White Paper

A Field Guide to the Future of Mobility

January 2016

Key Principles

Apply "Avoid, Shift, Improve" systematically

Mobility is essential. At the very least, it enables human interaction, provides access to jobs and makes it possible to send and receive goods and services. But mobility is not an end in itself. It is a means to an end – achieving access and helping people meet their needs in the most efficient and effective ways possible.

There are at least three ways to make access more sustainable:

1) **Avoid** moving altogether, for example by localizing services and access to jobs, or by telecommuting, tele-commerce, tele-medicine, tele-education

2) **Shift** individual transport choices to the most efficient mode or mobility model, for example from individual ownership to shared, connected, IT-enabled mobility modes, services and systems

3) **Improve** the mobility mode, for example by increasing occupancy rates of transport, improving fuel efficiency, using alternative drivetrains and applying more sustainable materials and design

Start with dialogue

#1

Mobility has many moving parts – transport modes, services, technologies, products, infrastructure and more. Transportation systems are shaped, determined and supplied by many different actors: city leaders; local, state, national and international legislators, policy-makers and planners; industry leaders; entrepreneurs; civil society, media, academia and citizens. Yet, often the moving parts do not come together in ways that truly serve communities and economies adequately. This is often because the various actors are only responsible for their own piece of the pie and do not get the chance to envision, let alone work towards, the kinds of whole systems needed to meet the full range of needs that transportation can address.

Recently, the most exciting and effective transport transformations have started with positive, solution-based and whole systems dialogue and direction-setting across all actors and sectors to address a wider and richer set of needs and opportunities.

Discover the existing mobility ecosystem (why reinvent the wheel?)

#2

It may be surprising that there are more innovative solutions being developed – and, thanks to the internet, more resources and platforms available to find out about them – than ever before, many free or low cost. It may seem obvious, but do not ignore recent developments. Use the growing ecosystem liberally to find information that can meet your needs and inform your plans and actions. It may not be exactly right for your situation, but perhaps the principle could be adapted.

Even if you have been in this topic for a while, you may not know what is happening in other sectors. For example, if you are a planner, you may not know much about technology, or if you are a technology entrepreneur, you may not know much about policy, and so on. Many of the most successful regions carry out research, bring in experts, create a buzz and emphasize what is positive and possible against all odds. Find out about the best new systems approaches, new information technologies, design and planning approaches, business models, innovative financing mechanisms, policies, cultural and marketing approaches and more. This way, it is easier to identify and achieve quick wins and implement successful long-term strategies.

Set goals and targets

#3

What inspires us? Shared goals, targets and timelines, whether modest or ambitious, are essential to moving the needle on transforming your mobility system.

Set quantitative targets (you may have more or less than you thought in some areas). Targets should also be pragmatic, measurable and easy to understand. They should be motivating, reinforce accountability and help to engage players who were previously not involved. Engage citizens in target-setting and communicate proactively to ensure transparency.

Map your own system

Take a quick inventory of your assets – you may have more than you think! What are the various modes, services, technologies, infrastructures, policies and political priorities, cultural tendencies, innovation capacities and preferences and barriers specific to your context?

Put as many of your existing resources as you can on a map. Overlay everything – all public and private transport (formal or informal) – routes, parking, stations, taxi stands, car-sharing and bike-sharing, ferry boats, airports, etc. Include key activity areas and even densities – anything that could be relevant to transport (challenges or solutions) in your area.

Next, put a red dot where two or more things connect. This will result in your "new mobility" grid. Engage in dialogue with other shapers and suppliers of transport and you will discover that you have at least the beginning of an integrated sustainable transport system you did not even know about. Now you can draw on your whole connected ecosystem to raise and answer questions and gather data points for creating and enriching your whole system, not just a single solution or two. As a consequence, with a connected picture before you, you can engage citizens and users and get them to contribute their knowledge and find out what they most want.

#4

Connect the dots, exploit available assets, then identify gaps and needs

With the help of the analysed and mapped ecosystem and engaging in private-public cooperation, start exploiting available assets and connecting the dots before, or at least at the same time as, considering investing in new assets. Keep the users' and businesses' door-to-door journeys in mind when mapping physical assets.

Identify gaps between the emerged (new) ecosystem and defined targets. Together, closely observe and critically examine prevailing public attitudes, political direction and industry trends. For each identified gap, identify strategic actions large and small, considering both current and potential policies and the underlying business cases.

#5

Invest and catalyse

Commit human and financial resources – strategically. From a public investment point of view, it may cost less than you thought, especially if your inventory process helped you optimize and reduce redundancies and especially if you were able to find IT solutions to what might previously have required big, heavy infrastructure.

Stimulate innovation and private investment through industry, enterprise, investment and employment development initiatives. New mobility is a multitrillion dollar global industry – not only can it help solve your local challenges, it can also offer regional industry and enterprise development opportunities for export at scale, based on your region's strengths and aspirations.

Finally, open your data – flip the switch to turn on local connectivity and interoperability and innovation for local solutions, some of which may well be scalable and exportable.

#6

Evaluate and communicate

Evaluation is often dropped off the task list. Partly because it is not always easy or cheap, and partly because it can bring inherent political and organizational vulnerability. Furthermore, it's much more difficult to evaluate how a whole system is working than how just one part of it is doing. And it is much easier to use more tangible measures like fuel consumption than more complex ones like connectivity, attitudes or quality of life.

Yet, the difficult and intangible are often the most useful and important in informing both accurate near-term adjustment and longer-term strategic directions. The point is, evaluation is essential. For evaluation to be as effective as possible, you should take an approach that relates directly to your shared goals, uses a range of measures, involves a range of stakeholders, communicates progress and engages citizens. At the same time, you should not over-evaluate or evaluate too soon at the risk of quashing innovation.

#7

Members of the Global Agenda Council on the Future of Automotive & Personal Transport

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Apply "Avoid, Shift, Improve" systematically

About this Guide

Why Focus on Automotive and Personal Transportation?

Personal mobility matters. It is one of the main enablers not only for human interaction, but also for knowledge transfer and relationship-building, and is a major contributor to the economy. Personal mobility is also key to income and employment around the world. Recent studies on upward mobility from both Harvard and New York Universities[1] have found that transportation can be the single largest factor in escaping poverty. This is even truer in the developing world and emerging economies. Personal mobility, or more accurately, access, can be a fundamental generator of social equity and prosperity.

The automobile has been a major pillar of personal transportation for the last 120+ years and has contributed to higher degrees of accessibility, social and economic prosperity, convenience and human interaction. However with a growing global urban population, an increasing demand for transport in urban areas and an increase in automobile access, the world is facing a new set of societal and environmental challenges. Fortunately, a host of opportunities enabled by technology and entrepreneurial innovation are resulting in new mobility models that can not only help to solve the mobility challenge, but also create tremendous economic and societal benefits.

Who Is Involved and How Did They Work Together?

The Global Agenda Council on the Future of Automotive & Personal Transport convenes relevant thought leaders from government, business, civil society and academia to challenge conventional thinking and develop new ideas for creating innovative urban mobility solutions.

Members of the network meet in person annually at the Summit on the Global Agenda in the United Arab Emirates and virtually several times per year to monitor trends, identify global risks, discuss ideas and explore connections between issues. They also develop recommendations and integrate findings into World Economic Forum activities, such as the Annual Meeting in Davos-Klosters and regional and industry events, as well as into decision-making processes at the global, national and city levels.

Who Is This Paper for?

This paper primarily targets the key decision-makers and opinion leaders of cities and states, established enterprises and start-ups, and representatives of civil society.

It aims to inform ideas and actions for future influencers, such as concerned or inspired citizens, professionals and students.

This paper:

▸ Is a **set of general principles** to improve urban mobility, developed based on the collective wisdom, research and experience of the group

▸ Specifies selected concrete **recommended deep dives** with related best practices and resources

▸ Is **a call to further action** and knowledge development in the area of urban mobility

This paper is not:

▸ E**xhaustive**, since urban mobility is vast, shifting and evolving rapidly

▸ A **prescription**, since every city has different characteristics (geography, density, motorization, urban design, modal split, governance, etc.)

▸ A **comprehensive** listing of case studies, tools, policies or innovations

▸ **Suitable for all**, as for each city the appropriate recommendations will need to be chosen and customized to its individual needs and societal priorities

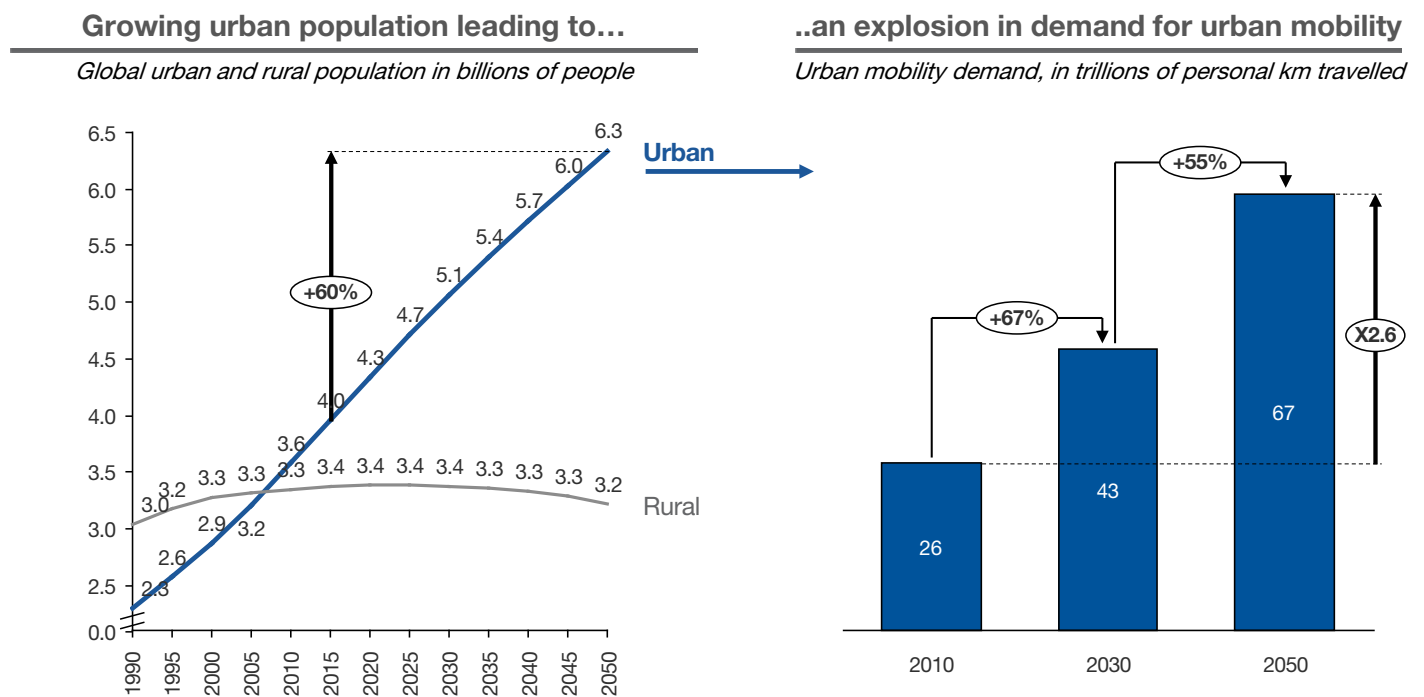# Context: The Changing Mobility Landscape

Trends and Challenges

The global population has tripled in the last 100 years, bringing the current count to over 7 billion people. Constraints related to this growth range from the global water shortage to acute poverty. Despite these issues, world population will continue to grow in the coming decades. Some forecasts suggest there will be 9 billion people by 2050, while other estimates go as high as 11 billion. In this context, natural resource constraints will become more prominent.

At the same time, cities will continue to become even more densely populated. Today, the world has over 20 megacities (cities with more than 10 million people). In the coming decades, there could be over 50 megacities worldwide. According to McKinsey Global Institute, by 2030 over 60% of the world's gross domestic product will be generated by a mere 600 cities. The traditional power players are not guaranteed a spot on the list. Indeed, it is estimated that 100 of the 600 cities have yet to be created.

A continuing trend towards urbanization, coupled with strong population growth, suggests that by 2050 an additional 2.5 billion people will be added to cities around the world, by which point, two-thirds of the world's population will be based in urban areas.[2] And 90% of the urban growth is predicted to take place in the developing world.[3] Africa and Asia are urbanizing faster than other regions and it is projected that 56% and 64% of their populations respectively will be living in cities by 2050. China and India are each predicted to have about 1 billion people living in cities by 2050.

With 64% of all travel made within urban environments in 2014, cities around the world will face an increasing need to secure accessible, safe and environmentally friendly urban mobility. Forecasts suggest an increase in demand of 2.6 times the current levels of mobility by 2050.[4]

Figure 2: Growth in Urban Population and Mobility Demand

Growing urban population leading to…

Global urban and rural population in billions of people

..an explosion in demand for urban mobility

Urban mobility demand, in trillions of personal km travelled

Sources: United Nations (2014), Arthur D. Little (2014)

Modern-day megacities like Mumbai, Beijing and Mexico City offer a glimpse of the complexities of living, working and moving in cities that are likely to become widespread. Future mobility projects will have to solve a host of complex issues, including congestion, pollution, access and gridlock.

Humanity's impact on the environment continues to be a major focus of discussion and debate – for governments, enterprises and individuals. Man-made greenhouse gas emissions and their contribution to climate change are among the biggest global challenges and will shape the way we approach transportation needs in the future. Global society needs to actively address the global greenhouse gas challenge by building sustainable models for safe, clean and affordable mobility that supports the needs of a growing, shifting, globalizing and digitizing population.

Public sector, civil society and industry leaders need to collaborate closely to take advantage of the opportunities presented by new mobility to transform urban transportation and to address a range of challenges in ways that are economically, environmentally and socially sustainable.

Societal Changes

Aging population: In the 1900s, the average global life expectancy was around 40 years of age. Thanks to advances in medical science, nutrition and healthcare, the average global life expectancy is currently close to 80. On the current trajectory, it is no wonder that some scientists believe the first person to live to be 150 years of age has already been born. Despite these positive advancements, in practice, longer life expectancy will create questions surrounding quality of life for the elderly and severe social and economic challenges for the entire population.

Dependency ratio: As the global population ages, so does the workforce. The United Nations has declared that the ageing of the world's population will be one of the greatest challenges mankind faces. The economic index known as the dependency ratio highlights the issue by measuring how many workers are supporting a non-working population. Japan, which has the oldest population in terms of percentage, is projected to have every 100 workers supporting 108 non-workers. A deficit position of this nature is likely to have a negative impact on the country's economic output and its ability to invest and innovate.

Digital is the new normal: With ubiquitous digitalization and connectivity, consumers are becoming increasingly digitally enabled and empowered. Generation Z, roughly defined as those born after 1993 (over 2 billion globally), will define the consumption patterns of tomorrow. This "native" generation was born after the evolution of the personal computer and raised with the revolution of smartphones. They take for granted emergent on-demand and sharing models. They consider digital "the new normal" and an integral part of their daily lives. They are used to constant innovation and quick shifts in technology, business and service models and they increasingly demand transportation that provides the level of digital utility and capability to which they are accustomed. As the new generation becomes less committed to ownership – 73% of all adults worldwide (56% in China) are saying "I would rather have a few useful possessions than many possessions"[5] – mobility as a service (MaaS) becomes a credible alternative to car ownership, even in mature economies.

Transition Themes and Emerging Opportunities

There is no single solution to the increasing urban mobility challenges. Instead, new and emerging technologies and business models, combined with evolving public policy and culture, are paving the way for many solutions. In addition, there is a growing variety of practical and affordable ways to combine these into integrated "systems of systems", which can simultaneously address the needs of people, communities, economies and the planet. This makes it possible for a larger and more diverse group of people, business sectors and public leaders to be involved in making it happen.

Narrative catalysts and shifting culture

Back in the 20th century, urban and sustainable transportation dialogue often polarized opinion across sectors, around pro- or anti-car sentiments and around pro-environment vs. pro-social-equity, or pro-industry. Recommended actions and policies were often characterized by constraint and regulation more than by collaborative and positive solution-building.

More recently, however, the dialogue has diversified, looking at a wider set of options that are more connected and enabled by new, nimble, affordable information technologies, business models and service models. While this evolution is still in process, the following trends are emerging in a range of geographies and contexts:

▸ There is some erosion of status and identity related to single occupancy vehicles in some demographics (especially millennials as they become a poster generation for on-demand, real time, door-to-door systems). Narratives are moving away from sacrifice, scarcity and commitment to only one type of vehicle and style of mobility towards a more inclusive picture of increased options and convenience through connectivity and sharing. "New mobility" is desirable, not a sacrifice.

▸ New decision models are moving away from decisions between modes (bike **versus** car) towards decisions **among** modes (i.e. on-demand multimodal options as an integrated service).

There is a new culture of bike-sharing among professionals, especially in Europe and the United States, highlighting it as an appealing commuting option across all income levels and social classes.

Technology and big data – enabling forces

Information and communications technology (ICT) and related big and small data has transformed all aspects of life, including the ways people move around and meet their personal and economic needs. With technological development, the centralized, top-down, capital-intensive, highly planned and engineered permanent systems that represent the grand visions of the 20th century are quickly giving way to more flexible, nimble, user-focused, connected, sustainable, customized and affordable options for moving people and goods, and even for moving less.

Information technology, even in the absence of good land use, good policy, good leadership or good funding, is making it possible for leaders and innovators to provide greener, safer and more equitable options at lower cost and higher returns. Meanwhile, as more and more people, even the very poor, transcend the digital divide through mobile technology, they are also better equipped to cross the mobility divide.

ICT makes the shared economy not only feasible, but powerful and transformative. Without technology and the data it generates, information and service models like Uber, Lyft, Didi, OlaCabs, Autolib', crowdsourced real-time transit planner moovit and the various parking apps would never have been possible. And without ICT, users would never have imagined the real possibility of seamlessly connecting multiple modes, services and technologies on demand to support their changing daily door-to-door transport needs.

Transportation leaders and operators now have access to sophisticated, real-time, multimodal cloud- and mobile-based traffic management systems that can help them better meet customer needs across the full range of transportation options. They have also been able to provide the kinds of systems that give access to people, products and services without having to move. Information technology helps us move less by reducing the length of trips or eliminating them altogether – through telecommuting, e-commerce, distance learning and tele-medicine to name a few. Looking to the future, more businesses are using ICT to develop automated and connective products for transportation with the goal of improving safety, efficiency and sustainability – and this is only the beginning.

Business models – moving the economy

Until recently, urban transportation has been associated with 20th-century bricks-and-mortar infrastructure and utilities in the portfolios of local and regional public sector leaders, and in state and provincial budgets. Financing for transportation has predominantly come from public sector capital investments and subsidies.

More recently, however, a new understanding of urban mobility as an economic benefit, and even further as a major economic driver, has begun to inspire a new approach to mobility as an investment.

"New mobility" (or sustainable urban transportation, or MaaS) saves money, creates jobs, contributes significantly to regional economic competitiveness and can form the foundation of a global new mobility industry valued in the trillions of dollars. Only recently, though, have these early findings manifested visibly on Wall Street, in Silicon Valley and in both mature and emerging economy markets. And only recently has the profusion of reports citing the industry begun to drive a multisector proliferation of new mobility demonstration and deployment investments and business model innovation.

New mobility business models range from individual on-demand mobility to peer-to-peer sharing models and on-demand transit. Figure 3 provides a (non-comprehensive) snapshot of the growing range of emerging business models for transportation. There has been an explosion of ideas driven by entrepreneurial spirit and creativity on the regional and global level, enabled by traveller and vehicle connectivity, automation, telematics and new capabilities of small and big data analytics.

Integration models – connecting the dots

Urban transportation comprises a complex and growing range of services, technologies and products. Infrastructures, information, revenue systems and design need to be better geared to users. Linking existing and new modes of road, rail and ferry travel with walking, cycling, automobile driving and public transit can increase the convenience, efficiency, safety, security and sustainability of personal mobility.

Recent focus has been on the provision of a digital platform through which a customer's transportation needs are met via one interface offered by a service provider. Some cities have already been investing in the development of multimodal hub networks (e.g. Bremen, Toronto, Munich, Anaheim and Amarillo). These holistic network approaches acknowledge that, while technology has enabled and continues to fuel the paradigm shift from single mode to connected and multifaceted systems, technology alone is not enough. The connectivity has to happen on a physical and virtual level, but the institutions responsible for each part also need to connect.

This kind of "connecting the dots" across businesses, the public sector and civil society is called public-private innovation (PPI). It involves bringing together those who play a role in providing the region's transportation to identify and deliver solutions together, based on how that city wants to live and thrive. This includes not only the usual suspects, such as city leaders and planners, but also other relevant public sector areas, such as housing, economic development, innovation, finance, tourism, communications and information technology. It also involves private sector players, from CEOs and SMEs to start-ups, representing sectors as wide-ranging as automotive, telematics/ICT, energy, real estate and development, logistics, architecture and infrastructure, finance and tourism. And of course it includes community and NGO leaders, thought leaders and academics. This often forgotten but crucial step of connecting all the dots is not always easy, but a number of practical approaches have been developed to facilitate and enrich the process, such as Sustainable Mobility and Accessibility Research and Transformation (SMART) and the World Business Council for Sustainable Development.

The fact that technology is currently outpacing policy makes it impossible for policy-makers (or anyone else) to predict the future. That is why connecting all the players is even more important now. It requires learning and understanding each other's languages and goals across sectors, seeing the system as a whole and evolving the transportation ecosystem that will supply the next generation of transport. Such a rich, informed and multisector ecosystem promises to provide, more cost-effectively, the resilience and responsiveness needed as challenges and opportunities arise.
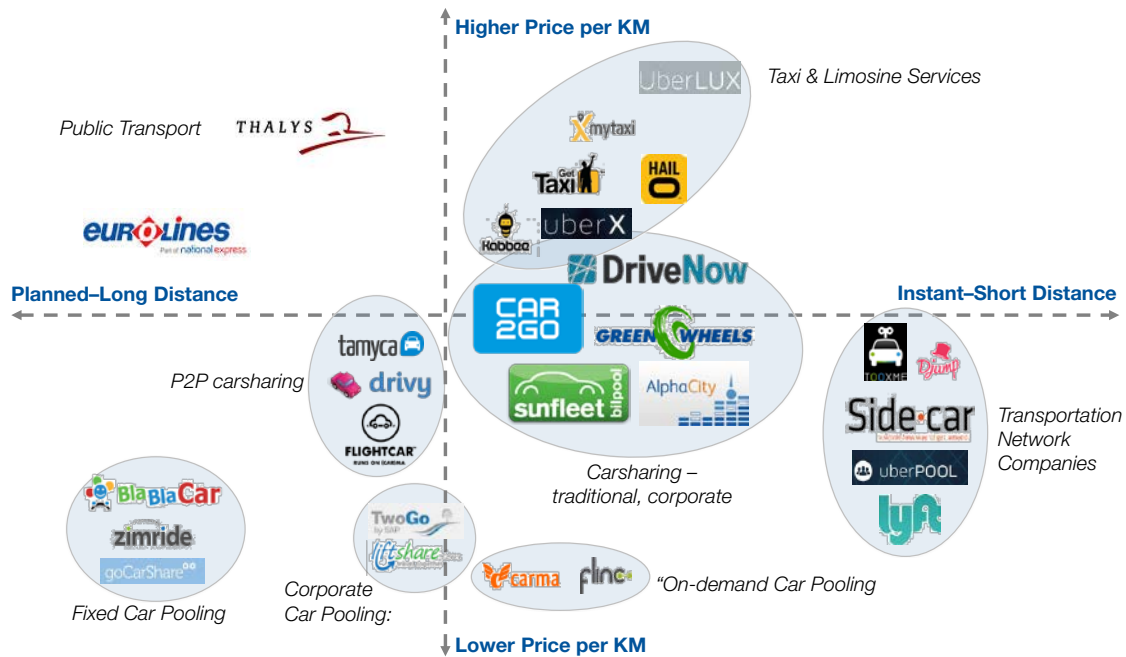
Figure 3: Snapshot of Mobility Business Models
Source: Frost & Sullivan (2015)

Policy models – innovative leadership

As technology outpaces policy-making and city planning, it becomes more starkly clear that trying to choose winners, or developing detailed rules and regulations to apply to innovations (that may be obsolete by the time the policy is enacted), is neither possible nor advisable. In this context of rapid change, the paradigm transition is not only in terms of **what** policies are emerging, but in terms of **how** policy happens. The following shifts are increasingly affecting the policy landscape:

▸ As transportation becomes more complex, policy needs to address a much wider range of issues and opportunities, going beyond planning, zoning, fuels and Corporate Average Fuel Economy standards to include innovation policy, housing, ICT and "internet of things", privacy, cybersecurity, housing, smart cities, tourism, logistics, finance, economic development, energy and environment, and more.

▸ Mobility is increasingly addressing or being asked to address the full range of user needs, via a variety of modes door to door.

▸ Transportation policy is increasingly being oriented towards an overarching goal of accessibility versus mobility. Mobility is a means to access. Achieving accessibility can include mobility, proximity or technology (tele-everything). Focusing on access and liveability, with mobility as a core component, addresses both the user and the whole system simultaneously.

▸ Mobility and related policy is also increasingly seen as a matter of economics, industry, enterprise, employment and talent attraction and development, rather than purely a matter of public infrastructure.

▸ Increasingly, national and regional governments are looking to MaaS for both transportation and economic reasons, as well as for industry and employment development.

▸ Transportation policy dialogue is increasingly focused on equity for the urban poor, senior citizens, the under-served, the vulnerable and the millennials, all of whom are shown to benefit from more connected, on-demand dynamic options that eliminate the need to own a car.

▸ As more players become involved, as change happens faster, and as developments become more virtual, less physical and more nimble, there is an emerging tendency towards platforms, frameworks and system architectures guiding action in addition to specified regulations, rules and official plans.

▸ Incentive policies as well as constraints and disincentives are increasingly being explored and applied.

While the new mobility policy landscape will continue to evolve, a number of business model and policy challenges will need to be addressed by both legacy and disruptive enterprises.

Principles in Action – Ten Recommended Deep Dives

Improve physical integration and connectivity between transport modes

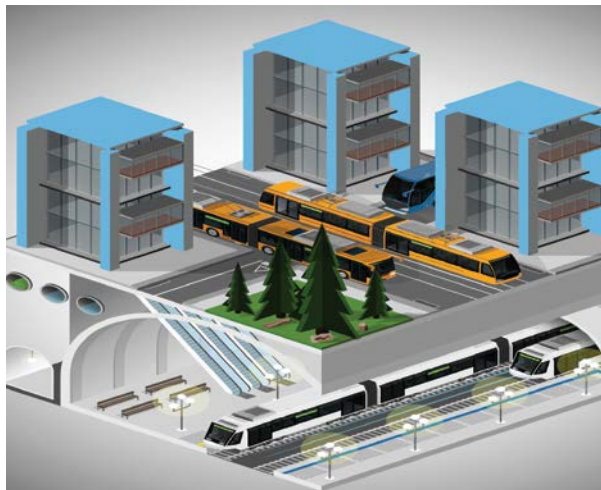Industry   Entrepreneurs   National government   City leaders   NGOs

Benefits: Increased quality and convenience of travel (seamless journey combination), reduced commuting time, reduced congestion and environmental footprint, reduced cost of mobility leading to increased accessibility

Recommendations:

- Improve physical integration and connectivity between transport modes to allow "seamless" journey combinations

- Offer support and incentives for industry initiatives, including MaaS, and create an enabling regulatory framework

- Create an open data platform for sharing real-time data on transit and passenger information and for enabling interoperability across modes, services, products and technologies

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Example: Gothenburg, Sweden – Ubigo integrated mobility pilot

Ubigo offers a simple, flexible, sustainable, reliable and price-competitive service as an alternative to car ownership. To start, 70 households were provided with a flexible monthly subscription – beginning from €150. A single app was used to access various modes of transport: public transport, car-sharing, bike-sharing, rental car service and taxi. Bonus points were assigned for choosing sustainable modes and a single invoice was provided at the end of the month.

http://www.ubigo.se/

Example: Bremen, Germany – transport integration strategy

Bremen developed an integrated, clean, smart and customer-oriented transportation system. Elements of the system include: multimedia hubs linking various mobility modes and residential developments with built-in car-sharing; traffic calming to favour bicycles; bike-and-ride facilities, including electrically supported bikes; intelligent tramways; an integrated smart card for transit, car-sharing and banking; an integrated central station for all modes; one umbrella organization for all 35 transit operators in the region; improvement of public transport quality standards by extension of the personal transport network, real-time information displays and easy interchange between personal transport modes, etc.

http://bit.ly/1O3GqyB

**Example: SMART – multimodal system accelerator**

SMART at the University of Michigan has developed and leads one- to three-day systems sessions in cities worldwide (to date over 20 in India, South Africa, Brazil, the Philippines, China, Europe and the United States). They offer a regionally customized transformational tool and related capacity building to leaders across the public, private and NGO sectors for designing and implementing sustainable, connected, smart, multimodal, inclusive door-to-door transportation systems, accelerating implementation of on-the-ground systems solutions, not only for moving people but also for moving goods and moving less.

http://bit.ly/1NPok1m   http://www.um-smart.org/

Establish industry standards on data/digital infrastructure across device types
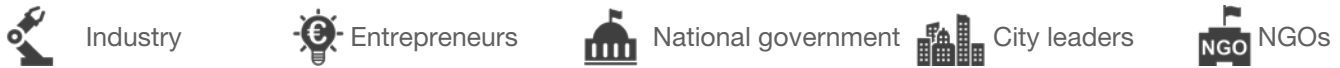
Industry | Entrepreneurs | National government | City leaders | NGOs

Benefits: Interoperability and seamless transition between device types, accelerated consumer adoption of new technologies and services, improvement of transport safety and environmental footprint
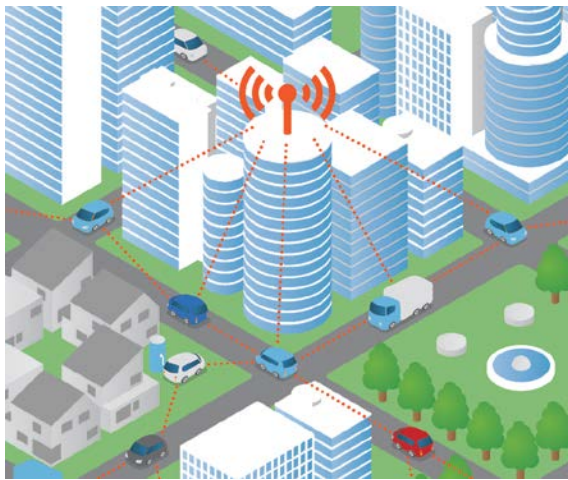
Recommendations:

Establish industry standards across device types

Leverage existing technologies, such as 3G/4G cellular data, smartphones, embedded vehicle wireless connections, vehicle sensor data, cloud solutions and analytics, to provide efficient safety, environmental sustainability and infotainment communications

Incorporate current in-vehicle active crash avoidance capabilities

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Example: Finland – Finnish Transport Agency pilot

This cellular-based, cooperative intelligent transportation systems (ITS) public field trial is being carried out to demonstrate the impact on safety of providing drivers with road hazard alerts based on community input and traffic agency origination. The cellular 3G/4G/LTE network carries safety-related messages with low latency, i.e. they do not generally suffer from human-noticeable delays between input and output providing real time characteristics. HERE Cloud processes messages and delivers targeted localized alerts to subscribers within or approaching an incident impact area. HERE has publicly released interface specifications to maximize compatibility across brands and devices.

http://bit.ly/1QXpsSV

Example: India – Mahindra REVA and Vodafone e2o

The Mahindra e2o – Mahindra REVA's connected car – is connected to a range of applications and services via the Vodafone network. Owners are warned remotely, via smartphone app or dedicated webpage, if the parking brake is left off, the battery is low or the car has technical issues. The services help with passenger safety and comfort, as well as lock or unlock doors and find the nearest charging station

http://bit.ly/1SASXaE

Best practice technologies

Cloud-based network computing | High-quality mapping and geospatial localized intelligence | Big data management and analytics | ITS solutions | Flow and predictive traffic and environmental analytics

Enhance day-to-day transport management through data-based approach

 City leaders

Benefits: Increased speed and effectiveness of problem-solving, reduced congestion and environmental footprint, improved road safety, increased transparency to the public
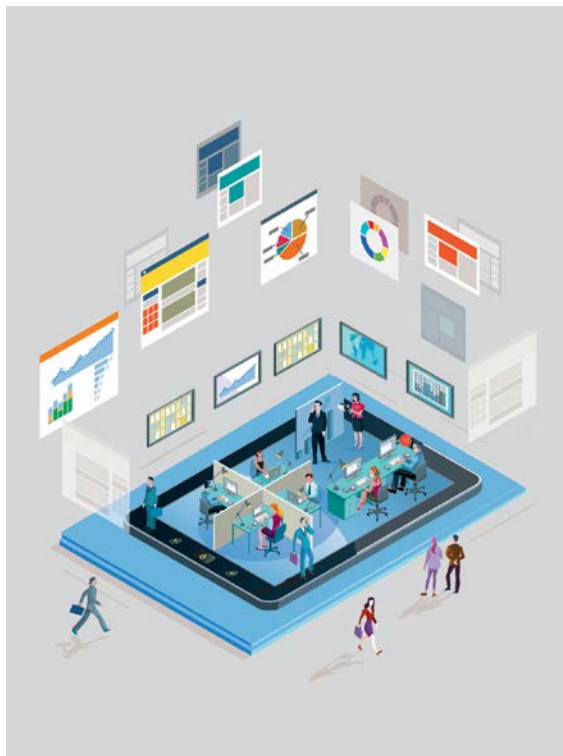
Recommendations:

- Implement performance-based multimodal transportation management leveraging real-time data analytics in an actionable overview of city metrics

- Apply a smart pyramid principle aggregating data into relevant indices with the required granularity of information on different levels (e.g. department, commission, mayor)

- Emphasize data-driven governance – leverage data-driven decisions to identify and address problems as they happen or even to prevent them arising

- Build strategic partnerships across the public and private sectors for reliable data provision

- Use data/indices to inform the public and create transparency

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Example: Boston, United States – CityScore

Boston's City Hall is using statistics and looking to distil its data-driven efforts into one gauge of government performance, referred to as CityScore. The figure summarizes dozens of measures, from how quickly crews fill potholes and fix street lights, to fire and emergency response times and crime levels. The idea is to give city leaders – and residents – a general sense of how city government is doing on a daily basis, and to quickly highlight areas that need improvement.

Example: Da Nang, Vietnam – IBM Smart Cities Challenge

As part of IBM's Smart Cities Challenge, Da Nang's traffic control centre introduced tools to predict and prevent congestion on the city's roads and to better coordinate responses to situations caused by adverse weather or road accidents. Data is aggregated from multiple streams – including real-time information from its 100-strong fleet of buses – which city planners can analyse to detect anomalies and control traffic flow. Embedded sensors monitor traffic on roads and highways and levels in the flood-prone Han River. Data can be shared with passengers through video screens at bus stations or via mobile apps.

http://bit.ly/1PC0GHU

Example: Sweden – National Traffic management System

The National Traffic management System (NTS) is an advanced traffic management and control system, developed to increase efficiency and support the operational work in the traffic control centres. It consists of a number of computer management systems, configured to work with the infrastructure, including: video walls, telephony, email, SMS, fax and interfaces to many external systems (sub-systems) which are used to communicate with and control the on-street infrastructure, running in a central virtual environment and connected to local operator workstations.

http://bit.ly/1T1uoUt

Promote demand-responsive shared transport

🔧 Industry   💡 Entrepreneurs   🏛 National government   🏢 City leaders   🚩 NGOs

> **Benefits:** Reduced cost of mobility leading to increased accessibility, higher quality of mobility (reduced commuting time, availability of seats, etc.), reduced congestion and environmental footprint

Recommendations:

⚖ Make it legally possible: force this form of supply in the regulations for on-demand transport services

☁ Additional measures would be desirable, e.g. an adaptation of vehicles to demand-responsive requirements

⚖ The much higher efficiency of these services should also lead to a much lower need for public subsidy of this new form of public transport

📊 Favour adaptable routes over fixed routes to increase the flexibility, accessibility and convenience of the service

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Example: Helsinki, Finland – Kutsuplus on-demand bus services

An on-demand minibus service run by Helsinki's public transit authority lets riders decide on a start and end point and choose whether to share a journey or take a private trip. Ajelo, a local technology start-up, has developed the dispatch system and the city manages the vehicles.

https://kutsuplus.fi/

Example: Hangzhou, China – Omnipay Co. Ltd

Hangzhou Omnipay Co. Ltd, is a transport-sharing system, including Hangzhou's public bike-sharing and car-sharing systems, the Segway PT rental system in Sanya and the electrical bike-sharing system in Shandong. Omnipay employs an innovative transportation-sharing credit system as an innovative approach for the urban poor. It is different from traditional money-based credit, but policy-oriented. The public can receive points and discounts by using public transport (users get an extra 30-minute free bicycle rental after a public bus ride through a one-card solution), by resource-sharing (one-hour free bike-share rental) and by taking part in green practices like recycling and garbage classification.

http://www.omnipay.cn/introduction1.html

Example: Mobi Platform – crowdsourcing, connecting and advancing new mobility

The global Mobi Prize and Platform crowdsources, connects, honours and advances a growing community of new mobility innovators and enterprises globally including and beyond demand-responsive shared transport. It fosters understanding and development of new business models and entrepreneurial opportunities related to an integrated, demand-responsive, multimodal, IT-enabled and sustainable transportation future.

www.mobi-platform.com

Streamline regulation and management of demand-responsive solutions

🏛 National government   🏙 City leaders   🚩NGO NGOs

Benefits: Accelerated consumer acceptance, "healthy" competitive environment, reduced congestion and environmental footprint, increased safety

Recommendations:

⚖ Single regional authority to set directions and oversee all aspects of transport, including parking, on-demand services such as car-sharing and bike-sharing, and potentially goods movement and trip reduction as well

⚖ Create a regulatory framework to address taxation, insurance liability and other policy issues related to emerging innovations

⚖ Provide specific incentive payments and/or direct relief from transport charges for MaaS users, e.g. parking privileges, guaranteed ride home, frequent rider miles, location-efficient mortgages

💬 Engage leaders (public and private) region-wide to promote regional sharing and MaaS programmes

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Example: Washington DC, United States – parking for car-sharing

Washington DC began offering free on-street parking spaces to car-sharing operators in 2005. Reserved on-street car-sharing spaces were selected in consultation with Advisory Neighborhood Commissions, businesses and community leaders. Car-sharing vehicles all display a special permit on their front windshields, allowing them to park in both residential and metered parking spaces free of charge and longer than the posted time limit. Operators relocate vehicles that are parked in residential blocks for more than 24 hours.

http://1.usa.gov/1SAYttR

Introduce policies to accelerate adoption of alternative fuel vehicles
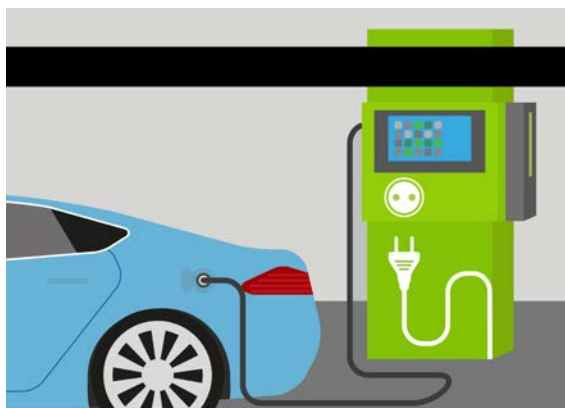
National government   City leaders   NGO NGOs

Benefits: Improved environmental footprint (CO$_2$, NOx and particulates), reduced noise levels from transportation

Recommendations:

Consider providing incentives relating to running costs (total cost of ownership) as a complement to one-off incentives on purchase price (e.g. VAT reduction)

Consider providing incentives to use alternative drivetrain vehicles over internal combustion engine vehicles (e.g. congestion-charge benefits, parking incentives/dedicated parking spaces)

Example: Norway – electric car incentives

With a population of 5 million, Norway had over 60,000 electric cars on the road in 2015, which made it world leader in terms of market share. The nation has adopted (and renewed until 2018) strong incentives for electric vehicle ownership, including exemption from a high purchase tax and from 25% VAT on purchase, no charges on toll roads, free municipal parking, free access to bus lanes and free use of more than 5,500 charging stations across the country.

http://bit.ly/1YMaOiL

Example: China – national and local subsidies

China's national programme 863, initiated in 2008, was designed to promote research, development and acceptance of new technology. Subsidies of RMB 50,000-60,000 were offered to consumers who purchased electric cars. The programme also offers incentives for manufacturers of public transit buses and their main suppliers to develop clean systems and rewards the transportation company that ultimately purchases the buses.

http://bit.ly/1Nqab9t

Develop and apply open infrastructure standards to reduce costs and ensure cross-border interoperability

🔧 Industry   💡 Entrepreneurs   🏛 National government   🏙 City leaders   NGO NGOs

Benefits: Interoperability and seamless transition between device types, accelerated consumer adoption of new technologies and services, improved transport safety, reduced environmental footprint

Recommendations:

☁ Establish global industry standards for plug type/fuelling

☁ Establish cross-border standards for billing and payment, point-of-interest (POI) data, charging station access:

- ▸ Provide drivers with easy access to participating charging/fuelling stations using common authentication credentials
- ▸ Enable one bill for all charging usage
- ▸ Provide accurate aggregated charging/fuelling station location data
- ▸ Utilize open national interoperability standards

⚬ Ensure interoperability of charging stations (AC and DC) for various available electric vehicles

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Example: Europe – interoperable electric vehicle infrastructure

The rapid charging network is the first collaborative project between electric vehicle manufacturers in Europe to install fast charging stations. Supporting industry partners are BMW, Renault-Nissan, Volkswagen and ESB eCars.

http://rapidchargenetwork.com/

Example: United States – interoperable electric vehicle infrastructure

The United States has the most harmonized form of electric vehicle charging infrastructure as there is a single standard for AC charging. Of the 20 electric vehicle models available in the United States, 19 are compatible with SAE J1772 and can use combo connector charging stations for AC charging as well. All infrastructure operators are working towards ensuring the interoperability of charging stations across the United States.

http://1.usa.gov/1NKINY3

Example: Japan – interoperable electric vehicle infrastructure

Japan is likely to lead the way in terms of development of hydrogen filling stations owing to the remarkable support of $378 million (2015-2020) provided by the government and local automakers.

Consider possible technological and business model (r)evolutions when making long-term or capital intensive investments

 City leaders

Benefits: Increased sustainability of long-term and capital-intensive investments, increased flexibility in city design and public asset allocation.

Recommendations:

💬 Keep options open to embrace new innovations (e.g. zero-emission technologies, automation, intelligent transport systems, new service models), including anticipated as well as unknown innovations – incorporate them into cities as seamlessly and affordably as possible

💬 Consider technologies and new operating models currently being developed when engaging in future city design

💬 Plan for convergence of personal and freight (city logistics) transportation, e.g. in autonomous and/or shared vehicles

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Example: Michigan, United States – Mobility Transformation Center

The Mobility Transformation Center (including urban test track) at the University of Michigan leverages multiple industry and government partnerships to develop the foundations of a commercially viable ecosystem of connected and automated vehicles to improve the safety, sustainability and accessibility of the ways that people and goods move from place to place.

http://www.mtc.umich.edu/

Example: Curitiba, São Paulo, Porto Alegre, Brazil – bus rapid transit

Several Brazilian cities successfully implemented bus rapid transit systems as far back as the 1970s by creating dedicated, separated bus lanes, fare pre-payment and express buses. Now many of the buses run on alternate fuels, leading to an improvement in the air quality in cities. In addition, vehicle-to-infrastructure communication now makes it possible to collect data from GPS devices, vehicle sensors and commuter apps, which improves timing and traffic flow.
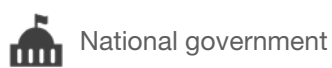
http://bit.ly/1lsq14j

Leverage corporate/institutional environments to test and showcase business model and technology innovation

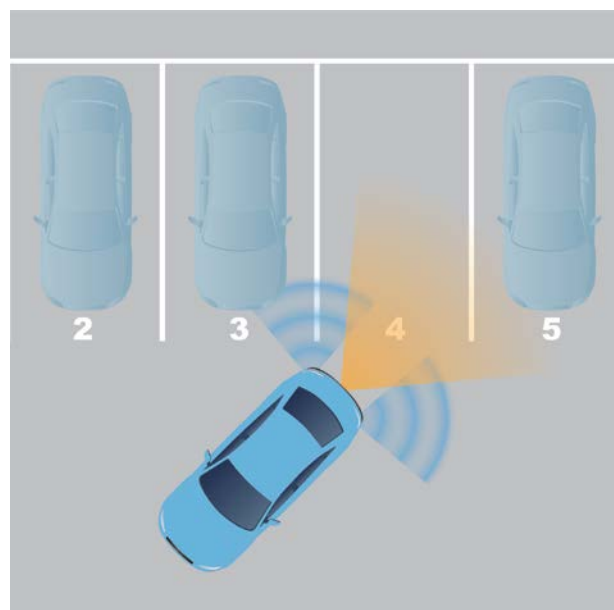 Industry   Entrepreneurs   National government   City leaders   NGOs

Benefits: Accelerated consumer acceptance, continuous learning and improvement from field experiences

Recommendations:

- Leverage available environments in the corporate (industry, entrepreneurs) or institutional (governments, universities, cities, NGOs) context to showcase technology and business models and learn from corporate pilots

- Specifically, on-demand sharing models and parking (corporate/institutional parking garages) offer no-regret opportunities to showcase the benefits of new mobility models

- Leverage data from corporate pilots and actively communicate the success and the impact on employee productivity and ecology

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Example: Stuttgart, Germany – Bosch and Daimler automated parking for car-sharing

Bosch and Daimler are collaborating to create a fully automated parking garage to test on car2go rental cars. Bosch is equipping the corporate parking garage for Daimler with the necessary infrastructure (e.g. parking space occupancy sensors, cameras and communication technology), while Daimler provides cars with corresponding sensors and software for auto-driving capabilities.

http://bit.ly/1QWPJAA

Example: California, United States – PG&E and BMW testing of grid benefits from electric vehicles

Pacific Gas and Electric Company (PG&E) and BMW teamed up to test the ability of electric vehicle batteries to provide valuable services to the electric grid. The automaker is creating a large energy storage unit at the BMW Group Technology Office in Mountain View, using lithium-ion batteries that were once installed in MINI E demonstration vehicles. These "second life" batteries can absorb cheap surplus electrical energy when demand is low and release it on request when demand soars. Furthermore, BMW enlisted 100 customers of its BMW i3 electric vehicles to take part in the BMW iChargeForward Programme. If PG&E needs to curb customer demand, it sends BMW an alert over the internet, indicating how much load to cut and for how long. BMW then signals the telemetry equipment in each participating vehicle, telling it to halt its charging for the duration of the event.

http://bit.ly/1GIHu5Q

Example: Global – Ford Motor mobility experiments

Moving from early global megacity mobility work begun in 2008 and more recently 25 mobility experiments launched globally, Ford Motor Company advances connectivity, mobility, autonomous vehicles, the customer experience and big data with a particular focus on flexible use and ownership and multimodal urban travel solutions. Examples include: partnership with Getaround in the United States and easyCar Club in London on peer-to-peer car-sharing with vehicles financed by Ford Credit; GoDrive's pay-as-you-go one-way trips with guaranteed parking; a new electric bike concept called MoDeFlex; and an extension of the smart phone app MoDe Link.
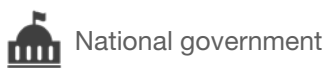
http://ford.to/2276xZO

Apply smart and competitive public-private financing models to fund new mobility ecosystems

🔧 Industry   💡 Entrepreneurs   🏛 National government   🏢 City leaders   NGO NGOs

Benefits: Reduced public debt, monetization of public assets, increased speed of mobility transformation

Recommendations:

- Leverage taxes and payments for building permission to create infrastructure for public parking lots connected to public and personal transport

- Create road tolls with private investment

- Introduce public companies to promote public-private investment and give legal certainty to potential investors

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Example: Bogotá, Colombia – Transmilenio bus rapid transit

Bogotá's Transmilenio system is overseen by a public body, but provided by private bus companies on a competitive contract basis. Private contractors are paid based on the total number of kilometres that their vehicles travel. The fare is pre-paid using a contactless smart card system, the production and maintenance of which is also contracted to private companies. Twelve lines totalling 112 km (70 miles) run throughout the city, making it the world's largest bus rapid transit system. Similar systems can also be found in other developing countries and emerging economies and could be adapted and adopted elsewhere.

http://bit.ly/1LRlhQA

Example: Mexico City, Mexico – Avenida Chapultepec

The Avenida Chapultepec project gives a 40-year concession to a private trust that will be in charge of developing and operating the Chapultepec Cultural Corridor. A private investor will provide the necessary resources to build and maintain the project during this period, and will receive income directly from the services offered in the Corridor, including his expected return on investment. Mexico City's Government will also receive a small percentage of the yearly income. Chapultepec Avenue, in the heart of Mexico City, will evolve to become a three-level linear park, incorporating public and private transportation, pedestrian and retail areas. It is expected to promote culture and stimulate the economy, as well as become a safe, clean and attractive recreational area.

http://bit.ly/1IdaLOQ

Example: Detroit, United States – M1-RAIL financing and partnership model

M1-RAIL is a leading public-private partnership in the United States. It brings together private businesses and philanthropic organizations in partnership with local government, the State of Michigan, and the US Department of Transportation to make light rail a reality in downtown Detroit. This 3.3-mile light rail is being touted as the poster child for redevelopment in Detroit. Its mission is to create a catalyst for investment, economic development and urban renewal, the positive impact of which extends to the entire region.

http://m-1rail.com/

Impact: The Journey from Here

As the number of people and volume of information in the mobility ecosystems across the globe increase and life moves at a faster pace, new approaches will be required to manage the growing complexity with limited resources. Luckily, technology, changing consumer behaviour and new approaches to business offer tremendous opportunities to tackle evolving challenges.

This new world, where new ideas spread fast and can be iterated instantly, also completely changes the game for competition, innovation, regulation and planning when it comes to mobility. Collaboration between governments, businesses, civil society and academia is crucial to cope with the new reality and come up with solutions which will provide growing access and liveability in cities in an economically attractive and sustainable way.

Leaders in public and private organizations will need to adapt to a culture of collaboration and experimentation and to focus their attention on agility, transparency and integration. By doing so, instead of simply developing individual successful mobility solutions, it will be possible to create an integrated mobility ecosystem which continuously evolves through a range of new, successful solutions.

Endnotes

[1] Chetty, R., Hendren, N., "The Impacts of Neighborhoods on Intergenerational Mobility". Harvard University, 2015, http://www.equality-of-opportunity.org/images/nbhds_exec_summary.pdf; Kaufman, S., Moss, M., Tyndall J., Hernandez, J., "Mobility, Economic Opportunity and New York City Neighborhoods", 2014, http://wagner.nyu.edu/rudincenter/wp-content/uploads/2014/12/NYURudinJobAccessReport.pdf

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[3] Urban Development | World Bank Institute (WBI), 2015, http://bit.ly/1KNOpsa.

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