Advisory Group on Game Changers

Policy Paper developed by the CIVITAS SATELLITE Advisory Group on Game Changers

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1. Executive Summary

The CIVITAS SATELLITE Advisory Group defines (urban mobility related) game changers as "recent or upcoming developments that change the existing mobility system (i.e. the way mobility is organised, provided, and used) in a significant and often disruptive way." A game changer is the result of complex interactions between changes in the realms of technology, society, businesses, economics, and policy.

It is utmost importance for planning and policy making in the context of urban mobility to understand how to identify and react to game changers. This Advisory Group focussed on game changers in the urban, metropolitan and regional mobility realms. Due to their influence on the planning process, addressing the impact of game changers in scenarios, visions, and action plans is an important aspect of Sustainable Urban Mobility Planning (SUMP). By definition, game changers will alter the mobility landscape and thus need to be factored into mobility planning and policy and measure implementation.

The Advisory Group identified eight key game changers, which are described in this policy paper: (1) electrification, (2) increased automation and use of C-ITS, (3) growth of data economy, (4) new business concepts for freight and passenger transport, (5) shared mobility, (6) growth of active mobility, (7) changing mindsets and behavioural patterns, and (8) integrated space management. The group devised general policy recommendations for each game changer. Without the requirements or constraints of a specific project context, the recommendations are not exhaustive, but meant to represent suggested priorities. The recommendations are the result of the specific processes of the Advisory Group and are intended to stimulate further debate rather than serve as a final comprehensive set of recommendations.

The collected ideas have been formulated for each game changer at three levels—for city authorities (considering all urban practitioners), for national government actors, and for the European Commission—and range from general to detailed, as they were developed in the context of the three expert meetings. From the assortment of thoughts collected, some broad recommendations across game changers can be drawn:

- **Regulation:** Create a regulatory framework for licensing, including clear criteria (e.g. data sharing), vehicle standards, and serving deprived areas. Devise dynamic licencing schemes to organise and monitor the various service providers in the city to ensure they are running in a positive way and are contributing to the city's mobility strategy, i.e. license fees should depend on how the provider reflects the goals of the city.
- **Pricing:** Recommendations for smooth integration of a game changer include subsidising and linking payments with public transport. Another pricing approach is to provide designated/less-expensive parking/operating fees for game changer vehicles (e.g. shared vehicles, electric vehicles).

- **Space management:** How space is prioritised influences the appeal of a travel mode, or in this case, a game changer. For each game changer, adequate, supportive infrastructure to support its integration or presence in the urban environment is integral to the recommendations made. For example, if shared vehicles such as e-scooters are introduced to a city, it should also be clear where they should be driven and parked. A game changer without adequate infrastructure or a clear allocated place in the urban fabric will likely be unsustainable and undesirable.
- **Stakeholder cooperation:** Coordination across sectors is already seen as an essential aspect of urban mobility and SUMP, so it is therefore of little surprise that recommendations for game changers advocate this approach as well. Recommendations include focusing on cross-sectoral integration, e.g. transport and health, and coordination between modes, e.g. local public transport and infrastructure for active mobility. This will help ensure that new vehicles do not compete with or otherwise interfere with public transport or active mobility.
- **EU/Global climate goals:** Policies concerning each game changer should be consistent with climate goals and prioritise emission reduction. Recommendations include conducting GHG accounting of ICT infrastructure and imposing environmental standards that must be met in order for the infrastructure to be built. Setting emission requirements that shared vehicle fleets must meet, prioritising active shared micromobility over motorised shared mobility, and creating urban spaces in which (non-motorised) shared modes are visibly prioritised.
- **Capacity building:** Transcending topic and policy level is an overarching capacity building recommendation to strengthen institutional capacity to regulate under uncertainty through capacity building and training for government actors on the potential impacts, how to strengthen the positive impacts, and how to reduce the negative impacts of game changers. Institutional capacity to recognise and make sense of emerging patterns is a valuable asset in navigating uncertainties about how new services will develop, how they will respond to policies, and what their impacts may be.

The above points are themes that pervaded recommendations for game changers across categories and policy levels. For each game changer and policy level, further specific, in-depth considerations are recommended. The Advisory Group's analysis of the game changers shows that each game changer presents unique governance challenges and has different requirements and consequences.

Depending on how policy makers deal with game changers, the result can be a healthy, people-focussed city with efficient mobility offerings at present and in the future. The final bullet point in the above summary is therefore of paramount importance: there is a need for preparedness to adapt. That way, the proliferation of new business models and the deployments of new technologies will not be hurdles to be overcome, but rather opportunities to be seized to maximise their benefits for

cities—or at the very least, they will present uncertainties that decision-makers will be well-equipped to handle.

> **COVID-19 Addendum**
>
> This document was prepared in consultations that took place over the course of late 2018 and 2019, and the draft was completed in February 2020. Prior to publication, it became apparent that COVID-19 is also a game changer to be reckoned with when providing policy recommendations on the original topics. The Advisory Group reconvened for a fourth virtual meeting on 9 June 2020 to review the impact of COVID-19 on urban mobility and game changers, exploring questions including:
>
> - How is COVID-19 changing the direction and intensity of the game changers?
>
> - What can be done to maintain/progress the game changers?
>
> - How can we avoid regression to the previous status quo?
>
> - What should be done?
>   - At local government level
>   - At national/EU level
>
> - What can be done to now to prepare for "next wave" or future pandemics?
>
> - What can be done to equip cities and urban mobility planning to better handle future uncertainties?
>
> Prior to the meeting, the group members assessed the impacts of COVID-19 on each game changer in the short (defined as partial recovery; stakeholders in the EU are still coping with the immediate effects of the pandemic; assuming in 1.5-2 years) and long (defined as a scenario in which public health is restored and economies have mostly stabilised; assuming in 3-5 years) term. During the meeting, the group selected three game changers they deemed most affected by COVID-19 (#5 shared mobility, #7 changing mindsets and behavioural patterns, and #8 integrated space management) and had an in-depth discussion on the impacts and potential recommendations.
>
> The results of the consultation are reflected in an addendum to the policy recommendations document. The original text maintains its relevance and is supported by addenda (always in blue text boxes such as this) that acknowledge the perspective gained through COVID-19 developments.

2. Background information on CIVITAS SATELLITE Advisory Group on Game Changers

CIVITAS SATELLITE is a Horizon 2020 project that coordinates and supports activities in the EU's ongoing CIVITAS programme.

The CIVITAS SATELLITE project coordinates **four Advisory Groups**:

- Game changers (led by Rupprecht Consult)
- Urban vehicle access regulations (UVAR) (led by Polis)
- Future of urban mobility policy (led by UITP)
- Road safety (led by TML)

The **objectives** of each Advisory Group are to (1) develop strategic and scientific guidance and to (2) broaden the scope of CIVITAS.

The game changers Advisory Group **met three times**, with the following objectives:

- Meeting #1 on 30 October 2018 brought together a group of experts with an academic leaning to identify key game changers on which this policy paper will focus and assess the impacts of those game changers across five impact categories.
- Meeting #2 on 18 February 2019 brought together expert practitioners to focus on key actions for generating the greatest positive benefits of game changers and integrating game changers into the mobility planning process.
- Meeting #3 on 28 May 2019 was comprised of a mix of experts from research and applied fields and focused on how policies on game changers could respond to a variety of potential scenarios in which those game changers are introduced.

This policy paper is the result of discussions during the meetings and follow-up post-meeting exchanges, including the presentation and the discussion of the outcomes of this Advisory Group with political representatives from European cities at the Politicians' Forum at the CIVITAS Forum conference in Graz, Austria, on 3 October 2019.

3. Definition of urban mobility game changers

The Advisory Group **defines (urban mobility related) game changers as "recent or upcoming developments that change the existing mobility system (i.e. the way mobility is organised, provided, and used) in a significant and often disruptive** way."

A characteristic feature of game changers is that conventional quality and assessment criteria become replaced by new ones. Technological advances may be the first thing that

come to mind when considering game changers, and these were indeed among the group's focus areas, however the group also pursued non-technological innovations (e.g. social, organisational, political, institutional, behavioural, value-related) as topics for its work and discussions.

Consensus on what constitutes a game changer depends on many contextual factors. Past examples of game changers can be the basis for exploring current and upcoming elements, which influence the urban mobility landscape and agenda. Conventional analyses of game changers in the field of urban transport often focus narrowly on one (or multiple) industries affected. What is often lacking is a thorough investigation about the specific urban aspects of certain game changers. In other words, clear answers to the question: What does game changer X mean for European cities and regions, how can it affect mobility? How can it be factored into the SUMP, its process and measures? How should SUMP principles be applied to our strategies towards game changers?

While the Advisory Group chose a limited number of game changers in order to provide practical and actionable policy recommendations, the list of potential game changers that adhere to this definition is still potentially very long. For the sake of developing useful policy recommendations, the following concrete, succinct list of **eight urban mobility game changers** was prioritised to serve as the basis for this policy paper's recommendations:

1) **Electrification**

   This includes the electrification of all modes (private, freight and public transport vehicles, scooters, etc.), including the innovative use of electric infrastructure, and taking into account energy sources.

2) **Increased automation and use of C-ITS**

   This game changer addresses the increased use of automated vehicles (and related infrastructure) and use of Cooperative Intelligent Transport Systems (C-ITS), enabling digital communication between vehicles and between vehicles and related infrastructure, taking into account the application of these technologies in new mobility offers and their impacts on urban form and function.

3) **Growth of data economy**

   This covers data as the driver of new businesses/ policies, but also more fundamental aspects like algorithms increasingly expressing rules/ regulations ("algorithmification", i.e. the rise of decisions or rules that are implicitly included in software code).

4) **New business concepts for freight & passenger transport**

   New business concepts for freight and passenger transport means, first and foremost, integration platforms providing new products from existing and new mobility offers ("platformisation"), e.g. MaaS, platforms for freight exchange or

Uber. The focus is predominantly on services bringing together customers and providers in new ways.

5) **Shared mobility**

Shared mobility refers to shared use of transport modes, esp. car sharing (with a focus on free-floating schemes, e.g. ShareNow), bike sharing, ride hailing services such as Uber and Lift, ride-sharing (i.e. shared space within a vehicle), etc. The focus is predominantly on non-technical aspects of shared mobility.

6) **Growth of active mobility**

This game changer covers the increased share of walking and cycling, but also other micro-mobility solutions like (e-)scooters such as Bird and Lime.

7) **Changing mindsets & behavioural patterns**

In addition to new mobility-related values and priorities (e.g. regarding car ownership or sharing) that are for example expressed in new mobility patterns of young people, this game changer covers more basic changes like growing expectations of users for immediate service ("instantaneafication" as expressed e.g. in demand for same day Amazon delivery) or the growing expectation of very easy to use services (simplification).

8) **Integrated space management**

This means new and integrated approaches of using and managing urban space, e.g. as expressed in policies such as placemaking, access regulation (UVAR) or kerbside management, and in space-related changes due to the implementation of new technologies such as urban air taxis or drone delivery.

4.   Impacts of game changers

The Advisory Group identified **potential impacts** of all game changers. Impacts of each game changer for five distinct **impact categories (societal, environmental, economic, institutional and transport-specific)** are described below. As it was often difficult to clearly attribute an impact of a game changer to just one impact category, the most relevant was chosen. Alongside the potential impacts, potential actions to avoid negative and advance positive impacts are listed per category. These brainstorming results make up the foundation of the later-described policy recommendations.

4.1. Electrification

Impact category	Potential impacts	Possible actions
Societal	• Decentralised energy production, e.g. e-car owners and vehicles can become energy providers by feeding back energy from their batteries into the grid	• Encourage decentralised electricity production • Develop an electricity plan for the city of the 21st century • Ensure market certainty of local production and for decentralised production (price, infrastructure, etc.)
Environmental	• Reduction of pollution and noise in cities (depending on energy generation source pollution might be shifted to outside cities) • Battery-related problems related to production and disposal • Losses in transmission/ efficiency • Time-specific CO_2 intensity of electricity generation	• Strong well-to-wheel accounting • Emission factors to be provided as official information (already in place and public) • Support the development of solid-state batteries for use in EVs • Reduce impacts of negative environmental impacts of batteries and battery manufacturing, e.g. leasing, re-use
Economic	• Change in operating costs • Lower monetised environmental impacts (in operation) • Infrastructure costs, esp. expensive grid infrastructure	• Create, prioritise and invest in (technological options for) performance-based infrastructure (e.g. swapping stations for batteries) • Set standards for interoperability between vehicles, batteries, grids, payments, etc.) • Explore impacts of leasing models on life cycle impacts of batteries and infrastructure

Institutional	• Decrease of local air pollution
	• Smart grids, flexible energy supply
		• Taxation (decreasing tax revenues from fuel taxes might have to be replaced e.g. by higher taxes on electricity for e-mobility)
		• Avoid costs of isolated policies
		• Strengthen institutional capacity to regulate under uncertainty
		• Experiment with pathways to scale and with certainty on mechanism, i.e. try to find strategies to appropriately address certainties and to limit uncertainty (we don't know what the future will bring, but we know what the future should look like), e.g.
		  - What principles should guide cost allocation between public and private?
		  - Think together passenger and freight electrification

Transport-specific	• New questions to access, regulation and parking (e.g. regulators might no longer be able to argue with the need to reduce pollution) • Relation between charging, range and mobility • Congestion not addressed • Space consumption	• Promote shared use (incl. PT) and aggregation (freight) • Promote new vehicle concepts (e.g. 2-wheelers) • Leveraging current assets (e.g. substations for metros) have for wider use • Common and reliable structure • Charge for space use by time and location (e.g. curbs) (now: volumes, trend: weight)

4.2. Increased automation and use of C-ITS

Impact category	Potential impacts	Possible actions
Societal	- Improved safety - Productivity gains (carrying out non-driving tasks) (value of time) - Increase of car dependency - Decrease of costs for consumers - Power distribution linked to ownership vs. vehicle use	- Introduce first in areas where safety gains outweigh concerns (some people fear automation) - Education - Review of vehicle ownership policies, taxation, etc.
Environmental	- Optimisation of energy consumption and urban space, if AVs are shared - Impacts on vehicle turnover/ scrapping/ design - Vehicle kilometres travelled (rebound effect due to the availability of new capacities) - Sprawl/ density - Throughput and traffic flow smoothing? - GHG/ pollution from ICT use for data transmission/ processing	- Make shared-use a condition for automation - GHG accounting of ICT infrastructure
Economic	- Elimination of driver costs, leading to employment and market transformation - Need for very expensive technology and very expensive highly skilled experts - Lower economic loss due to improved safety - Massive business potential for industry - Removal of service restriction hours (high benefit for truck companies)	- Coordinating actors across sectors - Performance-centric deliveries - System-based analysis
Institutional	- Safety & security: new systems have to be safe (and for this have to change). How do we know that they are? How do we then say "yes, you are safe enough to operate"? - ITS: critical but vulnerable public infrastructure	- Ensure safe systems - Prioritise measures (pricing, licensing, space allocation, taxation) based on hierarchy (e.g. a pyramid including use of space, efficiency, equity) - Extend slots managements from factories to city curb space
Transport-specific	- Better fleet management - Optimisation of road space usage (will influence vehicle kilometres travelled) - Better throughput - Even flow (e.g. at junctions) - Better regulation of access/ speed	- Assess how public authorities will ensure equity for automated fleets - Integration/ link with public transport and freight deliveries; maximising load factors (e.g. hourly charge for access to city) - Better throughput in cities with lower speeds - System to monitor impacts (space, GHG, congestion, safety, real estate)

4.3. Growth of data economy

Impact category	Potential impacts	Possible actions
Societal	- Privacy and ownership (endangered by emerging data markets and ecosystem) - Platform monopoly, compromising efficiency or privacy - Change in power relations & distribution in society, e.g. due to shift of organisation of work - HaaS ("Humans as a Service")	- Facilitate work flexibility, e.g. location, time, contracts, social protection - GDPR for companies in public sphere - Mechanisms to deliver GDPR principles in practice (e.g. protocols) and link to the "City Appstore" for cities (revenues for cities by public authorities becoming an app store)
Environmental	- Energy use (AV itself & AV devices) - Energy management - Induced demand of motorised/ private transport - Efficiency/ better use of assets	- Assess energy impact of ICT solutions - Disincentivise increased travel due to case/ data access
Economic	- Platform provider earns money from service and data on platform - New income for drivers turned taxi drivers - Private people can become parking providers (e.g. by renting space they own)	- Build capacities and competences for ICT industry and data analysis - Enable interconnection between freight documents issued for consecutive freight segments - Data exchange protocols
Institutional	- New challenges to maintain a competitive environment and open market access, preventing monopolies - Critical data infrastructure	- Outcome-based reporting where public assets are used (streets, sky), e.g. mobility data specification or Global Logistics Emissions Council (GLEC) declaration - Hire data managers - Ensure that private companies are open with their data, just like public authorities ("give and take" policy) - Open data and role of public authorities as data broker based on 3 building blocks - Digital identifier - Common syntax/ language - Geophysical space reporting (without revealing privacy/ common sensitive company information)
Transport-specific	- Induced demand - Redistribution of traffic (time/ place)	- Incentives to users to travel outside peaks/ hot spots - Mandate extended/ flexible delivery option to customers - Mandate windows for freight/ reservable slots - Hire data managers

4.4. New business concepts for freight and passenger transport

Impact category	Potential impacts	Possible actions
Societal	• Change in trust relationships, e.g. trust in authorities to enforce rules and trust in commercial entities to follow rules • Real-sized consumption • Breakdown of consumption into niches • Dis-intermediation (i.e. different social agents providing services separately)	• Build on automatic trust mechanisms (e.g. block chain) • Ensure same rules for level playing field ("risk-weighted regulation")
Environmental	• Energy use/ management • Induced demand • Efficiency/ better use of assets	• Mandatory reporting of environmental impacts • Leverage market size for penetrating environment-friendly energy-efficient technologies (e.g. by using platforms for freight exchange)
Economic	• New/ additional revenue streams • If old economy fails to keep pace with "digital native" companies, public sector might lose control • International tax avoidance • OEMs become mobility providers	Mandate transparency for the mechanisms for making and sharing revenue (explain rules)
Institutional	• Social/ employment impacts ("gig economy") • Impacts on conventional public transport • Challenge/ need to find holes in existing frameworks which may get undermined • Service only provided when there is demand	• It needs to be tackled that public and private sector are both subsidised by public money and venture capital. While the rules for public subsidies are clear, venture capital rules are not transparent • Ensure competitive markets (players have to have capacity to ensure competition) and fair competition • Make longevity a condition for licences for new services (e.g. up to now ride-sharing providers are not as regulated as traditional PT) • Be as digital as possible
Transport-specific	• Induced demand • Redistribution of traffic through time and space (which could e.g. generate through-traffic in formerly quite roads)	• Differentiate prices of roads according to street characteristics

4.5.   Shared mobility

Impact category	Potential impacts	Possible actions
Societal	• Increased access to opportunities • Equal access to mobility services • Land use decisions and value • Cities risk ending up in the wrong topic; a city is not a (mobility) service provider	• Cities should incentivise the price scheme to promote sustainable use of shared mobility • Increase space efficiency (dynamic urban spaces) • Local authorities may subsidise shared mobility (e.g. ride-hailing) to offer services in remote areas not well served by PT • Develop measures to increase the acceptability of sharing
Environmental	Fewer cars → less energy consumption, less pollution, less space use (if no shift from active to motorised modes)	• Restrictions on quality of the fleet to reduce pollution • Restrict access to certain areas to continue avoiding congestion • Improve infrastructure for active modes and not at the expense of pedestrians and cyclists (e.g. parking) • Define different approaches for motorised and active shared modes
Economic	• More affordable mobility • (Dis-)appearing market players • Negative impact on car industry, fuel companies (if no shift from active to motorised modes)	Dynamic licencing schemes to organise and monitor the various service providers in the city to ensure they are running in a positive way and are contributing to the city's mobility strategy, i.e. license fees should depend on how the provider reflects the goals of the city
Institutional	• Influence on governance of mobility system by new players • New business models between public and private transport service providers • Need to govern reselling of public services	• Integrated PT and shared mobility to address the needs • Regulate access, e.g. disincentivise, limit and/ or restrict car sharing in areas served well by PT and in the city centre to avoid competition with PT • Prioritise active shared (micro) mobility versus motorised shared mobility • Ensure that space for shared mobility is not taken from infrastructure for active modes, e.g. ensure that dockless bikes are rather parked on the road and not on walkways • Regulatory framework to impose restrictions on standards to run and operate • Data sharing and digitalisation of public space for licensing the operators
Transport-specific	• More mobility with the same infrastructure/ assets • Danger of shift from active to motorised modes	• Ensure high-quality, accessible, affordable PT to be competitive • Integrated PT and shared mobility as competitor to private car • Avoid fragmentation by regulating transport operators • Regulate evaluation of the impacts on PT, pollution, social, economy, usage patterns etc. and revisit the plans

4.6.   Growth of active mobility

Impact category	Potential impacts	Possible actions
Societal	• Increased health • Increased interaction • Increased security/ safety • Higher density and more land use mix • Social inclusion and equity	• Create community identity (e.g. social biking) • Incentivisation, e.g. bonusses for companies • Testing and piloting controversial solutions with citizens • Regulate e-scooters which might have a negative impact on increased safety
Environmental	• Less energy consumption • Less pollution (better air quality) • Less noise • Less space for motorised vehicles • Good for health	• Internalisation of external costs • Access regulations for motorised modes • Measures to force modal shift, e.g. taxes and parking restrictions • Collect real-time air and noise quality (e.g. through sensors) to inform and promote cycling and walking • Redesign and reallocate space to match the needs (dynamic and shared space), ensure that there is more space for active mobility
Economic	• More disposable income for users as ways to travel are cheaper • Creation of new markets • Infrastructure costs • Decrease of revenues due to fewer PT users	• Reduce taxes for active modes • Raise taxes for motorised modes • Incorporate health as one of the main aspects of investments in transport projects and services at all three levels (EU, national/ regional, local) • Make businesses aware that active modes are the cheapest way to move (revenues) • Use WHO's HEAT tool for evidence-based decision making (EC to promote use of tool by cities)
Institutional	• Need for institutions to adequately value walking and cycling • Need to create safe and secure active mobility environments • Involvement of cyclists and pedestrians • "cheapest way to move"	• Cross-sectoral integration, e.g. transport and health • Better data collection and digitalisation, sharing platform and relevant standard KPIs • Bold political vision for high quality of life, covering aspects such as safe, clean and secure transport • Develop pyramid of all modes of transport and prioritise cycling and walking; this should guide decisions at all governance levels • Provide better cycling and pedestrian facilities • Follow the SUMP approach, incl. a feedback loop from users (but avoid referendums)
Transport-specific	• Active people are more likely to accept to change between multiple modes • Need to integrate/ separate slow/ small sized "movers" in the transport system • Less congestion	• Pursuing the "Vision Zero" goal • Implementation of pedestrian zones and superblocks • Dedicated infrastructure to improve safety and security • Measures to improve image of cycling and walking

4.7.   Changing mindsets & behavioural patterns

Impact category	Potential impacts	Possible actions
Societal	• Coherency of lifestyle choices (e.g. locally green but globally polluting) • Corporate Social Responsibility • Machine-thinking, e.g. by relying on apps; erosion of human agency	• Promoting sustainable behaviour and eco-friendly modes • Promote the concept and acceptance of sharing • Experiment with different educational approaches for promoting sustainable behaviour • Incentivise employers for green mobility behaviour
Environmental	• Fragmentation of freight transport (e.g. through 3-D printing) • Reduced resource use • Induced/ new demand	
Economic	Relationship with customers becomes less based on (brand) loyalty – problematic for old players were there is no monopoly	
Institutional	• Social/ employment impacts ("gig economy") • Impacts on conventional public transport • Discourse/ ideology/ emotion/ non-evidence-based policy making may lead to inappropriate or inadequate regulatory response from public sector actors	• Make right policies (e.g. mobility marketing) for incentivising the right mobility choices when lifestyle changes take place, e.g. when people move, have their first child, get a new job, etc. • Find ways to capitalise on younger groups • Find ways to lock in early behavioural patterns, e.g. by providing incentives (as e.g. in Norway for e-mobility)
Transport-specific	• 3-D printed objects could reduce need to transport • Densification of freight flows of printable materials	

4.8. Integrated space management

Impact category	Potential impacts	Possible actions
Societal	• Shift in access opportunities • Change in socialization • Winners & losers within current behaviour pattern (in terms of rights)	• Education and experiencing the changes for fostering mindset change
Environmental	• Less pollution • Less noise • More re-naturification/ green space as space is freed up • Energy impacts of 3D space use (e.g. drones)	• Reallocating streets to green areas and for recreational activities
Economic	• New/ additional revenue streams	• (Dynamic) pricing of space • New models of parking revenues for city development • Road and parking pricing • Parking levy • EU to fund research on relation between parking and retail, i.e. what are the reasons for the increasing number of empty shops (e-commerce, high prices?) and how to address this problem
Institutional	• Land use impacts • Congestion impacts • New sources and revenues	• Regulating data collection and digitising the data • Better planning tools • Densification and new design standards for traffic engineering • Willingness to try out and experiment new ways of space management, e.g. pilot changes as a test • Flexible regulation for piloting and testing solutions Licensing new mobility modes (e.g. e-scooters) with considering space regulation • Smarter regulation of shared space
Transport-specific	• Change of modal split to more active modes • More space/ capacity for different functions (winners/ losers) • Mismatch in capacity between air and land transport	• Dynamic and demand-responsive urban space (should serve multiple purposes, prioritising active modes) • Prioritising modal shift by allocating more space to active modes • Reduce parking spaces in favour of sustainable mobility and public space • Implementation of transport hubs, seamless transport and interchanges • Implementation of E-hubs for electromobility & charging

5. Scenarios

The impacts of game changers are strongly intertwined with the contexts in which they exist, i.e. the impact depends on the "game" that is being "changed." There often exists an assumed, but uncertain future. In order to "future proof" these policy recommendations against inherently uncertain contexts the Advisory Group chose to consider within predefined scenarios. The Advisory Group Advisory Group explored **four hypothetical mobility scenarios** in which potential actions and policy solutions were considered for each game changer, i.e. what can be done by policy actors to maximise the positive impacts and to minimise the negative aspects of game changers under each scenario.

The scenarios taken as the basis for discussion were devised by the Mobility4EU project (with the support of stakeholders); in-depth information can be found in the project's document D3.1 – Report on MAMCA scenario descriptions.
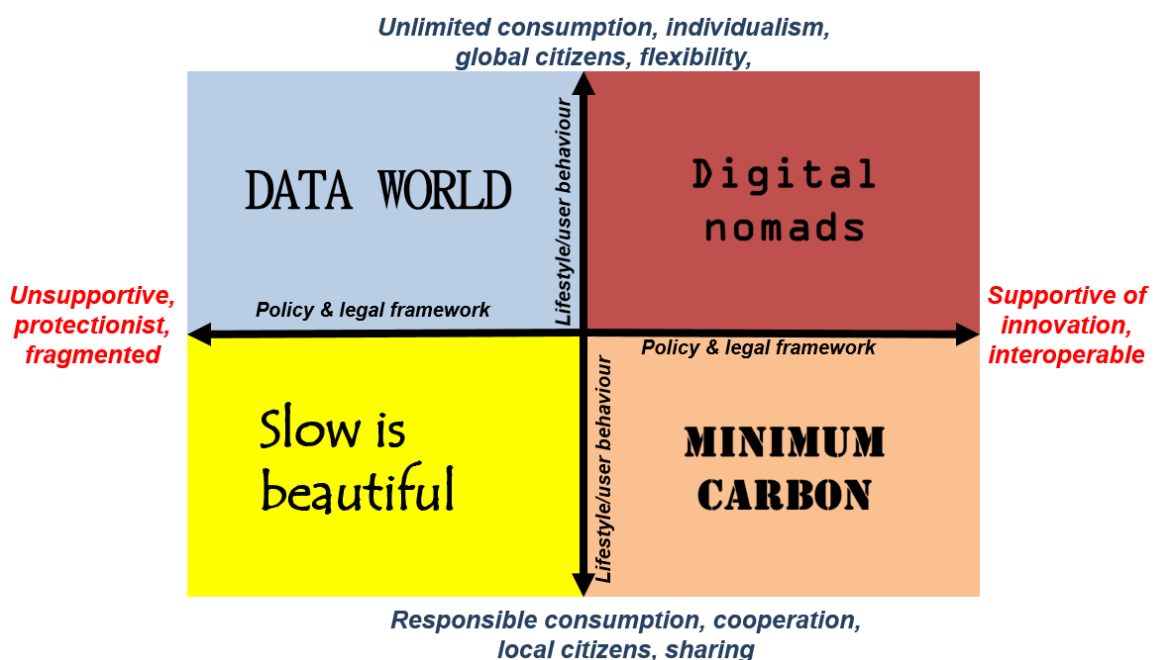
Figure 1. Four mobility scenarios, from the Mobility4EU project

Data world

Legal and policy framework:
Harmonisation of regulations and technology standards at the European level is limited. The activities of companies in the transport and mobility sector are less strictly regulated. Government support for innovation is limited, innovation mainly comes from private companies.
User behaviour and lifestyle

> *There is a fast-paced transformation of lifestyles. People are becoming increasingly flexible with an accelerated pace of life. Individualisation leads to smaller household size and flexible employment. Adoption of innovative technology is fast.*

- The general role of policy actors under this scenario is to defend citizens' interest, i.e. taking the role to safeguarding in a broker world.
- Potential actions for EU and national level policy actors involve regulation to ensure transparent processes for checks and balances and ensure transparent processes for checks and balances and to ensure standards and their enforcement, providing incentives and imposing penalties.

Digital nomads

Legal and policy framework:

Harmonisation of regulations and technology standards at the European level is limited. The activities of companies in the transport and mobility sector are less strictly regulated. Government support for innovation is limited, innovation mainly comes from private companies.

User behaviour and lifestyle

There is a fast-paced transformation of lifestyles. People are becoming increasingly flexible with an accelerated pace of life. Individualisation leads to smaller household size and flexible employment. Adoption of innovative technology is fast.

- Under this scenario for the game changers electrification, increase use of automation and C-ITS, growth of data economy and new business concepts & passenger transport potential actions for EU and national level policy actors are
  - to ensure transparent processes for checks and balances and to be aware that revisions will be necessary and that hence flexibility is needed (facilitation); and
  - to ensure standards and their enforcement, provide incentives and impose penalties (regulation); and
  - to provide high funding support for investments at the local level (funding).
- Again, for all those four game changers, national policy actors may develop a national vision to inform the EU.
- In order ensure that the above-mentioned actions work, research is needed.
- Again, for all those four game changers, local policy actors – in terms of facilitation – may ensure a good balance of interests, develop a citizen-oriented vision, mange urban space allocation and pricing.
- For this scenario, no statements were made on the game changers shared mobility, growth of active mobility, changing mindsets & behavioural patterns and integrated space management.

Slow is beautiful

Legal and policy framework:
Harmonisation of regulations and technology standards at the European level is limited. The activities of companies in the transport and mobility sector are less strictly regulated. Government support for innovation is limited, innovation mainly comes from private companies.

User behaviour and lifestyle
There is a fast-paced transformation of lifestyles. People are becoming increasingly flexible with an accelerated pace of life. Individualisation leads to smaller household size and flexible employment. Adoption of innovative technology is fast.

- Under this scenario for the game changers electrification, increase use of automation and C-ITS, growth of data economy and new business concepts & passenger transport potential actions for EU level policy actors are
  - o to provide guidelines, best practices and knowledge exchange (facilitation); and
  - o to encourage healthy democratic process (facilitation)
- Under this scenario for the game changers electrification, increase use of automation and C-ITS, growth of data economy and new business concepts & passenger transport national level policy actors have less power and fewer resources for funding.
- Again, for all those four game changers, at the local level
  - o in terms of facilitation there could be more policy based on local visioning, e.g. referendums; and
  - o in terms of research, there a culture for citizens engagement may be developed; and
  - o in general policy actors will have a broker role, promoting a positive vision, that in an ideal case should lead to citizen-oriented measures.
- For this scenario, no statements were made on the game changers shared mobility, growth of active mobility, changing mindsets & behavioural patterns and integrated space management.

Minimum carbon

Legal and policy framework:
Harmonisation of regulations and technology standards at the European level is limited. The activities of companies in the transport and mobility sector are less strictly regulated. Government support for innovation is limited, innovation mainly comes from private companies.

User behaviour and lifestyle
There is a fast-paced transformation of lifestyles. People are becoming increasingly flexible with an accelerated pace of life. Individualisation leads to smaller household size and flexible employment. Adoption of innovative technology is fast.

- Policy recommendations are geared toward providing guidelines and means for information and knowledge exchange, and for policy actors to benefit from citizen engagement by playing a broker role and enabling the co-creation of citizen-oriented measures.

- Local level policy actors have the possibility to push policies at a higher level.

- Incentivisation schemes are recommended.

- EU and national policy actors have the possibility to calibrate regulations by city size, characteristics or content.

- Research, regulation, and funding remain crucial pillars of recommended policies, and in these scenarios such policies may be more easily devised.

6. Recommendations for city authorities, national government actors and the European Commission

Based on the discussions within the Advisory Group, **policy recommendations** have been formulated (for each game changer) **at three levels**:

1) for city authorities (considering all urban practitioners)
2) for national government actors
3) for the European Commission

These recommendations are the result of the specific processes of the Advisory Group and are intended to stimulate further debate rather than serve as a final comprehensive set of recommendations.

The Advisory Group aimed at developing concise and concrete recommendations to ensure that the impacts of urban mobility game changers are positive and sustainable. The recommendations below are organised by game changer, though some recommendations appear under several game changers (e.g. a policy recommendation for e-vehicles under "electrification" is also made for shared e-vehicles under "shared mobility").

Transcending topic and policy level is an overarching capacity building recommendation to strengthen institutional capacity to regulate under uncertainty through capacity building and training for government actors on the potential impacts of game changers and how to strengthen the positive impacts and how to reduce the negative impacts of game changers.

6.1. Electrification

Recommendations for city authorities

- ***Provide infrastructure to support electrification:*** Create, prioritise and invest in (technological options for) performance-based infrastructure (e.g. swapping stations for batteries). Make use of existing infrastructure as much as possible in order to allow greater prevalence of e-vehicles. Leverage current assets (e.g. substations for metros) for wider use.

- *Ensure user-friendliness:* A common and reliable design and layout of charging stations for ease of administration/ maintenance as well as user-friendliness.
- *Promote new vehicle concepts:* (e.g. 2-wheelers) to reduce potential congestion impacts of electric vehicles, and provide dedicated travel lanes and parking for them. E-scooters and e-bikes will be perceived more favourably if they are not blocking pedestrian spaces, for example. Car parking spaces could potentially be converted to parking for such mode, which would provide more people using e-vehicles with spaces to park.
- *Implement performance/use-based taxes and fees:* Devise local taxation or charging schemes that promotes electrification and is immune to changing trends.Charge for space-use/ parking by time and location (e.g. curb-side) to mitigate potential congestion impacts of electric vehicles.

Recommendations for national government actors

- *Enable sustainable electrification:* Encourage decentralised electricity production so that e-car owners and vehicles can become energy providers by feeding back energy from their batteries into the grid. Set standards for interoperability between vehicles, batteries, grids, and payments. Reduce negative environmental impacts of batteries and battery manufacturing, e.g. supporting leasing or re-use schemes. This will help mitigate time-specific CO_2 intensity caused by electricity generation at peak times. Emission factors should be provided as certified information e.g. through a labelling scheme.
- *Provide and promote infrastructure to support electrification:* Create, prioritise and invest in (technological options for) performance-based infrastructure (e.g. swapping stations for batteries). Promote ion-pack charging to ensure that electrification runs smoothly and without battery problems.
- *Implement performance/use-based taxes and fees:* Devise a taxation scheme that promotes electrification and is immune to changing trends. That is, as less conventional fuel is consumed, decreasing tax revenues from fuel taxes might have to be replaced e.g. by higher taxes on electricity for e-mobility.

Recommendations for the European Commission

- *Support sustainable electrification:* Provide funding to support the development of solid-state batteries for use in EVs through research grants. Set standards for interoperability between vehicles, batteries, grids, and payments.
- *Ensure strong well-to-wheel accounting:* Emission factors should be provided as certified information e.g. through a labelling scheme.
- *Performance/use-based taxes and fees:* Encourage Member States to devise a taxation scheme that promotes electrification and is immune to changing trends. That is, as less conventional fuel is consumed, decreasing tax revenues from fuel taxes might have to be replaced e.g. by higher taxes on electricity for e-mobility.

<table>
<tr><th colspan="2">Addendum: Impacts of COVID-19 on electrification</th></tr>
<tr><th>Short-term</th><th>Long-term</th></tr>
<tr><td>

Positive if governments **provide subsidies for EV purchase** to boost economy
Economic downturn will **decrease uptake of large EVs**, small EVs (bikes) will rise significantly
Greater public **investment in research and infrastructure**
Manufacturers probably **less able and willing to invest in new technologies**

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<td>

No direct impact
Large EVs back on track but small EVs (electric bikes, etc.) will cut into projected market share of large EVs and large ICEs
Prime climate strategy of govts and companies will be electrification

</td></tr>
</table>

This game changer was not a topic of focus in the meeting on 9 June 2020.

6.2. Increased automation and use of C-ITS

Recommendations for city authorities

- *Coordinate actors across sectors*: In introducing automation and C-ITS, coordinate with local public transport and infrastructure for active mobility. This will help ensure that new vehicles do not compete with or otherwise interfere with public transport or active mobility. It will also be useful for dealing with such potential impacts in other areas than transport as the elimination of driver costs (and therefore, driver jobs), leading to employment and market transformation.
- *Integrate with public transport:* Link the operation of automated vehicles with public transport and freight deliveries; maximising load factors which could be achieved for example by introducing an hourly charge for freight vehicles for access to the city).
- *Establish safety, equity, and efficiency regulations:* Enforce lower speeds to achieve a better overall throughput in cities. Ensure equity for automated fleets.

Recommendations for national government actors

- *Update/introduce supportive policies:* Conduct a review of policies that facilitate policy-compliant automation/ C-ITS use at all governance levels to support harmonisation and develop good practices.
- *Ensure integration consistent with EU/Global climate goals:* Conduct GHG accounting of ICT infrastructure and impose environmental standards that must be met in order for the infrastructure to be built within the country.
- *Increase social acceptability:* Address people's fear of automation, through information campaigns and by focusing initially on low-stress situations (e.g. a person's first experience in an automated vehicle may be in an automated tram line for a short journey as opposed to a long journey alone in a self-driving car, the latter of which may be a greater source of anxiety due to a longer distance travelled and the experience of doing it alone).
- *Support integration with public transport:* Coordinate and support local government coordination of actors across sectors, including local public transport and infrastructure for active mobility. This will help ensure that new vehicles do not compete with or otherwise interfere with public transport or active mobility.

- *Establish safety, equity, and efficiency regulations:* Introduce and enforce safety standards to ensure safe systems. Introduce automation and C-ITS first in areas/ domains where safety gains outweigh concerns. Assess how city authorities will ensure equity for automated fleets.

Recommendations for the European Commission

- *Update/introduce supportive policies:* Conduct a review of policies that facilitate policy-compliant automation/ C-ITS use at all governance levels to support harmonisation and develop good practices across the different Member States.

- *Ensure integration consistent with EU/Global climate goals:* Make it obligatory for Member States to conduct GHG accounting of their ICT infrastructure and impose environmental standards on ICT infrastructure that must be met by Member States.

- *Support integration with public transport:* Incentivise that Member States coordinate actors across sectors, including local public transport and infrastructure for active mobility. This will help ensure that new vehicles do not compete with or otherwise interfere with public transport or active mobility.

- *Support comprehensive monitoring and evaluation:* Devise a system to monitor impacts (space, GHG, congestion, safety, real estate).

Addendum: Impacts of COVID-19 on automation and use of C-ITS

Short-term	Long-term
• Economic challenges may **reduce roll out of automated vehicles**. Some companies will exit field.	• Push for **better traffic management** during a crisis facilitated by C-ITS & digitalization
• Teleworking **reduces traffic and congestion** – may reduce willingness to use C-ITS services.	• No impact
• Need for social distancing may **increase pressure for automation** but investment may be lower than it has been	• Automation will concern **more delivery vehicles** of all sizes
	• C-ITS will integrate **spacing and tracking functionality**
• Short-term small automated devices will benefit from need for **contactless deliveries**	• **IT becomes the backbone** of providers of passenger and freight transport

This game changer was not a topic of focus in the meeting on 9 June 2020.

6.3. Growth of data economy

Recommendations for city authorities

- *Adapt to accommodate and stimulate changing norms:* Incentivise employers to facilitate work flexibility, e.g. location, time, contracts, social protection. This will help minimise negative environmental impacts of travel as well as ensure a better use of resources. Provide incentives such as fare reductions to users to travel outside peak times/ hot spots.

- *Ensure integration consistent with EU/Global climate goals:* Assess energy/ climate impact of ICT solutions and only implement said solutions if they pass

national/ EU standards. This will help ensure good energy management of emerging modes of mobility and contribute to climate goals.

- *Facilitate implementation of "open data" approaches:* Actively engage data exchange. Use a "give and take" policy that is included in tenders, cooperation agreements, and licensing to ensure that private companies are open with their data, just like public authorities. Engage in outcome-based reporting where public assets are used (e.g. streets, sky), e.g. mobility data specification or Global Logistics Emissions Council (GLEC) declaration.

Recommendations for national government actors

- *Ensure integration consistent with EU/Global climate goals:* Set standards for energy and climate impacts of ICT solutions. Assess energy and climate impacts of ICT solutions and only implement them if they pass these standards.
- *Facilitate implementation of "open data" approaches:* Establish data exchange protocols that will be used to ensure that private companies and public authorities are open with their data. Engage in outcome-based reporting where public assets are used (e.g. streets, sky), e.g. mobility data specification or Global Logistics Emissions Council (GLEC) declaration.

Recommendations for the European Commission

- *Support data protection:* Devise mechanisms to deliver GDPR principles in practice (e.g. protocols) and link to a "City Appstore" for cities (revenues for cities by public authorities becoming an app store)
- *Support setting standards:* Provide funding to Member States to assess energy and climate impacts of ICT (Information and Communication Technologies) solutions and encourage Member States to set standards for energy and climate impacts of ICT solutions. Alternatively, the EU could conduct a study on the energy and climate impacts of ICT solutions.
- *Support connections:* Enable interconnection between freight documents issued for consecutive freight segments, i.e. one document for entire route of transport.
- *Facilitate implementation of "open data" approaches:* Support open data and role of public authorities as data brokers based on 3 building blocks: digital identifiers, a common syntax/ language, and geophysical space reporting (without revealing privacy/ common sensitive company information).

Addendum: Impacts of COVID-19 on growth of data economy	
Short-term	**Long-term**
• Increase - **new data based services** have been set up to follow the coronavirus situation and to enable business • No impact beyond **diversification of type of data collected** (to account for reduced capacity and distancing requirements) • **Scrambling for data**, companies and govts will look for already available data sources and existing suppliers of date/IT solutions	• Keeps growing, **trend continuing** • **New business models** and new ways of working • Platforms set up during the crisis **continue** • **Digitization will accelerate** as companies want transparency of their supply chains

This game changer was not a topic of focus in the meeting on 9 June 2020.

6.4.   New business concepts for freight and passenger transport

Recommendations for city authorities

- *Differentiate prices of roads* according to street characteristics.
- *Be as digital as possible* to limit unnecessary trips.

Recommendations for national government actors

- *Ensure same rules for a level playing field:* While the rules for public subsidies are clear, venture capital rules are not transparent. What needs to be regulated is the ability to compete locally based on non-transparent funding for investor-funded businesses, while public entities need to meet strict rules.
- *Differentiate prices of roads* according to street characteristics.
- *Regulate new forms of passenger transport:* Think in the long-term when determining the conditions for licences for new services (e.g. up to now ride-sharing providers are not as regulated as traditional PT).
- *Be as digital as possible* to limit unnecessary trips.

Recommendations for the European Commission

- *Require mandatory reporting* of environmental and climate impacts from freight and passenger transport in Member States. This includes, for example, emissions, noise pollution, and infrastructural impacts.
- *Leverage market size* for penetrating environment-and-climate-friendly energy-efficient technologies (e.g. by using digital platforms for freight exchange).
- *Encourage Member States to mandate* transparency for the mechanisms for making and sharing revenue (explain rules).
- *Be as digital as possible* to limit unnecessary trips.

Addendum: Impacts of COVID-19 on new business concepts for freight and passenger transport

Short-term	Long-term
• Increase in **online shopping** may lead to increase in new business concepts for freight. • **Decrease in mobility** of people -> less demand for new business models for passenger transport. • Business models with poor unit economics will **fail or merge**. • Businesses will **pivot away from passenger** to delivery models • Pressure for conventional **PT to reinvent itself.**	• Increase in **online shopping** will be maintained • Need for new business models related to **transport of goods.** • Recession will **pare down** the number of viable business concepts. New ones will take hold. • **Integration** of passenger and freight in a) planning b) infra c) assets/equipment • **Steep decline for PT especially** in smaller cities unless governments prepared to subsidise very heavily.

This game changer was not a topic of focus in the meeting on 9 June 2020.

6.5.   Shared mobility

Recommendations for city authorities

- *Regulate shared mobility:* Create a regulatory framework for licensing, incl. clear criteria (e.g. data sharing), space management, vehicle standards, and serving deprived areas. Devise dynamic licencing schemes to organise and monitor the various service providers in the city to ensure they are running in a positive way and are contributing to the city's mobility strategy, i.e. license fees should depend on how the provider reflects the goals of the city.

- *Regulate access:* E.g. disincentivise, limit and/ or restrict car sharing in areas served well by PT and in the city centre to avoid competition with PT. This will also help avoid congestion and ensure that journeys made in car share vehicles are more likely to replace journeys made by private cars, rather than replacing PT, bicycle, or journeys made on foot.

- *Provide an attractive price scheme to promote sustainable use of shared mobility:* This could mean subsidising and linking payments with PT and promoting shared vehicles as a last-mile solution to reach PT stations or areas that are not well-served by PT. Another approach is to provide designated/ less-expensive parking for vehicles from shared mobility fleets.

- *Ensure high-quality, accessible, affordable PT*: Shared mobility, particularly car sharing, should not edge-out PT use. This can be as low-tech as ensuring that bus-stops have well-designed shelters, which is shown to reduce perceived waiting time. It can also mean a modern, accessible, frequently running, metro line.

- *Prioritise emission reduction:* Accept only car share fleets that meet emissions requirements to reduce pollution. Prioritise active shared micromobility versus motorised shared mobility. Create urban spaces in which (non-motorised) shared modes are visibly prioritised.

- *Provide and improve infrastructure:* Improve infrastructure for active modes to make shared options like bike-sharing more appealing, develop policies that ensure car-share journeys are not replacing walking or cycling trips. Ensure that space for shared mobility is not taken from infrastructure for active modes, e.g. ensure that dockless bikes are rather parked on the road and not on walkways. This can be done by ensuring designated parking and travel lanes.

- *Improve social acceptance:* Develop measures to increase the acceptability of sharing.

- *Enforce social standards:* Adapt employment/ labour standards, e.g. the length of time a ridesharing driver is allowed to drive at a stretch.

Recommendations for national government actors

- *Prioritise emission reduction:* Define discrete approaches for motorised and active shared modes in order to ensure that active shared (micro-)mobility is prioritised over motorised shared mobility.

- *Regulate evaluation of the impacts:* Develop SMART KPIs to evaluate and monitor impacts of shared mobility on PT, pollution, social, economy, usage patterns etc. and revisit the plans as needed based on the evaluation results. Monitor these variables closely. Consider introducing in test areas before a larger roll-out of a sharing service.

- *Regulate operators:* Regulate the licensing of operators; opening APIs; give regulatory balance/ power to cities (e.g. allow them to regulate e-scooter operators or ridesharing companies). Adapt employment/ labour standards, e.g. the length of time an ridesharing driver is allowed to drive at a stretch. Encourage and

incentivise local authorities to integrate PT and shared mobility. Require operators to provide certified data, which is reviewed regularly by the transport authority. Non-performing providers have their license cancelled.

Recommendations for the European Commission

- *Prioritise active mobility over motorised transport:* Help Member States define discrete approaches for motorised and active shared modes in order to ensure that active shared micromobility is prioritised over motorised shared mobility.

- *Regulate operators:* Encourage Member States to devise a regulatory framework to impose restrictions on standards to run and operate shared vehicles. Make data sharing and digitalisation of public space obligatory for licensing the operators.

- *Support research and evaluation projects:* Regulate evaluation of the impacts of shared mobility on PT, pollution, social, economy, and usage patterns. Provide funding for sharing commercial data from operators which can be used for research purposes; more research on actual impact on CO_2, air pollution, and car ownership.

- *Regulate safety:* Encourge Member States to regulate safety of shared vehicles that do not yet have clear standards. For the example of e-scooters: (1) vehicle perspective (technical standards), (2) vehicle recycling regulation, (3) enable data exchange (in order to evaluate environmental impact).

Addendum: Impacts of COVID-19 on shared mobility

Short-term	Long-term
• Drop in use of car-based shared mobility. **Many services will fail.** • Shared micromobility services will **recede.** • **Reduction in use** of shared mobility due to seen as risk of getting the virus, in addition to **reduction in mobility** of people in general (teleworking, unemployment, recommendations for not travelling) • Temporary but significant setback; reductions in service; **industry consolidation**	• Shared mobility use hopefully back on track when mobility of people is recovered and people do not **perceive use of shared vehicles as health risk**. • No significant impact • Shared micromobility sector will be less important than predicted, **more owned and leased MM.** Shared car-based MM will saturate markets at lower rates • Focus on **less mobility**

Actions of cities and regions

- Use forms of sharing to aid pandemic response, e.g. providing free rides to essential workers.

- Implement new public-private partnerships, smart subsidies, or waiving of fees for those shared mobility services that positively contribute to sustainable urban mobility, to help to take the pressure away from PT and avoid a massive return to the car.

- Establish hygiene standards for shared mobility.

- Launch educational campaigns to users of shared mobility on how to ensure that they use and leave the vehicles in a state that is safe for other users.

- Provide financial support for health management tasks (disinfection of vehicles, etc.) to sharing providers to maintain service for existing members and to provide a viable, appealing offer to possible new members.

- Allocate space for shared bikes, e-scooters etc. to avoid negative impression due to them imposing on pedestrian space.

- Establish sharing of vehicles for freight and passenger transport. This is something that is already happening but not yet formalised or considered in policy making.

  Further cut down on individual parking in public space and allow sharing/multi-modal points in public spaces.

- Take into account the effect of reduced public transport use on vehicle use (usually an increase) and make more sharing options available accordingly.

Actions of EU and member states

- Introduce guidelines to provide safe shared mobility with proper disinfection and cleaning procedures.

- Support research on shared mobility to better understand how it contributes to sustainable mobility goals.

- Integrate shared mobility with zero-emission mobility.

- Address the risk of monopolies developing if the industry consolidates as a result of the pandemic.

- Embed shared mobility into the Green Deal package.

- Provide guidance on favourable framework conditions, and the setting up of PPPs.

6.6. Growth of active mobility

Recommendations for city authorities

- ***Provide infrastructure:*** Regulate and provide appropriate infrastructure and driving guidelines for e-scooters which might have a negative impact on perceived safety. Provide well-designed cycling and pedestrian facilities. Consider building cycling superhighways. Provide dedicated infrastructure to improve safety and security.

- ***Use implementation approaches that may increase acceptance:*** This could mean involving people in the planning process, or testing and piloting controversial solutions with citizens before a full, permanent roll-out.

- ***Disincentivise car use:*** Introduce access regulations for motorised modes. Introduce measures to encourage modal shift away from personal cars, e.g. taxes and parking restrictions.

- *Monitor and report:* Collect real-time air and noise quality (e.g. through sensors) to inform and promote cycling and walking. Use WHO's HEAT tool for evidence-based decision making.
- *Create dynamic, shared spaces:* Redesign and reallocate space to active modes. Implement pedestrian zones and superblocks.
- *Take a comprehensive view of active mobility planning:* Incorporate health as one of the main aspects of investments in transport projects and services. Address active mobility in SUMP development, educate and incentivise users.
- *Set local goals that can be achieved through active modes:* Commit to the "Vision Zero" goal.
- *Provide funding to support active mobility:* Provide funding for infrastructure as well as research. Provide incentives for businesses to use and promote active modes.

Recommendations for national government actors

- *Disincentivise car use:* Introduce access regulations for motorised modes. Introduce measures to encourage modal shift away from personal cars, e.g. taxes and parking restrictions.
- *Monitor and evaluate:* Collect real-time air and noise quality (e.g. through sensors) to inform and promote cycling and walking.
- *Incentivise active modes:* Reduce taxes for active modes, e.g. lower sales tax on bicycles.
- *Adapt liability and insurance laws:* E.g. if one charges many e-scooters at home (trade-off between liability and safety); or vehicle checks for peer-to-peer shared cars.
- *Provide funding to cities* for the implementation of supercycle highways. Incorporate health as one of the main aspects of investments in transport projects and services.

Recommendations for the European Commission

- *Take a comprehensive view of active mobility planning:* Focus on cross-sectoral integration, e.g. transport and health. Incorporate health as one of the main aspects of investments in transport projects and services.
- *Support monitoring and evaluation:* Improve data collection and digitalisation. Provide a sharing platform and relevant standard KPIs. Encourage cities to use WHO's HEAT tool for evidence-based decision making.
- *Prioritise active modes:* Develop a pyramid of all modes of transport and prioritise cycling and walking; this should guide decisions at all governance levels. Communicate and demonstrate a bold political vision for to reach climate targets and achieve a high quality of life, covering aspects such as safe, clean and secure transport.
- *Support active modes financially:* Invest in infrastructure for active modes. Provide funds for active travel. Provide funding for the implementation of supercycle highways at the regional level.

<table>
<tr><td colspan="2">**Addendum: Impacts of COVID-19 on growth of active mobility**</td></tr>
<tr><td>**Short-term**</td><td>**Long-term**</td></tr>
<tr><td>

• Will **increase**

• Enormous, especially if we include electric micromobility in this. However, transfer of trips **largely from conventional PT**

• **Extremes**: those locked in apartments get less, those living in smaller towns / near nature get more exercise

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• **Slightly positive** impact (if dedicated measures to support cycling and walking are at least partly maintained)

• Increase because the bicycle sales have been remarkably high during this spring (at least in FI), new **bicycling habits likely continue**.

• With the deployment of infrastructure, AM will take more trips from PT and Cars -- **doubling modal shares**

• **Increase** as more city centers use corona crisis to turn centers to smart ecosystems

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This game changer was not a topic of focus in the meeting on 9 June 2020.

6.7.   Changing mindsets & behavioural patterns

Recommendations for city authorities

- *Agree on shared vision in SUMP development.* Focusing on promoting acceptance of active modes and shared mobility. Include climate targets in planning.

- *Find and act on ways to establish sustainable habits*: E.g. by providing incentives (as e.g. in Norway for e-mobility). Introduce policies (e.g. mobility marketing) to incentivise the right mobility choices when lifecycle changes take place, e.g. when people move, have their first child, or get a new job.

- *Facilitate mobility and urban space co-creation:* It will serve to raise awareness-raising and engage citizens and stakeholders in mobility projects. It is also a potential way to take advantage of changing mindsets (expectations) and behavioural patterns (mobility patterns) to create mobility policies and landscapes that better suit the needs of citizens.

- *Ensure that the behavioural patterns being encouraged are practical, convenient, and safe:* Do not get tripped up in the language of personal choice. The behaviour people engage in is structured by the system in which they operate.

Recommendations for national government actors

- *Agree on shared vision in SUMP development.* Provide national funding to develop SUMPs. Focusing on promoting acceptance of active modes and shared mobility. Include climate targets in planning.

- *Find and act on ways to establish sustainable habits*: E.g. by providing incentives (as e.g. in Norway for e-mobility). Introduce policies (e.g. mobility marketing) to incentivise the right mobility choices when lifecycle changes take place, e.g. when people move, have their first child, or get a new job.

- *Disincentivise funding and company cars:* Require companies to provide job tickets, company bicycles, and other sustainable mobility options.

Recommendations for the European Commission

- *Support member states in providing structural change to support behaviour change:* The behaviour people engage in is structured by the system in which they operate.
- *Ban advertisements* for polluting cars/ vehicles.
- *Facilitate capacity building* for evidence-based policy decision making.

Addendum: Impacts of COVID-19 on changing mindsets and behavioural patterns

Short-term	Long-term
• Fear of public transport - **preference for individual transport**	• **Unlikely to return** to mindsets of pre-COVID-19 times
• **Online purchasing** overtakes retail purchasing	• **Advent of a vaccine** may slow some short-term changes identified
• Increased tendency to stay at home and **carry out activities virtually** - trend in reduced number of trips	• **Long-term shift to more digital-based activities.** Many services are dependant on digital skills of the users. Life is hard for those without these skills.
• Tendency to **avoid crowded places** - more pressure for transport to countryside and less to cities.	• Policy decision makers gain confidence that **short-term measures are being accepted.**
• Shifts in **timing of trips** to avoid peaks	• **Stockpiling:** more long-term thinking, preparedness.
• **Decreased consumption,** and of a different nature (more local).	• **Anti-density reaction** (physical distance, living without gardens seen as a disadvantage)
• Decision making lacks time for stakeholder consultation so **new measures are introduced without consulting** stakeholders sufficiently leading to a kind of **trial and error** decision making.	

Actions of cities and regions

- Because travel habits are so disrupted, people may be temporarily more open to biking and walking. Cities can use this window of opportunity by offering free bike-share trips when the lockdowns end.

- Lock in positive new behaviour such as increased cycling and walking by making the temporary measures in favour of these modes permanent.

- Ensure that those without sufficient digital access can access essential services through e.g. distributing digital devices, training for digital skills.

- Provide online platforms for co-creation and stakeholder consultation to increase citizen participation without face-to-face contact

- Use scenarios to determine what is essential as a "service".

- Develop policies for the integration of passenger and freight transport to maximise efficiency and sustainability in light of new travel and consumption patterns.

- Establish partnerships with micromobility operators and develop new business models.

- Support regional start-ups / mobility service providers.

- Coordinate and regulate new sustainable mobility services to ensure their up-take and long-term viability.

Actions of EU and member states

- Provide a clear and consistent policy direction: e.g. electric vehicles, mandatory GHG reporting, carbon pricing

- Don't allow trade deals to dilute Green Deal: level playing field should apply to companies inside and outside the EU.

- Ensure that urban mobility policy and funding at the national level is not divided between research and implementation.

- Ensure that digitalisation is accessible for everyone.

6.8. Integrated space management

The Advisory Group concluded that while integrated space management funding and regulation rather take place at the national/ regional and local level, support for implementation should take place at the EU level.

Recommendations for city authorities

- *Reallocate street space for green areas and recreational activities.*
- *Reduce parking spaces* in favour of sustainable modes and quality public space.
- *Engage in (dynamic) pricing of space.*
- *Develop new models of parking revenues.*
- *Introduce road and parking pricing measures.*
- *Promote/ require densification and new design standards* for integrated space for traffic engineering.
- *Implement e-hubs for electromobility and charging.*
- *Prioritise modal shift by allocating more space to active modes:* Demonstrate a willingness to try out and experiment schemes that re-allocate space to pedestrians and other sustainable modes, e.g. pilot changes as a test before full implementation. This makes measures such as reallocating space seem less drastic and increases the likelihood of successful long-term implementation.
- *Prioritise multimodal hubs in SUMP development:* Implement transport hubs, seamless transport and interchanges.

Recommendations for national government actors

- *Introduce road and parking pricing measures.*
- *Promote/ require densification and new design standards* for integrated space for traffic engineering.
- *Allow flexible regulation for piloting and testing solutions.*
- *Combine licensing new mobility modes (e.g. e-scooters) with consideration of space regulation* to ensure that new modes can operate safely and successfully.

Recommendations for the European Commission

- *Fund research on relation between parking and retail:* i.e. what are the reasons for the increasing number of empty shops (e-commerce, high prices?) and how to address this problem.

Addendum: Impacts of COVID-19 on integrated space management	
Short-term	**Long-term**
• Changes for integrated space management **alter modal split** • Emergency **spatial rebalancing measures** deployed • Favoring **people** over vehicles • Actions of cities (and how many are making changes) **should not be overstated**	• **Positive** if measures maintained • **Lock-in of reallocated space -** benefits active and assisted mobility • Integrated **passenger and freight transport** • Empty store space used as **distribution centers** • Cities already advanced in this area will do more. **Majority will revert** to business as usual due to increased demand for car travel and parking.

Actions of cities and regions

- As physical distancing requirements recede, identify a framework for allocating space to the activities that benefit citizens the most.

- Introduce parking policies that cover freight and passenger vehicles

- Use the opportunity of trial measures to gain public acceptance of temporary, long-overdue space reallocation measures and make permanent changes.

- Ensure that logistics are accounted for in commercial, industrial and residential planning; this topic often slips through the cracks.

- Make public space available for restaurants so that they can continue functioning while allowing for physical distancing – this is something we see happening in many cities, with restaurants "spilling out" into the streets for increased outdoor dining capacities. But make sure there is equity. All people need space, but some can't afford a café/restaurant seat.

Actions of EU and member states

- Devise consistent/aligned (not separate!) policies for freight and passenger transport. E.g. in infrastructure for electric vehicles, consider all types.

- Ensure greater harmonisation of access regulations at EU level.

- Facilitate a national regulatory framework for providing accessible public space.

- Support R&I projects on dynamic signage of space usage (e.g. digital signs built into the pavement indicating walking direction, safe physical distance etc.)

7. COVID-19 Addendum

Impacts of COVID-19 on urban mobility game changers

Urban mobility opportunities

The pandemic has forcefully led to significant urban mobility changes (e.g. temporary street closures to cars, increases in space allocated to pedestrians and cyclists, rapid uptake of teleworking). The Advisory Group explored what can be learned from the socio-technical malleability as shown by COVID-19 to trigger further change and deepen and maintain the positive changes in the short and long term.

One of the main takeaways is that exceptional conditions boost acceptance. Taking space away from cars is also almost always a controversial decision. The exceptional circumstances posed by the pandemic have created an opportunity to implement beneficial measures that may have formerly been met with resistance. With sidewalks widened to allow pedestrians ample space for physical distancing, and car lanes reallocated to provide necessary space for the increased numbers of cyclists, people during and post lockdown experience the joy of streets without congestion, of more people-friendly public spaces, and of breathing cleaner air. This can be a source of momentum to gain citizens' support for usually controversial interventions and for temporary measures to become permanent – because people have already experienced the measures in real life.

The pandemic has forced our hand with many measures that previously seemed impossible, e.g. widespread working from home. People realise that they do not need to travel as much as they thought. Moving many activities to the virtual realm is a major game changer for urban mobility.

As many of the quickly-implemented changes have indicated, humans are socially adaptable, but as soon as conditions change, people often revert back to largely similar patterns of behaviour as long as they feel safe. The challenge of avoiding unwanted returns to the previous status quo needs to be considered side by side with seizing the opportunities.

Avoiding a back-slide

The COVID-19 pandemic also presents threats to urban mobility improvement efforts (e.g. increased car-dependence, retreats from public transport and car sharing, relaxed air quality standards). As restrictions begin to relax, it is a pivotal moment to fend off a backslide to the previous status quo. To avoid bounce-back to a situation similar to, or worse than the previous "normal" (e.g. an erosion of air quality standards), it is recommended to maintain temporary measures, e.g. lock-in space reallocation and make sure new measures support the increased uptake of public transport, shared mobility, and active mobility.

Public transportation is at risk, with ridership and perceived safety experiencing significant declines. To encourage a return to public transport, well-publicised cleanliness standards and health safety practices need to be introduced. As long as physical distancing is recommended by public health experts, the capacity of public transport is limited. These limitations extend beyond the public transport realm; office use, school capacity, shop and restaurant capacity, etc. are all limited. These capacity limitations need to be managed in a coordinated way.

To avoid a retreat to cars as a dominant travel mode, a concerted effort needs to be made to attract people back to public transport. This must be coupled with sustainable business models for shared mobility services. An integrated multimodal urban mobility ecosystem will be needed. Avoid economic measures that support car ownership (e.g. subsidies). Invest in bike routes and services to keep new bike-riders travelling by bike.

Improving pandemic preparedness and resilience

Resilience must be a key element of planning from now on. The pandemic was a wake-up call to many, indicating a lack of preparedness to deal with the challenges posed by COVID-19. There are countless examples of innovative responses, but those do not negate the need for preparedness and resilience to future uncertainties. COVID-19 is a game changer from outside the transport system. The game changers addressed in this policy paper are specifically in the field of urban mobility. Considerations of game changers as a whole need to encompass outside forces, which can sometimes deliver the biggest blows to transport systems. Interaction with other systems is therefore critical. Urban mobility preparedness and resilience in the case of a pandemic can be addressed by focusing on the following areas:

Space allocation: Observe what space allocation makes the city more functional. This involves improving information on mobility, including active mobility and freight. General information on walkability and capacity is required to assess repurposing potential. Cities must also determine which principles guide space allocation decisions, creating an evidence base on what works. This information will also be useful in the event of future needs for quick, temporary space reallocation; cities can prepare plans of quick space rearrangement during a pandemic, including dynamic reallocation of road space. This would ideally be coupled with flexible regulation to allow quick reallocation of space for businesses which cannot be run safely in their normal space requirements during a pandemic situation. Many commercial exhanges that were once inside buildings are now taking place on the sidewalks; this has to be accounted for when dedicating space to pedestrians.

Urban goods movement: When making planning decisions designed to help the city ecosystem function better, freight must be a factor. Namely, what is the city's capacity to absorb increases in urban freight flows? The coronavirus pandemic has led to a significant uptick in the amount of online orders placed, and some cities are taking inventories of pick-up and drop-off days to better handle the increases in deliveries.

Public transport: Clear recommendations are needed on how safe use of public transport can be organised during pandemic situations. In response to COVID-19, public transport operators instituted safety measures such as occupancy limits, mask requirements, cashless operation, rear-door boarding, and sanitation of stations and vehicles. Pandemic resilience may mean changes for public transport vehicle fleets that would require retrofitting to provide proper ventilation systems, virus-resistant materials, and options for frequent cleaning. Physical distancing requirements have meant a steep drop in public transport capacity, and future situations with similar requirements will need an integrated approach that supports other modes, e.g. walking and cycling, to take on the displaced public transport trips and ensure that physical distancing doesn't result in traffic congestion.

Air pollution: As evidence suggests that air pollution exacerbates the impacts of illnesses such as COVID-19, substantially reducing air pollution needs to be a top priority in all policy arenas.

Goods and services and consumption: The coronavirus pandemic has changed consumption patterns. In some cases, this means that people have realised that they can be satisfied with less consumption. For others, the nature of consumption (e.g. online purchases, different products) has changed. A world more resilient to future pandemics needs to adapt the former system to different levels of consumption, so that the recovery impulse is not a rush to mass consumerism of goods. Services also need to have plans in place to adjust to different delivery models (e.g. remote work, service delivery models for health and education, etc.).

Equality: The impacts of the coronavirus pandemic are not equally distributed across gender, social group, or ethnicity. Planners and policymakers should investigate the role of transport in reducing that inequality. Free transport services for essential workers is a helpful short-term adjustment that some cities have offered, but in the long term, an equitable mobility scheme will need to go beyond this. Equitable street space allocation and a concerted urban planning approach to address geographic disparities in health (i.e. availability and quality of health determinants such as employment, childcare, schools, healthy food, transport, and recreation space) is crucial.

Scenarios: Scenarios can be assessed to select a vision or to ensure that a proposed measure is resilient. There will never be perfect information to make the decisions required to build a more resilient transport system, so principles are needed to guide decisions.

The above factors are considered from the perspective of resilience in the case of future pandemics, but we can and must apply the learnings of this health crisis to longer term preparedness for unexpected events and crises that can impact transport. Just as urban mobility needs to be resilient in face of uncertainties, it also plays a significant role in contributing to the resilience and recovery of other systems. Therefore, resilience in urban mobility is a critical component of resilience as a whole.

8. Annex

8.1. Members of CIVITAS SATELLITE Advisory Group game changers

As specific expertise was required for each meeting, SATELLITE opted for a flexible membership with meeting participants representing a mix of urban innovation generalists, thematic experts, and experts in assessing social trends. These were:

- Representatives from universities and research sectors, particularly in the field of urban studies and planning
- Representative from private companies/ associations engaged in new technology development/ implementation
- Representatives from public sector organisations applying new technologies
- City representatives focused on applying new mobility technologies and innovative approaches
- Consultants/ experts in game changers

8.2. Participants 1st Advisory Group game changers meeting, 30 October 2018

Name	Organisation
BOILE, Maria	Centre for Research and Technology Hellas (CERTH)
BRAUN, Marcel	Rupprecht Consult
CHIRCA, Mihai	UITP
CRE, Ivo	Polis
CRIST, Philippe	International Transport Forum (ITF)
KESSEL, Tanja	European Center for Information and Communications Technologies (EICT)
MORODOR, Helmuth	City of Bologna
RAPACZ, Piotr	European Commission, DG MOVE
RUPPRECHT, Siegfried	Rupprecht Consult
RYE, Tom	Edinburgh Napier University

8.3. Participants 2nd Advisory Group game changers meeting, 18 February 2019

Name	Organisation
BAHAR, Namaki Araghi	Smart Mobility Center, Technical University of Denmark
BRAUN, Marcel	Rupprecht Consult

Name	Organisation
CERFONTAINE, Caroline	UITP
CRIST, Philippe	International Transport Forum (ITF)
KESSEL, Tanja	European Center for Information and Communications Technologies (EICT)
PUNTE, Sophie	Smart Freight Centre
RAPACZ, Piotr	European Commission, DG MOVE
RUPPRECHT, Siegfried	Rupprecht Consult
RYE, Tom	Edinburgh Napier University
VANCLUYSEN, Karen	Polis

8.4. Participants 3rd Advisory Group game changers meeting, 28 May 2019

Name	Organisation
BRAUN, Marcel	Rupprecht Consult
CRIST, Philippe	International Transport Forum (ITF)
CUESTA, Rafael	Transport for Greater Manchester
GOGER, Thierry	Forum of European National Highway Research Laboratories (FEHRL)
INNAMAA, Satu	VTT Technical Research Centre of Finland
KESERU, Imre	Vrije Universiteit Brussel
MACBETH, Iain	Transport for London
RUPPRECHT, Siegfried	Rupprecht Consult
VANCLUYSEN, Karen	Polis
WIEDERWALD, Doris	AustriaTech

8.5. Participants 4th Advisory Group game changers meeting, focusing on COVID-19 impacts, 9 June 2020

Name	Organisation
BIDASCA, Luana	DG MOVE
BOILE, Maria	CERTH
CHIRCA, Mihai	UITP
CRIST, Philippe	ITF
CUESTA, Rafael	Cuestra Consulting

GOGER, Thierry	FEHRL
INNAMAA, Satu	VTT
KESERU, Imre	Vrije Universiteit Brussel
JONES, Peter	UCL
PETERS, Hana	Rupprecht Consult
PUNTE, Sophie	Smart Freight Centre
RAPACZ, Piotr	DG MOVE
RUPPRECHT, Siegfried	Rupprecht Consult
RYE, Tom	Molde University College, Urban Planning Institute of Slovenia, UAB
VANCLUYSEN, Karen	Polis
WIEDERWALD, Doris	AustriaTech