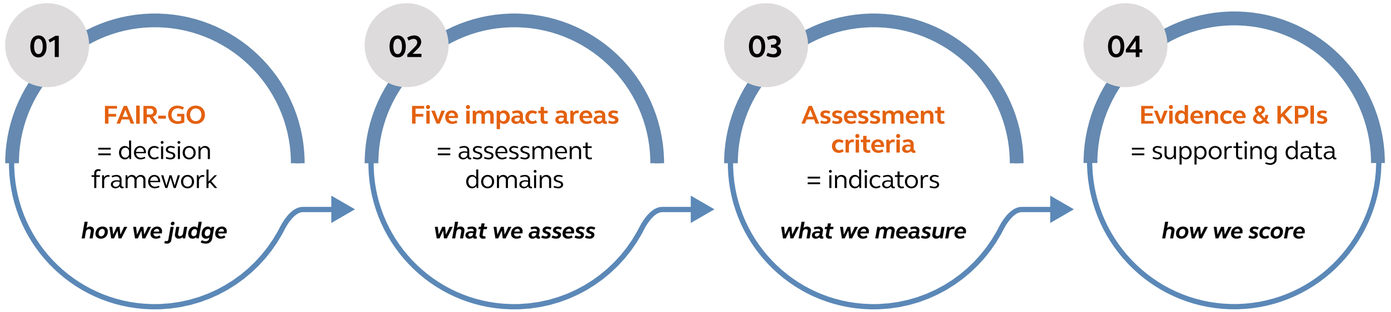
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Rather than considering individual indicators in isolation, **FAIR-GO** enables a holistic interpretation of assessment results. This allows decision-makers to evaluate how environmental, social, economic, digital, and implementation-related factors interact and collectively shape the likelihood of successful deployment. Consequently, the framework supports a broader understanding of readiness, one that encompasses not only technical capability, but also societal legitimacy, governance capacity, economic sustainability, and long-term public benefit.

The integration of **FAIR-GO** with the five Impact areas establishes a coherent analytical framework for assessing automated mobility solutions. By systematically linking strategic principles, assessment domains, evaluation criteria, and measurable indicators, the framework creates a transparent pathway from evidence generation to decision-making.

**The relationship can be summarised as follows:**




This hierarchical structure ensures that **FAIR-GO** shifts the focus from technology deployment towards implementation outcomes. The framework therefore supports decision-makers in identifying solutions that are not only operationally feasible, but also socially desirable, economically sustainable, institutionally viable, and capable of generating lasting benefits for people and communities.

Ultimately, FAIR-GO promotes a more comprehensive understanding of implementation readiness, recognising that the successful deployment of automated mobility solutions depends on the alignment of technology, infrastructure, governance, institutions, and human needs within real-world urban environments.

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# From evidence to action: decide what to do



**Rather than functioning as an additional set of assessment criteria, FAIR-GO serves as a normative decision-making framework through which evidence generated across the five impact areas can be synthesized, contextualized, and translated into implementation-relevant insights.**

In this sense, the impact areas answer the question of **what should be assessed**, whereas FAIR-GO provides a framework for determining **how the resulting evidence should inform implementation decisions**.

## From evidence generation to decision-making

Assessment begins within the impact areas, where evidence is collected through indicators, criteria, and KPIs. These findings are subsequently interpreted through the six FAIR-GO dimensions, to decide whether the proposed intervention is capable of generating long-term public value. The mapping between FAIR-GO and the impact areas is therefore not intended as a mechanistic one-to-one correspondence. Instead, it reflects the conceptual relationships between implementation objectives and the underlying evidence domains from which these objectives derive.

Rather than considering individual indicators in isolation, **FAIR-GO** enables a holistic interpretation of assessment results. This allows decision-makers to evaluate how environmental, social, economic, digital, and implementation-related factors interact and collectively shape the likelihood of successful deployment. Consequently, the framework supports a broader understanding of readiness, one that encompasses not only technical capability, but also societal legitimacy, governance capacity, economic sustainability, and long-term public benefit. The integration of **FAIR-GO** with the five Impact areas establishes a coherent analytical framework for assessing automated mobility solutions. By systematically linking strategic principles, assessment domains, evaluation criteria, and measurable indicators, the framework creates a transparent pathway from evidence generation to decision-making.

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**For each FAIR-GO dimension we need to follow these steps:**

1. Summarize the relevant evidence from the five impact areas.
2. Identify any minimum standard failures or unacceptable harms.
3. Record potential additional public value and expected benefits.
4. Document uncertainties, dependencies and evidence gaps.
5. Define conditions or mitigation measures required before proceeding.
6. Assign an overall finding for that dimension.

**Once all this evidence is gathered, it should be possible to decide whether for each dimension the solution:**

- Meets requirements
- Meets requirements with conditions
- Further evidence or testing required
- Does not meet requirements.

After assessing all six dimensions, and based on the evidence obtained and synthesized, the city should be ready to select one of seven pathways for implementation.



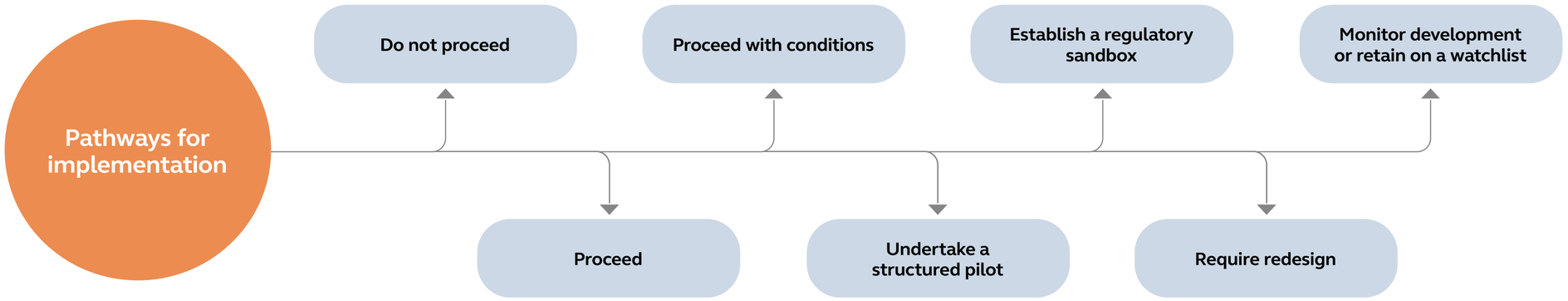



*Figure 8: pathways for implementation*

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## Coordination across assessment domains

A defining characteristic of digital and automated mobility solutions is the interconnected nature of their impacts. Improvements in one domain may generate benefits, trade-offs, or unintended consequences in another. As a result, implementation decisions cannot be derived solely from individual indicators or assessments conducted within disciplinary silos. The FAIR-GO Framework explicitly acknowledges these interdependencies by facilitating the integration of evidence across domains. This enables decision-makers to identify synergies, trade-offs, implementation barriers, and enabling conditions that may otherwise remain obscured within sector-specific assessments. In this sense, the framework can be used to foster collaboration and a common language between departments that usually work independently or in a non-coordinated manner.



## A public value-based interpretation framework

Ultimately, FAIR-GO positions public value creation as the overarching objective of assessment and decision-making. The framework moves beyond questions of technological capability and asks whether a proposed intervention is capable of delivering meaningful societal benefits while remaining environmentally sustainable, economically viable, institutionally manageable, and socially legitimate. By linking strategic principles, assessment domains, evaluation criteria, and measurable indicators within a coherent analytical architecture, FAIR-GO establishes a transparent pathway from evidence generation to implementation decisions. The framework thereby enables cities, mobility providers, and public authorities to evaluate not only whether a solution can be deployed, but whether it should be deployed, under which conditions, and with what anticipated contribution to long-term urban sustainability and societal wellbeing. Within this architecture, the six FAIR-GO dimensions function as the final interpretive layer through which evidence is translated into decision-relevant knowledge, ensuring that implementation choices remain aligned with broader public value objectives rather than being driven solely by technological opportunity.

This process should produce a decision log that is transparent about:

- the public need being addressed;
- the benefits expected;
- the risks and uncertainties identified;
- the evidence available and still required;
- the conditions under which implementation can proceed and the chosen pathway for implementation;
- the responsibilities of the city and its partners;
- the outcomes that will be monitored over time.

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# Conclusion

Cities are entering a period of profound transformation in mobility and urban logistics. Electrification, automation, AI, shared mobility, connected infrastructure and new delivery models are rapidly expanding what is technically possible. Yet the central challenge facing cities is no longer simply whether a technology works. It is **whether a proposed solution addresses a genuine local need**, creates meaningful public value and can be implemented responsibly within the environmental, social, financial, institutional and infrastructural conditions of a particular city.



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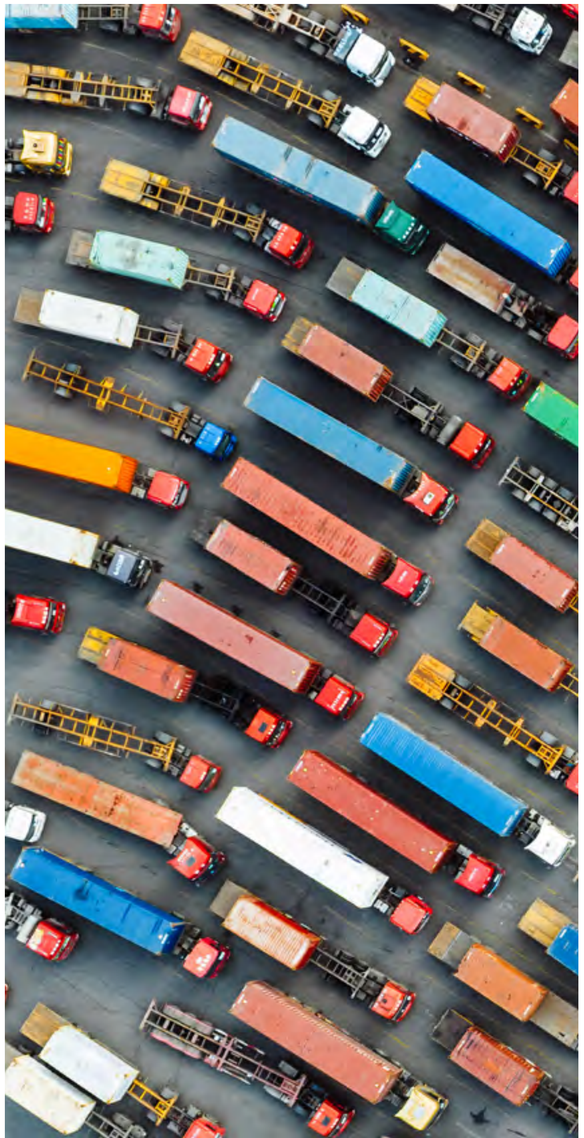
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**This guidance therefore moves away from a technology-centered understanding of innovation. A solution should not be supported merely because it is novel, digital, electric, automated or data-driven. Its relevance depends on the outcomes it can deliver for people, communities and the wider urban system.**

Across each impact area, the assessment distinguishes between two levels of ambition. The Minimum Standard establishes whether the solution avoids unacceptable and avoidable harm. Only solutions that meet this threshold should be considered for implementation. The Additional Public Value layer then asks whether the solution can make a positive contribution beyond its primary purpose, such as improving access to opportunities, reducing emissions, strengthening resilience or making more effective use of existing infrastructure.

**FAIR-GO** provides the interpretive framework through which this evidence is translated into a decision. Its six dimensions do not correspond mechanically to individual impact areas. Instead, each dimension draws on relevant evidence from across the assessment:



- **Fair:** Does the solution contribute to equitable, inclusive and accessible mobility outcomes?
- **Affordable:** Is it financially sustainable for users, operators and public authorities?
- **Implementable:** Can it realistically be delivered within the local technical, regulatory and operational context?
- **Responsible:** Does it support environmental sustainability, resilience, safety and wider societal wellbeing?
- **Governable:** Are the institutions, responsibilities and stakeholder arrangements required for implementation in place?
- **Optimal:** Does the solution address the identified challenge effectively and provide greater public value than credible alternatives?

Implementation success depends on **alignment**. Solutions need to align with the **local challenge** and the city's **long-term objectives**. Their environmental, social and economic benefits need to align with the evidence. Financing needs to align with lifecycle costs. Governance responsibilities need to align with decision-making power and accountability. Technology needs to align with infrastructure, energy, data and organisational capacity. Above all, implementation needs to align with the needs and lived realities of the people whom mobility systems are intended to serve.

This alignment cannot be achieved through a one-off assessment. Implementation should therefore be understood as an adaptive process of evidence gathering, testing, monitoring, learning and revision. Pilots and regulatory sandboxes can play an important role, but only where they are designed to resolve clearly identified uncertainties and generate evidence for a subsequent decision.

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The appropriate outcome will not always be immediate implementation or outright rejection. Depending on the evidence, minimum standard findings, expected public value and outstanding uncertainties, a city may choose different pathways to implementation. The quality of the decision does not depend on how quickly an innovation is adopted. It depends on whether the evidence, trade-offs, risks, responsibilities and implementation conditions have been made visible and assessed transparently.

**Leadership** remains essential. Successful urban transformation requires visible **political or institutional champions** who can communicate a clear public purpose, build coalitions and sustain momentum across departmental, political and budget cycles. However, leadership must be supported by formal responsibilities, institutional capacity and durable governance arrangements so that implementation does not depend on one individual alone.

The ultimate objective is not simply to move people and goods more efficiently. It is to **improve quality of life** through better informed mobility and logistics choices. Successful transitions will be demonstrated by systems that are cleaner, more accessible, inclusive, affordable, financially sustainable, trustworthy, resilient and better integrated with urban life.

*"You need people who are internally motivated to actually move ahead and change things."*

***Sascha Meyer, MOIA***



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Move from interest in innovation to implementation with purpose.

The transition to better urban mobility and logistics will require leadership, evidence, institutional capacity and deliberate choices about what should be implemented, where, for whom and underwhich conditions.

We have put together a set of final recommendations for the principal audiences of this guidance.



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# For cities and public authorities

**Start with the local challenge**

Define the local challenge and the change the city wants to achieve before selecting a technology, operator or delivery model.

**Pilot with a decision in mind**

Use pilots and regulatory sandboxes to answer clearly defined questions about performance, user experience, governance, affordability, integration or scalability. Establish success criteria, monitoring arrangements and exit conditions from the outset.

**Plan for the full lifecycle**

Consider infrastructure, operation, maintenance, financing, data governance, system integration, renewal and end-of-life responsibilities before implementation. Initial deployment is only one stage of the intervention.





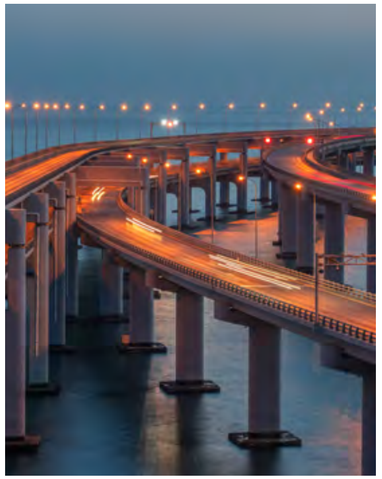
**Protect the public interest**

Maintain clear accountability, meaningful human oversight and the ability to challenge, adapt or discontinue solutions that do not perform as expected.



**Assess the complete picture**

Examine environmental, social, economic, digital governance and implementation readiness implications together. Strong performance in one area should not conceal unacceptable risks or unresolved dependencies in another.



**Ask for evidence, not assurances**

Require providers and delivery partners to explain their assumptions, methodologies, limitations and implementation conditions. Where evidence remains insufficient, identify what needs to be learned or resolved before progressing.

**Invest in institutional capacity**

Successful implementation depends on people and organisations as much as on technology.Cities need the expertise and resources to assess solutions, manage partnerships, oversee contracts, govern data, monitor outcomes and learn from implementation.

**Make uncertainty visible**

Document evidence gaps, unresolved risks and dependencies. Uncertainty does not necessarily prevent action, but it should influence the chosen implementation pathway and the conditions attached to it.

**Keep a transparent decision log**

A decision log is a valuable tool to document all aspects factoring into the decision made, allowing for an easier revision at a later stage and preventing loss of information during changes in government and responsibilities.

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## For cities and public authorities



**Demonstrate the local use case**

Generic claims and performance estimates are insufficient. Explain how the solution responds to the city's specific challenge, infrastructure, users and operating conditions.

**Provide evidence across all five impact areas.**

Technical performance is only one part of implementation readiness. Cities also require evidence concerning environmental effects, accessibility, affordability, governance, integration and long-term operation.

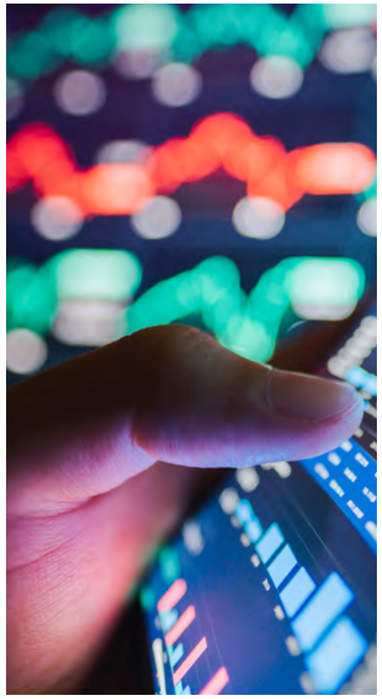
**Be transparent about limitations.**

Communicate operational boundaries, dependencies, uncertainties and areas requiring further investigation. Credibility grows when limitations are acknowledged rather than concealed.

**Design for interoperability and adaptation.**

Avoid unnecessary dependence on proprietary systems. Cities need solutions that can work with existing infrastructure and evolve as technologies, standards and local requirements change.





**Support learning, not only deployment.**

Pilots should produce usable evidence for public decision-making. Data, findings and lessons should be presented in forms that public authorities can understand, scrutinize and apply.

## For regional, national and international institutions

**Create enabling conditions for local implementation.**

Cities may carry responsibility for mobility outcomes without possessing sufficient legal authority, funding or technical capacity to act. Higher levels of government should support appropriate regulatory frameworks, financing pathways, common standards and knowledge exchange.





**Align investment with long-term public value.**

Funding programs should encourage integrated outcomes rather than isolated technological deployments. Capital funding should be accompanied by consideration of operation, maintenance, institutional capacity and long-term sustainabllity.

**Enable shared learning.**

Common evidence standards, comparable evaluation approaches and transparent reporting can help cities learn from one another without assuming that solutions can be transterred unchanged.

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## Applying the FAIR-GO framework with Arcadis

Cities may apply **FAIR-GO** independently or with support from Arcadis. Arcadis can support the complete assessment process, including:

- framing the challenge and desired public outcomes;
- assessing the solution across the five impact areas;
- reviewing provider evidence and methodologies;
- identifying risks, gaps and implementation dependencies;
- applying the six FAIR-GO lenses;
- defining conditions and implementation pathways;
- developing monitoring requirements and KPIs; and
- documenting the assessment in a transparent decision memo.

Independent assessment can be particularly valuable where solutions involve several departments, complex technologies, uncertain evidence, evolving regulation or competing public objectives. The purpose is not to determine whether a solution is innovative. It is to establish whether it is appropriate for the local context, whether it can create public value and whether the conditions for responsible implementation are in place.

The responsibility for implementation is shared, but public accountability cannot be outsourced. City leaders and public authorities ultimately determine which outcomes should be prioritised, what risks are acceptable and how the public interest will be protected.

The call to action is straightforward:

**Begin with people.**
**Define the public purpose.**
**Demand evidence.**
**Address the gaps.**
**Integrate the system.**
**Monitor the outcomes.**
**Adapt when conditions change.**



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World Business Council *for Sustainable Development*

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Their perspectives helped the project team understand the evidence cities require, the barriers encountered during implementation and the conditions that enable mobility and logistics solutions to progress responsibly from concept and piloting to implementation and scaling.

We also acknowledge the researchers, public institutions and practitioners whose work informed the five impact areas and the development of the FAIR-GO Framework, as well as the colleagues across WBCSD and Arcadis who contributed to the research, interviews, drafting, review and production of this guidance.

The views shared by interview participants informed the guidance but do not necessarily represent the formal positions of every participating organisation. Responsibility for the synthesis and final interpretation rests with the authors.

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| **1. Congestion charge** | Charges road users, or applies higher peak charges, to manage excess demand and generate revenue. | Congested urban centreres with strong public transport, walking and cycling alternatives. Revenue can support public transport improvements. | Manages traffic demand without expanding road capacity; can reduce car use and generate substantial revenue; supports modal shift when revenues are earmarked. | Revenue declines if the measure succeeds in discouraging driving; traffic may shift outside the charging zone; high capital and operating costs. | Public and political acceptability; setting an effective but acceptable tariff; need for enabling legislation; stakeholder disagreement; inadequate alternatives to car travel. |
| **2. Municipal green bonds** | Municipal debt instruments whose proceeds are restricted to qualifying climate-mitigation or resilience projects. | Larger sustainable infrastructure packages, including public transport, clean vehicles and climate-friendly mobility infrastructure. Smaller cities may use pooled issuance. | Access to new private capital; attractive to ESG-focused investors; fixed returns may appeal to institutional investors; can strengthen internal focus on sustainable projects. | Additional transaction, external-review, monitoring and reporting costs; creates debt and repayment obligations. | Small project scale; lack of an investment-grade credit rating; perceived default risk; limited municipal expertise; need for cooperation among finance, transport and environmental departments. |
| **3. Civic crowdfunding** | Residents and other contributors provide small amounts through an online platform, sometimes supported by municipal match-funding. | Small, visible community projects such as walkways, public squares, gardens and neighbourhood mobility improvements. | Mobilizses community funding; can leverage limited public funds; encourages local ownership and participation; online platforms can lower administrative costs. | Limited suitability for major infrastructure; uncertain revenue; risk that wealthier communities raise more funding; should not replace core public funding. | Need for an appropriate platform and possibly new regulation; municipal capacity constraints; bureaucratic barriers; alignment of project owners, platforms and authorities; need to support marginalised groups. |
| **4. Stamp duty land tax and related land-value capture** | Dedicates a proportion of property -transaction tax or value uplift around improved transport infrastructure to finance that infrastructure. | Projects expected to increase nearby property values, including rail, metro, additional services, infrastructure and fare support. Most evidence comes from large, dense cities. | Recycles part of privately captured property-value gains; links beneficiaries to infrastructure costs; can contribute a meaningful share of project funding. | Revenue often becomes available after infrastructure is delivered; captures only part of the uplift; may burden a relatively small cohort; can undermine development viability if set too high. | Limited evidence in smaller cities; need for public support and clear zones of influence; difficulty forecasting uplift; requirement for complementary funding. |
| **5. Lottery funding** | Uses profits from lotteries to fund projects considered to serve good causes. | One-off community infrastructure and mobility projects, including bridges, shuttle buses and links to cycling routes. | Non-repayable funding; suitable for community-scale projects; can support social and environmental outcomes. | Irregular and unpredictable; linked to ticket sales and prize payments; unsuitable as a baseline revenue stream; distributors may follow a “fund it and forget it” approach. | Competitive applications; possible weaknesses in project appraisal; only available where lottery-funding systems exist; need for a strong business plan and evidence of need. |

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| **6. Voluntary capture** | Developers or property owners voluntarily contribute where anticipated benefits from infrastructure exceed their contribution. | Transit stations, links to existing transport facilities and infrastructure associated with private development. | Mobilizses private contributions without imposing a mandatory levy; connects infrastructure investment to those receiving development benefits. | Contributions cannot be guaranteed; private objectives may conflict with community objectives; project design may require compromises. | Convincing landowners of expected benefits; absence of a legal obligation to contribute; creating a transparent contribution process; protecting wider community interests. |
| **7. HGV charging schemes** | Charges heavy goods vehicles by distance, time or area, potentially varying by vehicle class, emissions or road type. | Freight corridors, urban road networks, emission zones and cities incorporated into regional or national charging systems. Proceeds may support roads and sustainable transport. | Internalizses some freight externalities; manages HGV traffic; can support road maintenance and sustainable mobility investment; charges may reflect distance and emission class. | High implementation and operating costs; traffic may divert to secondary roads; proceeds may largely cover operating costs; possible impacts on local businesses. | National legislation; freight -sector resistance; limited city knowledge and capacity; enforcement and international debt recovery; compatibility with neighbouring systems; reliable IT requirements. |
| **8. Workplace parking levy** | Local authority charges employers for workplace parking spaces, with employers deciding whether to absorb or pass on the cost. | Congested employment centrers where strong public transport alternatives and parking controls are available. Revenue is reinvested in local transport. | Raises ring-fenced transport revenue and discourages commuting by car; established schemes have supported public transport infrastructure. | May burden businesses and lower-income commuters; does not distinguish clearly between peak and non-peak travel or availability of alternatives; displaced parking may affect nearby streets. | Political risk; employer opposition; enabling legislation; lengthy development and consultation; parking -space audits; appropriate pricing, exemptions and enforcement; need for political continuity. |
| **9. Community infrastructure levy** | Mandatory charge on new development, usually calculated according to added floor area, to finance infrastructure needed to support development. | Roads, public transport, schools, health facilities, recreation, flood defence and other strategic infrastructure. | Legally binding; contributions can be calculated during planning; provides a structured and relatively predictable infrastructure funding route. | High levies may discourage development or redirect it to lower -charge areas; requires administration, collection and enforcement. | Need for enabling legislation; balancing infrastructure needs against development viability; preparing and examining charging schedules; regional inconsistencies; dependence on development activity. |
| **10. Advertising, sponsorship and naming rights** | Generates revenue by advertising on public assets and media, securing event or service sponsorship, or selling or leasing naming rights. | Visible assets such as stations, interchanges, bus shelters, cycle -hire schemes, events and digital media. | Shares costs with private partners; can finance construction and maintenance; naming rights may generate significant revenue from prominent infrastructure. | Advertising may affect streetscape quality, cause light pollution or distract drivers; income depends on market exposure and economic conditions; commercial branding may be controversial. | Planning and legal restrictions; limited municipal marketing capacity; need for specialist expertise and coherent policy; difficulty attracting sponsors; public objections and competing advertising businesses. |

| Financing mechanism | Short description | Potential applicability | Upsides | Downsides | Main barriers to implementation |
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| **11. Collaboration with cities, research consortia and private companies** | Cities join demonstration, pilot, capacity -building or applied -research projects with other authorities, researchers or companies. | New technologies, low -carbon vehicles, real -world pilots, transport modelling, demand analysis, capacity building and policy development. | Access to technology, investment, training, research results and technical know-how; manageable pilot costs; networking and institutional learning. | Funding may be tied to specific projects or agendas; benefits may be confined to training or technology transfer; long-term funding is not guaranteed. | Lack of awareness of programmes; limited experience, staff and expertise; eligibility requirements; political constraints; need for a long-term strategy and dedicated personnel. |
| **12. Citizen cooperatives** | Democratically controlled, jointly owned organizsations whose membership contributions finance services or projects serving collective needs. | Community-based car sharing, bicycle sharing and other services that may be socially useful but insufficiently profitable for commercial investors. | Local ownership; services can respond directly to community needs; non-profit structure supports projects avoided by private investors; revenues can be reinvested. | Members bear some financial risk; democratic decisions may conflict with municipal preferences; dominant members may exert disproportionate influence; potential mismanagement. | Legal and administrative complexity; limited member expertise; viability assessment and registration; need for advisory, business -planning and possibly municipal support. |
| **13. Emissions trading and climate-finance revenue** | Uses proceeds from carbon markets or the sale of verified emission -reduction credits to finance transport measures. | Low -carbon transport projects with measurable emission reductions and access to national carbon -market revenues or climate -finance instruments. | Places an economic cost on pollution; can channel climate finance into mobility projects; potentially attracts private -sector participation. | Complex and variable; unreliable as a continuous revenue stream; high transaction costs; projects may underperform and generate fewer credits than anticipated. | Carbon markets and revenues often controlled nationally; limited municipal expertise; legislation not designed for city projects; overlapping jurisdictions; political dependence; need for verified emission reductions. |
| **14. Planning obligations and developer contributions** | Negotiated or fixed developer contributions used to mitigate development impacts and provide supporting infrastructure or services. | Site -specific transport infrastructure, car -club services, phased infrastructure, maintenance payments and pooled cross-development projects. | Internalizses development-related external costs; can provide money or infrastructure in kind; legally follows the land; can pool contributions across projects or authorities. | Negotiations may be long, uncertain and resource-intensive; can delay planning; may discourage development; outcomes may favour larger developers; risk of opacity or corruption. | Need for robust legislation and evidence-based policy; viability negotiations; monitoring and enforcement resources; uncertainty over timing and amount; cross-authority coordination. |

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| **15. Tax Increment Financing** | Local authority borrows for infrastructure and repays the debt using future increases in property-tax revenue within a defined district. | Regeneration and transport projects expected to increase land values, economic activity and property-tax receipts. | Brings forward infrastructure investment; links repayment to expected growth; can support redevelopment without immediate budgetary backing. | Revenue depends on uncertain property -value growth and economic cycles; may capture growth that would have happened anyway; can divert future tax revenue from public services; creates debt exposure. | Demonstrating the counterfactual; accurately defining district boundaries and revenue increments; political favouritism concerns; mixed evidence of additional growth; enabling legislation and public approvals. |
| **16. Sales tax increase financing** | Applies a temporary or ongoing increase in tax on selected goods and services, with the additional revenue dedicated to transport or public -realm improvements. | Region-wide transport programmes where local authorities possess sufficient taxing powers; most cited examples are from the United States. | Can generate revenue locally without direct central -government funding; uses established tax -collection systems; exemptions can be tailored. | Regressive because the rate does not reflect income; may suppress consumer spending; revenues fluctuate with economic activity; residents may oppose paying for services they do not use. | Legal competence; administrative capacity; public resistance; uncertain revenue forecasting; need to ring-fence and account for proceeds; setting a proportionate rate. |
| **17. Toll roads** | Charges users of roads, bridges or tunnels to pay for construction, operation, maintenance or wider mobility investment. | Expensive road infrastructure and urban charging systems; excess revenues may support public transport and sustainable mobility. | Enables projects without full upfront public funding; supports cost recovery over an asset's life; can manage demand and encourage public transport use; revenues may be earmarked. | Traffic and tariffs may not cover full costs; users may perceive double taxation or unfairness; frequent users bear greater costs; can face strong public resistance. | Political and public opposition; need for clear pricing objectives; uncertain traffic forecasts; lack of viable alternatives; coordination between authorities; communication and earmarking of revenues. |
| **18. Selling expertise and technical know-how** | Local authority commercialises specialist knowledge, processes, technologies or intellectual property developed through its transport activity. | Ticketing systems, cycling expertise, asset management, procurement, legal tools, transport modelling and other areas where the authority has recognizsed expertise. | Generates additional revenue; strengthens reputation; encourages knowledge exchange; may attract businesses, visitors and partnerships. | Buyers may struggle to value the knowledge; poor transfer can cause misunderstanding; commercializsation may conflict with knowledge -sharing culture; not every city has marketable expertise. | Limited staff capacity; identifying market demand; intellectual -property ownership; pricing; contractual protection; legal alignment and effective communication. |

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| **19. Sale or productive development of public land and property** | Sells, releases or jointly develops underused public assets to generate revenue, lower maintenance costs and support transport investment. | Brownfield sites, station areas, regeneration schemes, housing linked with transport improvements and rationalizsation of public estates. | Generates capital receipts; reduces asset-running costs; supports housing, employment, regeneration and integrated services. | One-off disposal of public assets; exposure to property -market fluctuations; complex due diligence and planning; risk of failing to secure best long-term public value. | Need for political and public support; limited administrative and legal capacity; land and planning constraints; economic uncertainty; cross-sector collaboration and strong governance. |
| **20. Grants from private foundations and trusts** | Non-repayable funding provided by philanthropic foundations or trusts for specified public -interest purposes. | Smaller, one-off, innovative or experimental mobility projects without major ongoing costs. | Does not require repayment; may support adventurous ideas and pilots that conventional funders avoid; can supplement municipal innovation capacity. | Highly competitive; generally one-off and unreliable; strict eligibility and reporting requirements; does not normally cover continuing operating costs. | Identifying opportunities; demanding application processes; limited bid -writing capacity; strict selection criteria; reporting burden; uncertain continuity after the grant period. |
| **21. Donations linked to consumer purchases** | Consumers voluntarily add a small donation to individual purchases or recurring bills, with proceeds channelled to a specified mobility project. | Small local measures linked to relevant merchants or services, such as public transport providers, metro operators, parking or cycle -hire businesses. | Uses existing payment infrastructure; small contributions are affordable; can connect users with a clearly identified local cause; automated collection can increase uptake. | Usually generates relatively modest and unpredictable revenue; depends on corporate and consumer participation; vulnerable to economic downturns; may require considerable marketing. | Finding appropriate commercial partners and an independent intermediary; designing convenient opt-in or opt-out arrangements; maintaining public awareness; ensuring transparent allocation of donations. |

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The five impact areas

Implementation process: Applying FAIR-GO

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Acknowledgements

Annex

# Abbreviations

| | |
|---|---|
| **ADA** | Americans with Disabilities Act |
| **AI** | Artificial Intelligence |
| **AV / AVs** | Automated Vehicle(s) or Autonomous Vehicle(s) |
| **BRT** | Bus Rapid Transit |
| **CCTV** | Closed-Circuit Television |
| **$CO_2$** | Carbon Dioxide |
| **EU** | European Union |
| **EV / EVs** | Electric Vehicle(s) |
| **FAIR-GO** | Fair, Affordable, Implementable, Responsible, Governable and Optimal |
| **GDP** | Gross Domestic Product |
| **GHG** | Greenhouse Gas |
| **HGV** | Heavy Goods Vehicle |
| **ICLEI** | ICLEI – Local Governments for Sustainability |
| **ICT** | Information and Communication Technology |
| **IoT** | Internet of Things |
| **IT** | Information Technology |
| **ITDP** | Institute for Transportation and Development Policy |
| **KPI / KPIs** | Key Performance Indicator(s) |
| **MaaS** | Mobility as a Service |
| **PMT** | Private Motorised Transport |
| **NIMBY** | Not In My Back Yard |
| **PPP / PPPs** | Public-Private Partnership(s) |
| **R&D** | Research and Development |
| **RAB** | Regulatory Asset Base |
| **RAS** | Robotics and Autonomous Systems |
| **RES** | Renewable Energy Sources |
| **SLOCAT** | SLOCAT Partnership on Sustainable, Low Carbon Transport |
| **UAV / UAVs** | Unmanned Aerial Vehicle(s) |
| **UNFCCC** | United Nations Framework Convention on Climate Change |
| **V2G** | Vehicle-to-Grid |
| **V2X** | Vehicle-to-Everything |
| **VKT** | Vehicle Kilometres Travelled |
| **WBCSD** | World Business Council for Sustainable Development |



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