Call topics

After an introduction describing the context and the issues, each challenge is divided into two sets of questioning or topics corresponding to two pathways:

- a pathway to generate ***research projects*** that aim at producing new knowledge, analysing data, better understanding and modelling phenomena and developing expertise and tools that will be useful to practitioners and policy makers; research projects cover both strategic and applied urban research;
- a pathway to stimulate ***innovation projects***, focused on the development or the improvement of practical, operational solutions – technological and organisational - for companies, local communities and authorities in charge of urban transport and urban planning and management.

Challenge 1: Conceptualise and develop solutions for an overarching approach on sustainable urban physical mobility and transport, land use and digital connectivity

The 'subsystems' of physical mobility and transport, spatial form (proximity, land use), and digital connectivity are interwoven and interrelated but are not always approached as an integrated system. However, integrational approaches beyond these three subsystems promise radical new potentials for a sustainable system transition.

An important challenge is how to achieve such an integrated approach that has a comprehensive take on accessibility, connectivity (as for example the Triple Access System (TAS) approach[1]). Such a transition requires overcoming (single) system barriers and limitations in terms of responsibilities and roles of stakeholders, actor orientation, business models, financial arrangements and regulations and therefore requires the collaboration and integration of perspectives across actors, professions and geographical scales. Innovative framework conditions are required and incentives have to be created to really engage the necessary stakeholders.

New concepts in mobility and transport and services as well as in digital connectivity often partially integrate technologies and services in different domains including transport, communication and energy (examples include cooperative and connected mobility, MaaS/TaaS concepts, electric mobility and automated mobility). Enabling technologies, such as (big) data mining, artificial intelligence optimisation and block chain transaction processing approaches, support such new developments. So, within and between subsystems, there is already a plethora of innovative solutions, and much more are to be expected (see challenges 2 and 3). On top of that, emerging technologies and digital enabled solutions (e.g. VR/AR and virtual presence, telecommuting, e-commerce) will change the need for physical movement of persons and goods and that might change the view on spatial proximity.

However, we still need to know which technologies and innovative solutions will help to utilise new potentials of 'virtual mobility', which new solutions need a combined approach of physical and virtual mobility options/modes, and how to better capture system dynamics related to time and time-use in the urban system, and especially which approaches contribute to a transition to sustainable accessibility and connectivity.

We need to consider, understand and anticipate the complex (inter-)dynamic interactions and implications of these developments, and to give the various stakeholders insight in these interactions so they can truly engage in the decision processes. We will need novel simulation, monitoring and decision-support tools to help actors to take well balanced decisions.

Questions for **Research Projects** could include:

- How can emerging mobility/immobility (virtual presence, e-commerce…) patterns and solutions be integrated in (existing) modelling tools used for decision-making, planning, management of urban mobility?
- How can rethinking role/organisational models and new overarching concepts help to utilise the potential of new developments to achieve sustainable accessibility and connectivity?

[1] Glenn Lyons. Cody Davidson (2016) Guidance for transport planning and policymaking in the face of an uncertain future, Transportation Research Part A: Policy and Practice Volume 88, June 2016, Pages 104-116

Innovation Projects can focus on strategies and new solutions for a systemic, comprehensive optimization of the urban mobility system through transport, land-use and telecommunication systems, and can aim to:

- Implement and test new solutions for new needs through enabling technologies like big data, Artificial Intelligence, blockchain, physical internet and solutions that are based on new and enabling digital technologies for information, navigation and guidance (intelligent assistance, augmented intelligence etc.)
- Utilizing the potentials of virtual mobility to mitigate the mobility of persons and goods via integrated concepts & solutions
- Connect management systems and strategies for mobility and the local and regional energy system, in order to foster energy flexibility, sector coupling, and storage solutions.

Challenge 2: Develop and support the implementation of innovative mobility systems and services with a potential to contribute to sustainable urban mobility

Another important challenge is to determine which (new) mobility and transport technologies, services and concepts have the potential to contribute to more liveable cities and improved and more evenly distributed accessibility (for example for different social groups, for low density areas where car is still the first option…).
Innovative transport systems (such as various types of personal light electric vehicles, drones, small scale delivery vehicles), intelligent transport systems (such as traffic management, connected and cooperative driving, geofencing), electric mobility, and various implementations of automated driving in passenger cars, in public transport as well as in freight transport can have both positive and negative effects on accessibility and sustainability. The same goes for new, and sometimes disruptive, mobility and transport services (MaaS, TaaS, shared vehicle concepts, shared ride concepts).

Disparities amongst user groups or urban areas might arise in terms of access to and usability and affordability of these systems or the underlying, supporting systems and concepts (like data collection, information and payment systems). The developments are not necessarily beneficial for all, or might bypass, neglect or even discriminate specific groups in society (gender, socio-economic class, age, ethnicity…) or specific areas.
There is no one single best solution: individuals' and societal groups' needs and characteristics differ: people have different physical and mental abilities (including digital proficiency or literacy), economic possibilities and preferences and uses. We have to identify sustainable mobility solutions that do not place people or groups of people in a disadvantaged position in society.

Regarding the sustainability effects, it is often unsure what the overall effect of these innovations are when they compete with existing options like walking, biking and using efficient public transport and/or highly efficient logistics services. It is also unsure how, on one hand, selective introduction of new mobility technologies and services or, on the other hand, restrictive policies that try to limit the environmental footprint of transport (like banning fossil fuel powered transport) affect cities' attractiveness and socio-economic development – also in comparison with exurban and rural areas.
We have to find solutions that cater areas with spatial concentration and proximity (where 'walkability', 'bike-ability', efficient public transport and efficient logistics services are feasible) as well as areas with lower densities (where efficient high quality public transport and logistics operations are harder to achieve, and perhaps other solutions must be found to achieve sustainable mobility and transport).

We need to assess the potential of these new, emerging systems and concepts (with inherent uncertainties on attractiveness, adoption, performance in large-scale deployment) in comparison with 'traditional' systems and in different (future) spatial settings and socio-economic environments.
We need insight in the interactions, direct and indirect effects of the various implementation possibilities and therefore need novel simulation and scenario models that are capable of taking these developments into account. These instruments should help decision makers to develop policies for sustainable,

affordable, accessible and reliable urban accessibility and connectivity, tapping on the innovativeness and perseverance of private initiatives.

Questions for **Research Projects** could include:

- What are the potential impacts and effects of (potentially) 'disruptive' concepts in terms of use and what are the consequential sustainability effects? What are main drivers (actors, driving forces) to use these new concepts and what are possible opposing forces?
- To what extend are disruptive developments beneficial for all, or do they bypass, neglect or even discriminate specific groups in society? And if specific groups would be left out, what would be the consequence for them (for example, what happens to the affordability, quality and accessibility of the transport modes those groups still need)?
- How should cities monitor and continually improve upon connectivity and accessibility, also relating to sustainability and equity/equality ambitions? Are current planning and management systems sufficient or in need of reform?
- What are potential solutions (technological, social, economic, etc.) to increase accessibility and connectivity in low density areas and for the less able or less well off?
- How would radical changes in the mobility patterns affect socio-economic development? Should the current views on the interlinks between socio-economic development and accessibility be revised at the light of these transformations?

Innovation Projects can focus on digitally enabled and enhanced access for a fair and inclusive urban mobility, and aim to:

- Test concepts to identify, avoid and mitigate the digital mobility divide.
- Pilot transport, land-use and telecommunications systems solutions for fair and inclusive mobility
- Pilot targeted support for a self-defined urban mobility for groups with prevalent diseases like people with dementia.
- Pilot approaches to integrate local mobility into the new ambition towards carbon-neutral (or even energy-positive) urban neighbourhoods and districts.
- Pilot concepts to avoid or mitigate urban heat through innovative solutions for mobility and the public space.

Challenge 3: Transform and re-organise urban spaces to pave the ground for sustainable urban mobility and accessibility – balancing conflicting claims on public space

New mobility and transport technologies and services as well as developments in digital connectivity will have an impact on spatial organisation, the utilisation of public space and the configuration of activity spaces. Reversely, spatial developments – together with economic and demographic developments – impact demand for physical mobility and transport, and digital connectivity. The challenge here is to promote and support a sufficient and fair distribution/re-allocation and utilization of public space for sustainable and spatially efficient forms of mobility in urban spaces along a 'human scale' (notably walking and bicycling). We need to better design and manage public space according to current needs and future demand for mobility and transport, taking into account the (changing) preferences and views on spatial quality of residents, visitors and other stakeholders.

We need to get insight in the potential of solutions based on new enabling digital technologies for information, way-finding, guidance, assistance and improving the comprehensive user-experience of public space that can be a complement and can interrelate with the build environment (Intelligent Assistance, Augmented Intelligence, Internet of Things and ambient intelligence). Also, we need more insight in the potentials (and perhaps problems) of spatial development in accommodating desired social and digital transformation and new mobility options, building on already well established approaches

such as sustainable urban mobility plans (SUMP)[2] and instruments such as land-use transport interaction (LUTI) models[3].
These insights are needed to move towards future-proof and integrated public urban mobility spaces (e.g. for multi-use/multimodality, active mobility modes, shared/automated mobility, urban aerial mobility) that ensure a fair and inclusive use of urban public space and transport infrastructure, also for people with limited mobility options.
The resulting insights can help local and regional authorities to deal with competing claims on public space and with uncertainties related to mobility and transport innovations via land-use planning, local regulation and other local or regional policies.

Questions for **Research Projects** could include:

- How can emerging, new forms of mobility/immobility be included in (current) LUTI models and other tools/instruments?
- How can space design concepts and urban environments be made suitable for new mobility solutions (shared, automated, vertical)?
- How can short-distance structure developments (city or urban districts of short distances) be integrated into urban planning ?

Innovation Projects can focus on future tools to shape the urban mobility space (personal mobility, mobility of goods), and aim to:

- Pilot innovations in digital technologies to enable and boost the transformation of the public mobility space (planning, management, participation, monitoring).
- Pilot innovations to enhance physical and/or digital accessibility/usability of the public space and to trigger sustainable mobility (data content and data infrastructure, interior, design).
- Test approaches to strengthen interrelations between the built environment, the public space, transport nodes (e.g. with public transport or logistics hubs) and different (new) means of transport or mobility models (AV, shared mobility and MaaS, micro-mobility means, etc.), utilizing potentials of IoT/ambient intelligence).

Challenge 4: Making best use of the opportunities of integrating transport, spatial and digital systems whilst limiting vulnerability and enhance resilience

The developments result in mobility and transport, data-, information technology, energy, spatial and financial systems becoming more and more intertwined, interrelated as well as interdependent[4]. The growing complexity and interdependency might increase the risk of vulnerability, instability, and unreliability.
Also, the scale, the complexity of the systems and the dynamics of the system interactions pose questions on the morality of choices, the role of human accountability and responsibility[5], power relations (public-private, sectors, countries), data safety and safeguarding privacy.

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[2] as appearing in the Urban Mobility Package (European Commission 2013 -) as central elements for addressing the challenges related to (mainly) urban areas; the SUMP concept is "a set of guiding principles that can be adapted to the specific circumstances of the urban area under consideration."; the SUMP approach is already applied in numerous cities all over Europe (see http://www.eltis.org/mobility-plans/city-database).
[3] see for instance Michael Wegener (2014) Land-Use Transport Interaction Models, in: Fischer M., Nijkamp P. (eds) Handbook of Regional Science. Springer, Berlin, Heidelberg
[4] Alessandro Vespignani (2010) The fragility of interdependency, in: Nature volume 464, pages 984–985 (15 April 2010)
[5] See for instance: Robert Sparrow, Mark Howard (2017) When human beings are like drunk robots: Driverless vehicles, ethics, and the future of transport, Transportation Research Part C: Emerging Technologies, Volume 80, July 2017, Pages 206-215

A key challenge is therefore to ensure accessible, inclusive as well as reliable, safe, robust and resilient[6] urban passenger and freight transport and connectivity that is capable to cope with various types of systems interactions and with internal (peak demand) and external, natural and man-made disruptions, and protects the rights of individuals.

Questions for **Research Projects** could include:

- How to get a better understanding of the vulnerability of individual systems, of the interdependencies between systems, of the risks of propagation of disruptions within systems and over system borders ('spill over')[7] – especially in the new configurations?
- What concepts and solutions can be developed that bring about a high level of resilience and capacities of adaptation to sudden changes (incidents) or long term changes to maintain accessibility?
- What are innovative infrastructure provisions, technological provisions, strategies and other solutions and approaches to mitigate vulnerability and enhance resilience?

Innovation Projects can focus on the integration of different approaches, services and products for interoperable and portable urban mobility solutions.

Challenge 5: Develop innovative and effective policy options for achieving a shift towards true sustainable urban accessibility and connectivity

A main challenge in achieving sustainable, affordable, accessible and reliable urban accessibility and connectivity is to balance interests of various stakeholders, to adopt and integrate promising mobility and transport concepts, spatial concepts and innovations in digital connectivity and to tune public policies with private and citizens initiatives.
The transition to sustainable and accessible mobility and connectivity asks for a careful implementation and large scale deployment of new mobility, transport, connectivity and spatial concepts.
First we need to expand and use our knowledge on what will be needed to achieve a transition towards sustainable and inclusive mobility and transport (see the extensive overview on experiences in European cities as published in the ELTIS[8] database and, for example, the experiences in the MAtchUP Programme[9]), how to achieve desired effects, to investigate consequences, synergies and conflicts between different policy areas, and to prevent or mitigate possible rebound and compensational effects. Furthermore we have to know to effectively and continuously involve relevant actors, stakeholders, and how to create conditions to assure long lasting changes. Also we know we have to overcome pressing barriers, for example in privacy, data integrity and security, organisation and governance complexities, legislation as well (still) in cross cutting technologies and system optimisations. We have to develop compatible and mutually reinforcing viable business models, public policies and practises, and effective approaches to support changes in socio-technical systems for such a transition.
Public, private as well as individuals will need new practices, procedures, role- and organisational models, financial arrangements, negotiation and participation models and most likely decision supporting tools and technologies (e.g. planning/modelling/simulation, design- and effect evaluation tools) to be able to find integrated and workable way in the complex and dynamic urban multi-stakeholder ecosystem.

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[6] Aura Reggiani, Peter Nijkamp, Diego Lanzi (2015) Transport resilience and vulnerability: The role of connectivity, in: Transportation Research Part A: Policy and Practice, Volume 81, November 2015, Pages 4-15
[7] Lars-Göran Mattsson, Erik Jenelius (2015) Vulnerability and resilience of transport systems – A discussion of recent research, in: Transportation Research Part A: Policy and Practice, Volume 81, November 2015, Pages 16-34
[8] the 'European Local Transport Information Service'(http://www.eltis.org/), or 'urban mobility observatory'
[9] MAtchUP wants to redesign cities with a set of technical solutions in the energy, mobility and ICT sectors and additional non-technical solutions, such as specific social engagement activities. To do this, different key actors – policy makers, universities, industry, investors and, most importantly, citizens –join forces to develop smart models of innovation, inclusion and prosperity to restore cities' liveability. https://www.matchup-project.eu/solutions/

Urban Living Labs and local 'grass roots' initiatives, community-led development and NGO projects can play an excellent role in creating stakeholder, public, private and end-user involvement and the co-creation of solutions for sustainable and inclusive mobility[10] and freight transport[11].
A further challenge is how to upscale and translate successful examples so to achieve a significant overall contribution to sustainable accessibility and connectivity.

Questions for **Research Projects** could include:

- How to resolve conflicts between different scales of transport planning; what are schemes to improve governance and cooperation between stakeholders and policy makers?
- What are effective business models and sociotechnical solutions for sustainable mobility, and do emerging business models support or frustrate sustainable development?
- Which principal levers (incl. legal and regulatory frameworks) for policy strategies can be defined? Can sound business models be supported? How can developments be guided in desired directions - tuned to the (specific) needs for citizens in cities and urban areas?
- Advanced systems and/or the related business models often rely on sharing detailed data that can by very privacy sensitive – both for the users (customers) and for employees – are these sacrifices acceptable to individuals and society?
- How to safeguard privacy of users of the system whilst maintaining the functionality, affordability and reliability?

Innovation Projects can focus on innovative business-models, organisational models and frameworks to foster sustainable mobility, for instance aimed at carbon responsive and healthy accessibility and connectivity, and aim to:

- Pilot integrated supply- and demand-side solutions to achieve sustainable accessibility and connectivity in innovative frameworks.
- Pilot new systemic settings and integrated approaches in the context of the triple-access system model (TAS) by merging novel solution in planning, mobility services and ICT.
- Demonstrate interventions, components and innovative framework conditions in real world settings to test integrated concepts for the future-proof transformation of urban mobility spaces.

Challenge 6: Change behaviours and perspectives towards sustainable urban accessibility and connectivity

To be able to find action perspectives to ease the transition toward sustainable, affordable, accessible and reliable urban accessibility and connectivity we need to know the key aspects and motivations of person mobility and logistics (freight transport) choices and behaviour, as well as the factors determining the adoption of new technologies and concepts, taking into account social-economic-cultural background, gender, physical and mental abilities, preferences and sensitivity to price and other incentives.
We need to know how increased connectivity, advanced information-based services (incl. real-time availability of information) and the availability of optimisation tools or services influence mobility and consumption behaviour, including the consequences for city logistics and thereby freight transport. In particular, we need to know where different entities (societal groups, companies as well as decision makers, planners and policy makers) respond differently to such developments[12].

[10] Frank Nevens, Niki Frantzeskaki, Leen Gorissen, Derk Loorbach (2013) Urban Transition Labs: co-creating transformative action for sustainable cities, in: Journal of Cleaner Production Volume 50, 1 July 2013, Pages 111-122
[11] Valerio Gatta, Edoardo Marcucci, Michela Le Pir (2017) Smart urban freight planning process: integrating desk, living lab and modelling approaches in decision-making, in: European Transport Research Review, September 2017, 9:32
[12] see for instance: Sara F. Jahanmir Joana Cavadas (2018) Factors affecting late adoption of digital innovations, in: Journal of Business Research, Volume 88, July 2018, Pages 337-343

Also, we need to know to what extent 'carbon-awareness', 'health promotion' and life style objectives might help to bring about paradigm shifts that eventually result in changes in actual, day-to-day behaviour, or that we need other incentives to achieve the necessary radical transition towards sustainable mobility and accessibility.
On basis of this knowledge, we can develop public-private-citizen approaches to promote, incentivise and, when necessary, enforce sustainable mobility and transport behaviour on an individual and household level, and on organizational level (decision making behaviour, policies) using means such as legislation, marketing and pricing incentives, as well as 'nudging' and social network influencing approaches.

Questions for **Research questions** could include:

- What are the main reasons and drivers behind actors' mobility behaviour (including responses to new technologies and policies), taking into account various types of actors, and the intricate behavioural interactions?
- How to limit the discrepancies, and even contradictions, between increasingly environmentally-centred perceptions and the actual mobility practices – related to housing choices, location of economic activities and services, configuration of public transport offers - that are still often resource intensive;
- What is the relative importance on mobility and transport behaviour of influencing factors such as social-cultural background (incl. values, ethics), age, personal abilities (mental, physical), economic position, group-pressure, education, information provision / raising awareness, and marketing?
- Are there deficiencies of communication or information availability in specific target groups in society (socio-economic, social-cultural, geographic, age-related, abilities-related) and, if so, is there a need to address such deficiencies?
- To what extent do advanced traffic management, travel information and tariffing systems and ICT facilitated connectivity change travellers' behaviour and logistics choices, activity place and residential/location choices?

Innovation Projects can focus on innovations needed for the paradigm shift to sustainable access through carbon-awareness and health promotion, and aim to:

- Pilot or introduce awareness, incentive and regulation based demand-side solutions in the context of mobility and health (physical ability, mental setting and active mobility) to achieve acceptance, viability and impact.
- Pilot or introduce carbon mobility budgeting (or similar mechanisms and concepts) – from exchange of approaches towards common European implementation concepts and schemes (traffic avoidance and sustainable mode/transportation choice).