

INTERNATIONAL TRENDS IN 4IR MOBILITY

Headline messages

- How we live, work, move and experience the world around us is rapidly changing.
- 4IR technologies have the potential to transform daily travel for millions of citydwellers and address supply chain inefficiencies. In highly unequal societies, however, they can also worsen existing inequalities.
- Emerging 4IR applications demonstrate the mobility sector's innovation potential.
- The 4IR, and the COVID-19 crisis, prompt the need for new forms of governance and regulation to match the pace of technological change and manage impacts on marginalised groups, climate and environment
- Cities play several, important roles in 4IR mobility, as regulator and policymaker, financier and investor in the ecosystem, open-access partner, stimulator of the modal shift and, in some cases, the user.

Emerging 4IR technologies

A suite of digital, physical and biological innovations are shaping the 4IR response to challenges faced by cities today; many already show promise at reshaping urban transport networks, and change will only accelerate over the coming years. Ranging from Artificial Intelligence to Robotics, Virtual Reality to Drones, 4IR technologies are complementary and even interdependent.

International trends in 4IR mobility

The five key trends shaping 4IR mobility today can inform planning and implementation strategies for cities across the world.

- **Rise of Automation** reflects the growing trend of AVs and other robotic devices operating without direct human control or oversight, with risks of job losses and safety concerns.
- **Intelligent and Connected Systems** optimise processes for communicating and sharing data across wider networks, yet also introduce a host of data and cyber security risks.
- **Electrification for Greener Transport** has led to a rise in EV uptake, with the demand for electric charging infrastructure crucial to recognise and incorporate into city planning.
- The **Sharing Economy** expands the range of shared, as-needed mobility options, though, accessibility and affordability remain key concerns to ensure inclusion.
- A **Responsive and Evolving Enabling Environment** supports all the above, to effectively respond to, and promote, the development and adoption of 4IR mobility technologies.

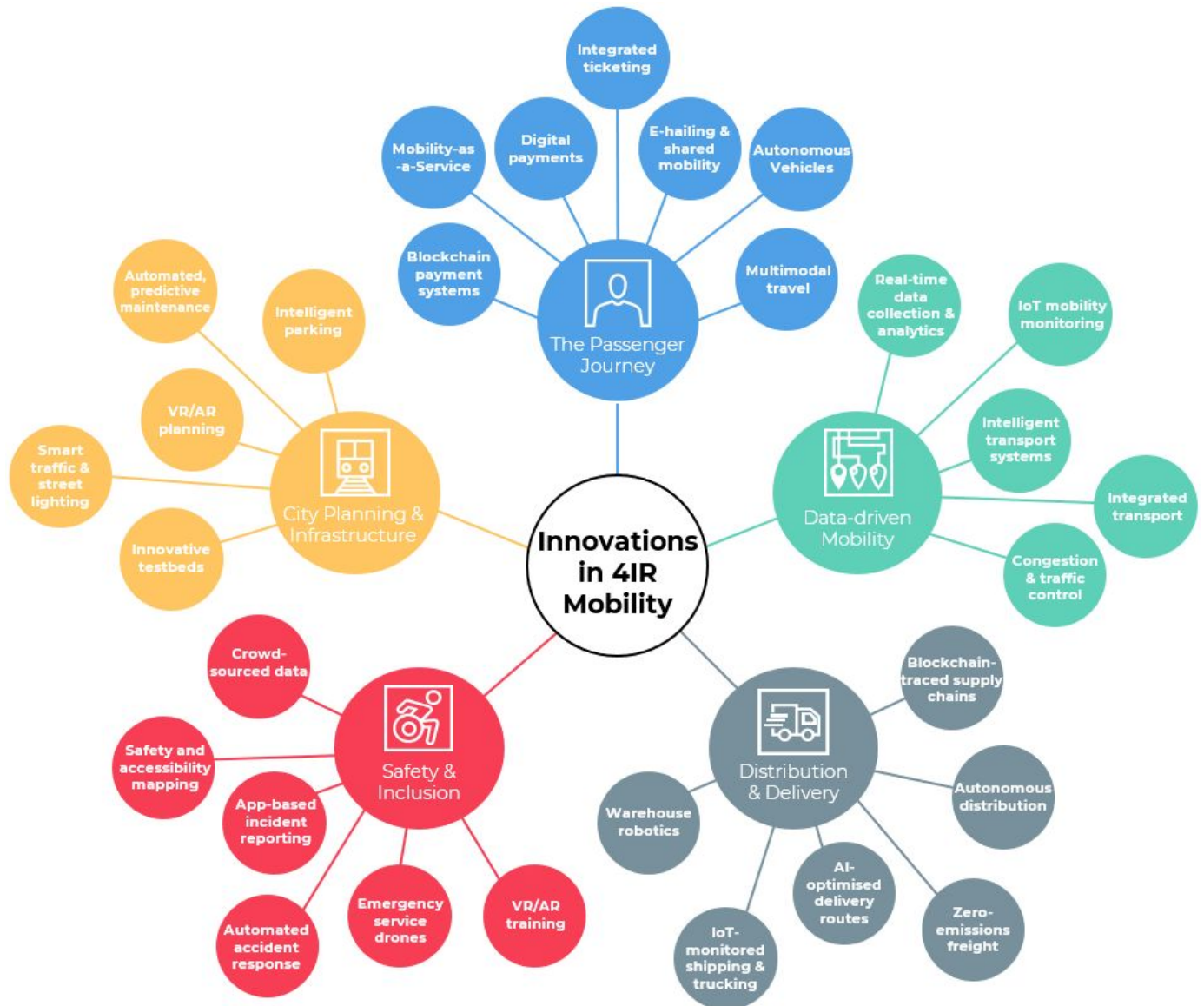
Figure 1: Five interlinked global trends in 4IR mobility



Five application areas for 4IR mobility

International 4IR mobility use cases showcase the range of potential innovations. 4IR technologies can unlock opportunities both in the short- and long-term in five overarching areas of mobility.

Figure 2: Network diagram showing 4IR innovations under the five thematic areas of mobility



The Passenger Journey

The development of digital payment systems and decentralised ride-hailing services will enable the continued rise of MaaS platforms and apps. These innovations offer a number of flexible ways to enhance the user experience of transport use across cities, with the potential to increase inclusivity, enhance convenience and streamline travel. The implementation of such innovations requires effective collaboration between transit stakeholders and engagement of the urban public in behavioural change.



City Planning and Infrastructure

Coordination across siloed city departments to plan and manage space holistically is an important first step to consider innovative 4IR planning tools. VR/AR for real-time planning, RFID sensors for optimised parking and 3D-printing drones to repair potholes, are just some of the

ways which 4IR technologies are being used in this area. These innovations can support urban planning and the ongoing management of infrastructure, effectively remedying problems of depreciating assets, ineffective use of space and insufficient parking. Potential for job displacement and losses are risks that need to be addressed when automating more labour-intensive tasks, so reskilling should go hand-in-hand with these applications.



Data-driven Mobility

Innovations of the 4IR to optimise traffic management are currently immature in cities globally, but offer exciting opportunities in the long-term. Big data analysis can identify new efficiencies in public transportation logistics, traffic management and seamless journey planning. Connected devices and Internet of Things enable urban planning authorities and transit operators to integrate transportation networks, offer real-time insights and reduce congestion. Along the need to add supporting technology and infrastructure, a key challenge is building trust across mobility players and ensuring data security to enable V2V, V2I and V2X communications.



Safety and Inclusion

An increased focus on the safety and inclusion of 4IR mobility is imperative across all aspects of change in urban mobility. Safety and inclusion agendas are benefiting from 4IR innovations, including 'accessible' routes identified through IoT, cars that automatically report accidents, and crowdsourced data on safer areas for women. Leveraging these solutions could democratise movement across the city, helping people with disabilities navigate streets, enhancing safety for women and preventing road traffic accidents. Key challenges include access to smartphones and the internet as many of these innovations rely on real-time data collection.



Distribution and Delivery

While emerging technologies are already being leveraged in distribution and delivery, the uptake of robotics and drones will remain sporadic until the cost and regulation challenges are addressed. Industrial robotics and UAVs present many opportunities to optimise and integrate the movement of people and goods around cities. These innovations could reduce congestion and alleviate pressure on road infrastructure, speed up delivery times as well as improve the transparency and cost-effectiveness of supply chains. The most important barriers to entry are the costly implementation of robotics and the need to remain abreast with regulation for drones.

How are cities implementing 4IR mobility?

Four **areas of implementation** underscore the importance of cities in creating an enabling environment for 4IR innovations to flourish in the mobility sphere.

Financing and procurement of infrastructure and technology

City investment in, and support of, local infrastructure and technology development is a crucial catalyst for 4IR interventions. Direct city contributions can include the upgrade of local roads, allocation of specific bus lanes and installation of electric charging stations. Cities should also explore alternative mechanisms to financing, including blended finance, as well as to public procurement, such as reverse pitching and competitions, to boost 4IR innovation adoption.

Upskilling and building digital readiness

Cities can play a key role in overcoming physical barriers to access 4IR mobility innovations, improve digital literacy, upskill and re-skill staff, as well as build trust in emerging technologies. Methods include the facilitation of rent-to-own smartphone schemes, or alternative engagement mechanisms that do not require internet or mobile access. Enhanced digital readiness, through digital education programmes and training, is also needed. Similar techniques can also be used to build public understanding of and trust in 4IR technologies, which is fundamental to their success.

Facilitating change through adaptive governance, policy and regulation

City governments can support the adoption of 4IR mobility by developing governance structures that allow for proactive and enabling policymaking. These policies are vital to set best practices around data governance, protection and sharing to build trust and transparency across all

stakeholders. Fiscal policies and regulatory sandboxes also offer ways for cities to proactively shape the market and promote more sustainable mobility options that suit the city's needs.

Engaging stakeholders and developing partnerships

Transversal collaboration across government and community is vital to enable a holistic approach to 4IR mobility that accounts for the needs and interests of all concerned parties. Mechanisms can include crowdsourcing platforms and innovation guidebooks. There is also great value in engaging in PPPs, innovation ecosystems and triple-helix partnerships, with both academic and private institutions, to pool knowledge, experience and capital. These partnerships should be considered and executed at an international level to share lessons learnt and success stories.

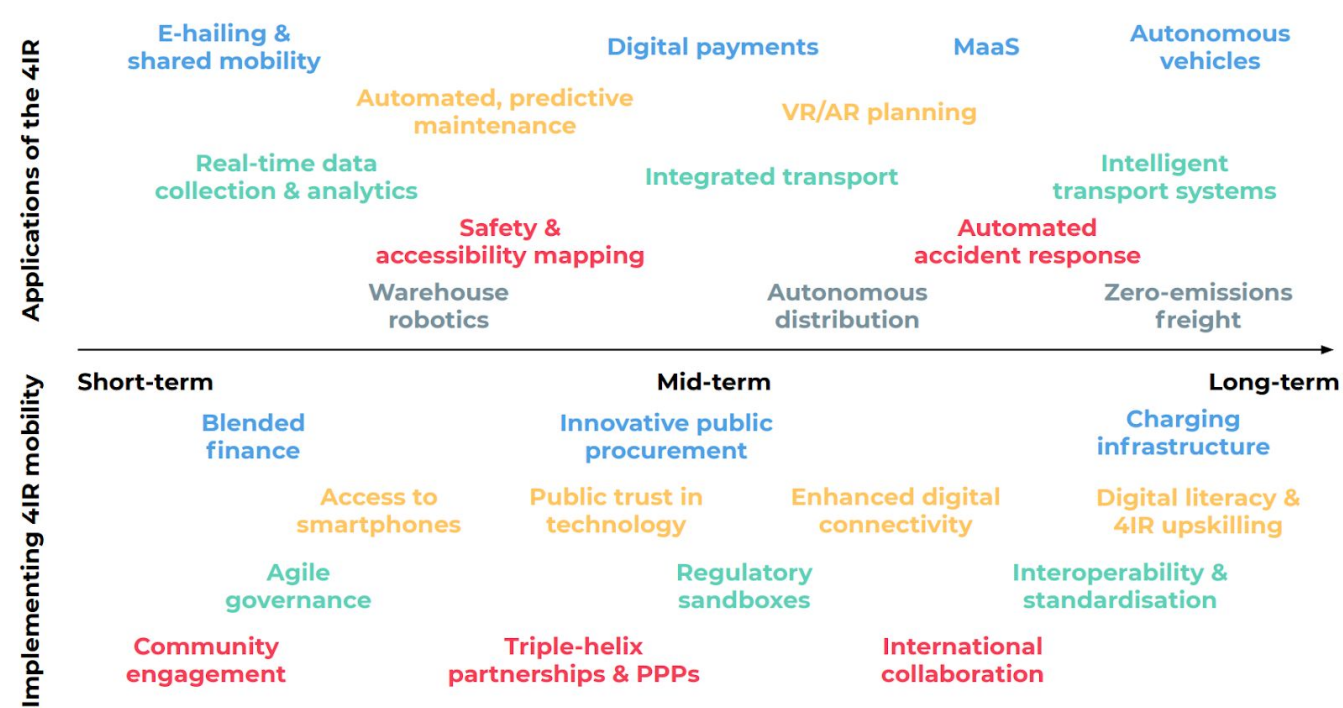
Moving forward and implications for cities

The range of innovations in 4IR mobility, and the significant technological and skills investments required, may seem daunting. For cities wanting to keep up with the rapid pace of change, which will happen regardless of their action or inaction, these considerations are key:

- Context matters:** Ultimately, each city needs to decide which technological innovations can enhance its overall developmental agenda and how to identify and mitigate potentially negative impacts of these innovations and platforms.
- Process of change:** Whichever mobility innovations are chosen for implementation, the process will require a willingness from cities to be more agile and adaptive in governance, policymaking and regulation, and accept that failures and missteps are part of testing.
- Empowering transformation:** Successful 4IR mobility draws on wide-ranging partnerships and creates a sense of ownership among stakeholders, while building trust and skills for 4IR readiness will help mitigate the very real risks around exclusion and the digital divide.

What 4IR mobility innovations might be deployed and how cities can enable their implementation differ by urban context, foundations and experience, but indicative timelines for adoption can be drawn between different solutions. Figure 3 ranks these according to the requirement of: new infrastructure or technology, capital expenditure, partnerships, regulation and digital readiness.

Figure 3: Timeline of 4IR mobility innovations and implementation



Cities play several important roles in 4IR mobility, as regulator and policymaker, financier and investor in the ecosystem, open-access partner, stimulator of the modal shift and in some cases the user. Starting points for action include setting and communicating a clear vision, exploring finance mechanisms for implementation and identifying quick wins to gain buy-in for larger-scale adoption of 4IR mobility applications that prioritise safety, access, affordability and sustainability.



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