
**Title: New Mobility Services and sustainable urban development: The common EU vision and the challenges for transport planning in Greek cities.**

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# New Mobility Services and sustainable urban development: The common EU vision and the challenges for transport planning in Greek cities.

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**Abstract**
*The transport sector is one of the sectors that has been greatly influenced by the 4th Industrial Revolution through the development of New Mobility Services (NMS). NMS include innovative transport modes, such as autonomous road vehicles, and new concepts for serving mobility needs, such as Mobility as a Service, which are gradually being implemented in cities of Europe and worldwide. As part of the implementation of the European Union's (EU) Green Deal, the EU strategy for transportation and mobility sets specific ambitions and targets regarding NMS and their contribution to sustainable urban development. The core documents outlining the relevant EU strategy comprise the "Sustainable and Smart Mobility Strategy – putting European transport on track for the future" (COM(2020) 789 final) and "The New EU Urban Mobility Framework" (COM(2021) 811 final). In this context, the purpose of the current paper is the comprehensive description of the EU policy priorities for the implementation of NMS, deriving from the synthetic analysis of the information presented in the above-mentioned policy documents. The paper also aims at the discussion of challenges from the perspective of planning for urban mobility in Greek cities, such as the attachment to the private car for daily mobility, the necessity for data exchange and cooperation between stakeholders and the need for a long-term vision for sustainable urban development. Taking into account the overall policy objectives at the EU level and the challenges for pursuing these objectives to achieve the digital and green transition of Greek cities, the paper concludes with the suggestion of planning recommendations to integrate NMS into their urban transport system with a positive impact on their ongoing effort for the "sustainable mobility paradigm" shift. These recommendations mainly refer to the application of contemporary planning approaches, such as participatory planning, interdisciplinary cooperation and evidence-based planning, with focus on the issue of NMS implementation at the urban level. The issues discussed in the current paper directly concern planners and policy makers in urban areas of Greece, while they can be appropriately adjusted to the considerations of stakeholders in other cities. They can also provide the background to develop case-specific methodological processes to address the planning needs for the integration of NMS to a particular city.*

***Keywords:*** *City, New Mobility Services, Sustainable Development*

## Introduction

Almost four decades since the publication of the milestone United Nation's (UN) report "Our Common Future", also known as the "Brundtland report" (World Commission on Environment and Development, 1987), sustainable development continues to be widely considered by scientists, policy makers and society as the main pathway towards progress and welfare. Nowadays,

the intensification of human activity, mainly due to industralisation and globalisation, is having an unprecedented impact on climate change as well as on other environmental and socio-economic aspects, leading to potential existential threats and, thus, highlighting the need for global action towards sustainable development (IPCC, 2023). In this context, the 2030 Agenda for Sustainable Development, adopted by UN countries in 2015, sets out 17 Sustainable Development Goals (SDGs) with 169 targets and the corresponding measurable indicators (United Nations, 2015). In the same year, the "Paris Agreement", i.e. a legally binding international treaty on climate change, was signed to agree on common policies for "limiting by 2050 global warming to below 2, preferably to 1.5, degrees Celsius, compared to pre-industrial levels" (United Nations, 2015). As cities account for approximately 56% of global population (more than 80% in developed economies), they play a key role in the implementation of policies against climate change and sustainability threats (United Nations, 2020). Urban mobility is responsible for a significant share of Green House Gas (GHG) emissions and other negative externalities. In the European Union (EU), more than 70% of the population resides in urban areas, which generate approximately 23% of all transport GHG emissions that correspond to a quarter of total emitted GHGs (European Union, 2023). Moreover, urban transport is responsible for 7 million premature deaths and over 600,000 road traffic fatalities annually (United Nations Economic Commission for Europe, 2020). Taking the above into account, the EU promotes sustainable urban mobility through the regular publication and communication of transport policy frameworks. The current transport policy framework, which will be further analysed in the present paper, is described in the "Sustainable and Smart Mobility Strategy – putting European transport on track for the future" (European Commission, 2020a) and "The New EU Urban Mobility Framework" (European Commission, 2021). These policy documents implement the overall EU strategic framework, i.e. the "European Green Deal" (European Commission, 2019), in the transport sector. The transport policy sets tangible mid-term and long-term targets, outlining "transformative" policies to address climate change and capitalising on new technologies and innovation to increase the overall sustainability of the urban transport system. In terms of technological innovation, the EU transport policy promotes the adoption of New Mobility Services (NMS) by cities in the context of a multimodal, user-oriented urban transport system, considering the environmental and social concerns (European Commission, 2020b). However, the adoption of innovation on urban mobility depends on the specific features of each city, related to preparedness, commitment, acceptance, and integration to the overall planning goals. The purpose of the current paper is the analysis of the current EU transport policy regarding the implementation of NMS in European cities and the development of a framework of the opportunities and challenges and the corresponding recommendations from the perspective of planning for urban mobility in Greece. The remainder of the paper is structured as follows: The following section aims at the review of literature with the aim of describing the trending concepts related to NMS as well as sustainable mobility and development. Then, the methodological approach of the current bibliographical research and analysis is presented. The findings of the research are presented and discussed in the next section. The final part of the paper is dedicated to conclusive remarks and prospects for follow-up research.

## Literature Review

### New Mobility Services

In the era of the 4th industrial revolution, the rapid progress in digital technologies, and namely in digital connectivity, artificial intelligence and flexible automation, is leading the development of innovative services in all sectors of socio-economic activity (World Economic Forum, 2018). The transport sector is one of the sectors that has been intensively affected by technological evolution. New Mobility Services (NMS) emerge as a potential game changer in the

field of urban mobility. According to (ITF, 2023), NMS can be broadly defined as "intraurban passenger mobility services and vehicles enabled by digital technology". In this sense, NMS refer to new types of services, such as shared mobility and Mobility as a Service (MaaS), and new modes, such as Autonomous road Vehicles (AVs) and micromobility devices (Mubiru & Westerholt, A scoping review on the conceptualisation and impacts of new mobility services, 2024); (UITP, 2020). The following definitions can be used to clarify the different types of NMS. Shared mobility refers to the shared use of a travel mode to provide users with short-term access to the specific mode according to their current needs and preferences, without having to own the vehicle in use (Shaheen & Cohen, 2021). Different types of shared mobility services include the shared use of cars in terms of car-sharing, i.e. renting a car for a limited amount of time, ride-sharing (carpooling), i.e. sharing a ride in a privately owned car with other passengers, and ride-hailing, i.e. hiring a personal driver and car for a specific trip. Shared mobility services may accordingly apply to bicycles, e.g. bike-sharing, and micromobility (Guyader, Friman, & Olsson, 2021); (FHWA, 2016). Different definitions can be found in literature regarding Mobility as a Service (MaaS). A comprehensive definition in the framework of the current paper refers to the user-oriented, on demand, "door-to-door" mobility service that combines different (shared and public) transport modes by different operators through a common digital platform, offering the ability to the user to remotely plan, book and pay for the trip (UNECE Inland Transport Committee, 2020); (MaaS Alliance, 2017); (UITP, 2019). Autonomous road vehicles (AVs) can be defined as self-driving vehicles with technological equipment, such as telecommunications and sensors, that enable driving operations without the driver's intervention (Li, Huang, Liu, Zheng, & Wang, 2016); (Gordon & Lidberg, 2015). Similar concepts that are often used in EU policy are: Cooperative, Connected and Automated Mobility (CCAM); and Connected and Automated Driving (CAD). The SAE levels of automation are usually used as a common reference to rank the automated driving technologies (SAE International, 2021). There are 6 levels, starting from Level 0 (no driving automation) to Level 5 (complete driving automation under all conditions). Autonomous vehicles belong to level 4 and higher. It should be highlighted that AVs are currently tested for different purposes and scenarios or operated under controlled conditions, while their wide-scale implementation is estimated to be feasible by the end of the decade (ERTRAC Working Group "Connectivity and Automated Driving", 2019). There is no internationally recognised definition of micromobility, while the term usually refers to light vehicles for personal travel in low-speed (UNDP, EU4Climate , 2023). The micromobility devices can be human or electric (fully or partially motorised) and may include bicycles, e-bikes, scooters, e-scooters, segways, onewheels etc. (Price, Blackshear, Blount, & Sandt, 2021).

### Sustainable mobility and development

According to the European Union Council of Ministers of Transport (2001), a sustainable transport system "allows the basic access and development needs of individuals, companies and society to be met safely and in a manner consistent with human and ecosystem health, and promotes equity within and between successive generations." Sustainable mobility is achieved through "the provision of services and infrastructure for the mobility of people and goods—advancing economic and social development to benefit today's and future generations—in a manner that is safe, affordable, accessible, efficient, and resilient, while minimising carbon and other emissions and environmental impact" (UN Secretary General's High-Level Advisory Group on Sustainable Transport, 2016). In other words, sustainable mobility is closely linked to the well-known parameters of sustainable development, i.e. environment, society and economy, due to the fact that the transport system provides physical access to locations of socio-economic activity through the transportation of people and goods, a process which generates socio-economic and environmental impacts (Figure 1). The EU strategic planning frame-


*Fig.1. The link between sustainable mobility and the parameters of sustainable development (source: own elaboration)*

work for urban mobility, i.e. the Sustainable Urban Mobility Plan (SUMP), comprises the tool for integrated planning in terms of urban sustainability (Rupprecht Consult (ed.), 2019). The aforementioned 2030 Agenda for Sustainable Development acknowledges the relationship between mobility and sustainable urban development by defining, among others, the SDG11: "Sustainable Cities and Communities" (United Nations. Department of Economic and Social Affairs. Sustainable Development, 2023), with targets which are directly or indirectly related to the transport system (Table 1). For example, target 11.2 refers directly to the characteristics of sustainable mobility, as presented in Figure 1, while targets 11.b and 11.3 refer to integrated policy making and planning for sustainable cities, which includes urban mobility policies and plans. Target 11.6 focuses on the environmental impact of cities, which is affected by urban mobility. Targets 11.7 and 11.a cover aspects of intra-urban and extra-urban accessibility respectively, which significantly depend on the transport system. Finally, regarding target 11.4, spatial accessibility and the mobility of people and goods facilitate the exchange of ideas and the interaction between cultures, while the development of transport networks may create pressures on the assets of cultural and natural heritage.

## Methods:

### Methodological steps

The methodology of the current paper comprises the following steps:

a.Review and analysis of the current EU strategic framework on transport with focus on urban mobility

b.Overview of the implementation of the corresponding strategic priorities in the Greek planning practice

c.Development of a framework of opportunities, challenges and planning recommendations.

### Review of EU strategic documents and overview of Greek planning practice

The review of the main policy documents regarding transport and urban mobility for the current EU programming period (2021-2027) is conducted with focus on the implementation of NMS and their potential contribution to sustainable urban development. In specific, the "Sustainable and Smart Mobility Strategy – putting European transport on track for the future" (COM(2020) 789 final) and "The New EU Urban Mobility Framework"

| | Code | Target |
|---|---|---|
| By 2020 | 11.b | Increase the number of cities and human settlements adopting and implementing integrated policies and plans towards inclusion, resource efficiency, mitigation and adaptation to climate change and resilience |
| By 2030 | 11.2 | Access to safe, affordable, accessible and sustainable transport systems for all, improving road safety, notably by expanding public transport, with special attention to the needs of those in vulnerable situations, women, children, persons with disabilities and older persons |
| | 11.3 | Enhance inclusive and sustainable urbanization and capacity for participatory, integrated and sustainable human settlement planning and management in all countries |
| | 11.6 | Reduce the adverse per capita environmental impact of cities, including by paying special attention to air quality and municipal and other waste management |
| | 11.7 | Provide universal access to safe, inclusive and accessible, green and public spaces, in particular for women and children, older persons and persons with disabilities |
| Constant pursuit | 11.a | Support positive economic, social and environmental links between urban, peri-urban and rural areas by strengthening national and regional development planning |
| | 11.4 | Strengthen efforts to protect and safeguard the world's cultural and natural heritage |

*Table 1. The transport related targets of SDG11: "Sustainable Cities and Communities" (source: own elaboration from (United Nations. Department of Economic and Social Affairs. Sustainable Development, 2023)*

(COM(2021) 811 final) are analysed as the strategic framework for the implementation of the "European Green Deal" (COM(2019) 640 final) in the field of transport and mobility. Moreover, a comprehensive overview of the adoption of EU policy priorities in recent SUMPs of Greek cities is provided to assess the implementation of NMS in the local sustainable mobility policy. Main sources to collect information are the CIVITAS SUMPS-UP registry (CIVITAS, 2023) (only one Greek SUMP was registered) and the SUMP Observatory of the Sustainable Mobility Unit of the National Technical University of Athens (Sustainable Mobility Unit, National Technical University of Athens, 2023).

### Framework of challenges and opportunities and planning recommendations

Based on the above review, the second part of the methodology comprises an attempt to propose a comprehensive framework which presents the challenges and opportunities for the implementation of NMS in Greek cities and the corresponding planning recommendations to address the challenges and capitalise on the opportunities. The framework is structured under specific criteria that cover main aspects of sustainable urban development, i.e. citizen and society; spatial development; and natural and built environment. The challenges stem from the conceptual approach of the Urban Mobility Innovation Index (UMii, 2021). The planning recommendations refer to the appropriate adoption of the tools and approaches suggested by the SUMP guidelines (Rupprecht Consult (ed.), 2019).

## Results and discussion:

### The role of NMS in the EU policy for transport and mobility

As mentioned above, the EU strategy for sustainable development in the current Programming Period (2021-2027) is described in the "European Green Deal" (COM(2019) 640 final). The purpose of the Green Deal is to renew the European Commission's commitment to tackle climate change and to implement the "2030 Agenda" and the SDGs. The objectives of the specific strategy are presented in respect to the corresponding dimension of sustainable development in Table 2. The strategy outlines specific priorities for each sector, including the priority for the transport sector to accelerate the "shift to sustainable and smart mobility" (European Commission, 2019). In order to support the implementation of the Green Deal in the transport sector, the "Sus-

| Environment | Society | Economy |
|---|---|---|
| • No net GHG emissions in 2050<br>• Protect, conserve and enhance the EU's natural capital | • Fair and prosperous society<br>• Protect the health and well-being of citizens from environment-related risks<br>• Just and inclusive transition to decarbonization | • Modern and competitive economy<br>• Decoupling economic growth from resource use |

*Table 2. The European Green Deal main objectives (source: own elaboration from (European Commission, 2019))*

| Environment | Society | Economy |
|---|---|---|
| • Combination of policy measures set out in this strategy can deliver a 90% reduction in the transport sector's emissions by 2050 | • Transport system resilience against future crises (such as Covid-19)<br>• Mobility available and affordable for all (incl. rural and remote regions, persons with reduced mobility and persons with disabilities)<br>• Good social conditions, reskilling opportunities and attractive jobs in the transport sector | • Transport growth coupled with greening mobility |
| • Digitalisation for seamless and more efficient transportation | | |

*Table 3. The Smart and Sustainable Mobility Strategy main objectives (source: own elaboration from (European Commission, 2020a))*

tainable and Smart Mobility Strategy – putting European transport on track for the future" (COM(2020) 789 final) delivers a detailed roadmap to promote the different aspects of sustainable and smart mobility. The objectives of the Sustainable and Smart Mobility Strategy in respect to the dimensions of sustainable development are presented in Table 3. The objective of digitalisation in Table 3 is considered a "horizontal" objective as its main purpose is to accelerate the overall shift towards more sustainable transport systems. More specifically, the Strategy highlights the need for "transformational" policies with time-bound target setting, as presented in Figure 2. The measures to achieve those targets are categorised into three fields of priority, i.e. zero-emission mobility; seamless, safe and efficient connectivity; and resilient and inclusive single European transport area. Each of the fields of priorities contains measures concerning different "flagship areas". These measures comprise proposals for legislative and regulatory actions, standardisation and technical specifications, thematic studies, roadmaps and action plans, governance tools, financial tools, cooperation initiatives and partnerships, as well as research and innovation opportunities through the current R&I Framework Programme (Horizon Europe). The strategy mentions that "Cities are and should … remain at the forefront of the transition towards greater sustainability" and highlights the role of new and shared mobility solutions, such as MaaS, towards this direction (European Commission, 2020a). The implementation of the Sustainable and Smart Mobility Strategy in the context of urban mobility is the scope of the "New EU Urban Mobility Framework" (COM(2021) 811 final). Its purpose is the formulation of the appropriate policies for the "transition to safe, accessible, inclusive, smart, resilient and zero-emission urban mobility through active, collective and shared transportation" (European Commission, 2021). The priorities of the Framework comprise:

1. TEN-T urban nodes
2. Sustainable Urban Mobility Plans (SUMPs) and mobility management plans
3. Sustainable urban mobility indicators
4. Public transport services
5. Active transport and micromobility
6. Freight logistics and last-mile delivery

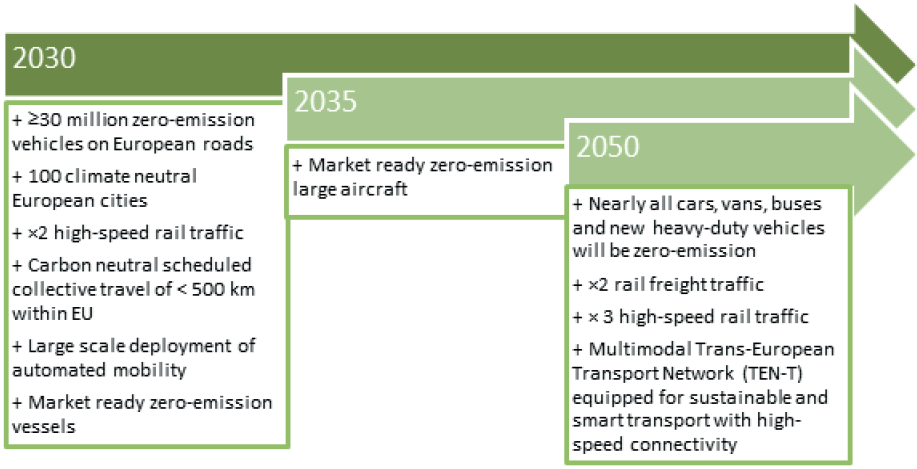


*Fig. 2. Targets of the Sustainable and Smart Mobility Strategy (source: own elaboration from (European Commission, 2020a))*

7. Digitalisation and new mobility services
8. Climate neutral cities

The above priorities and respective policies and measures are discussed below from the perspective of the current paper, i.e. the implementation of NMS to promote sustainable urban development. The New EU Urban Mobility Framework highlights that the public transport system continues to play the key-role for affordable and inclusive transport, environmental sustainability, enhancement of territorial cohesion and creation of jobs. However, there has been relatively limited development over the last years and further disruption in the period of the pandemic. The sustainable recovery of the urban public transport system can be achieved, among other measures, through the development of appropriate MaaS services with public transport operating as the backbone of collective mobility by 2030 (Figure 3). This can be facilitated by the implementation of new technologies, increased funding and policy support through the aforementioned SUMPs. In contrast to the public transport system, the pandemic favoured active transport and micromobility due to social distancing and the need for outdoor activity. According to the New EU Urban Mobility Framework, micromobility can complement public transport to provide attractive, competitive and low emission solutions for "door-to-door" trips. It is worth mentioning that a SUMP Topic Guide on the safe deployment of micromobility devices for planners and local authorities has been recently developed (European Platform on Sustainable Urban Mobility Plans, 2021). In this context, the Framework stresses the need for specific rules on the safety of micromobility devices. The Framework explicitly refers to the role of digitalisation and data sharing for the effective implementation of NMS, capitalising on the technological advancements of Industry 4.0. In terms of planning for the integration of these new and potentially disruptive services into the urban transport system, the perspective of cities as fields of experimentation is suggested, through participatory activities, such as living labs, and through innovative tools, such as digital twins. Moreover, the Framework aims for the realisation of sustainable Connected, Cooperative and Automated Mobility (CCAM). Specific topics under the Horizon Europe R&I Framework Programme are directed towards this purpose. Finally, transport innovation is promoted to support the "100 Climate-Neutral and Smart Cities by 2030" mission. The particular mission is one of the five EU missions for the current Programming Period, which essentially comprise coordinated actions, including research and

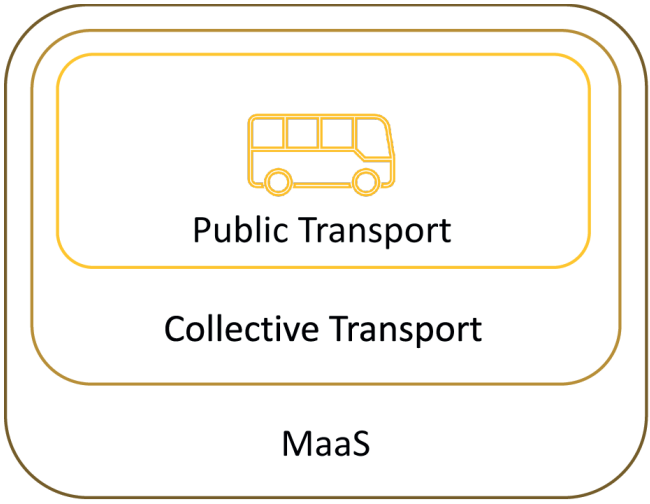


*Fig. 3. Public transport as the backbone of collective transport in EU cities according to the New EU Urban Mobility Framework (source: own elaboration from (European Commission, 2021))*

innovation, funding, policy, regulation, information sharing and stakeholder mobilisation, to deliver 100 smart and carbon neutral cities across the European Union (European Commission, 2021). In contrast to the public transport system, the pandemic favoured active transport and micromobility due to social distancing and the need for outdoor activity. According to the New EU Urban Mobility Framework, micromobility can complement public transport to provide attractive, competitive and low emission solutions for "door-to-door" trips. It is worth mentioning that a SUMP Topic Guide on the safe deployment of micromobility devices for planners and local authorities has been recently developed (European Platform on Sustainable Urban Mobility Plans, 2021). In this context, the Framework stresses the need for specific rules on the safety of micromobility devices. The Framework explicitly refers to the role of digitalisation and data sharing for the effective implementation of NMS, capitalising on the technological advancements of Industry 4.0. In terms of planning for the integration of these new and potentially disruptive services into the urban transport system, the perspective of cities as fields of experimentation is suggested, through participatory activities, such as living labs, and through innovative tools, such as digital twins. Moreover, the Framework aims for the realisation of sustainable Connected, Cooperative and Automated Mobility (CCAM). Specific topics under the Horizon Europe R&I Framework Programme are directed towards this purpose. Finally, transport innovation is promoted to support the "100 Climate-Neutral and Smart Cities by 2030" mission. The particular mission is one of the five EU missions for the current Programming Period, which essentially comprise coordinated actions, including research and innovation, funding, policy, regulation, information sharing and stakeholder mobilisation, to deliver 100 smart and carbon neutral cities across the European Union (European Commission, 2021).

## Assessment of the implementation of NMS in Greek cities based on the overview of SUMPs

In order to assess the progress in the implementation of NMS in Greek cities, an overview of the corresponding SUMPs was conducted, using the CIVITAS SUMPS-UP registry and the SUMP Observatory of the Sustainable Mobility Unit of the National Technical University of Athens. The SUMPs were considered as a valuable source of information because they comprise the main strategic plans for sustainable mobility in Greek cities with a long-term vi-

| Perspective | Opportunities | Challenges |
|---|---|---|
| Citizens and society | • Increase mobility alternatives, and decrease private mode dependency and personal travel costs<br>• Improve accessibility for people with mobility impairments, limited budget and vulnerable users in general<br>• Provide attractive and dynamic service to user-oriented mobility needs<br>• Offer new opportunities for the local digital and green economy | • Establish governance strategy and attract investment with a clear citizen/society-oriented perspective<br>• Develop adequate infrastructure for digital connectivity and physical access for "door-to-door" traveling<br>• Access to data and know-how for the implementation of new technologies<br>• Increase awareness, control and incentivisation to change the current "mobility culture", such as the attachment to the private car |
| Spatial development | • Enhance spatial accessibility and connectivity of under-serviced areas (e.g. areas with low coverage by public transport)<br>• Create new connections and interactions between areas, leading to new sustainable development opportunities | • Ensure that the NMS business models for under-serviced areas are economically viable, resilient and competitive<br>• Exchange data and information and establish cooperation between the transport and other sectors of the local economy |
| Built and natural environment | • Reduce congestion in central areas, and cut emissions, fossil fuel dependency and energy consumption<br>• Improve the quality of urban environment, and free public space for sustainable urban development | • Manage the transition to NMS and the changes in travel patterns and the potential increase in travel demand, due to improved mobility services<br>• Establish integration and complementarity between different planning jurisdictions |

*Table 4. Opportunities and challenges from the adoption of NMS in Greek cities (source: own elaboration)*

sion which covers the current EU Programming Period and its policy priorities for urban mobility. According to national law (N. 4784/2021), all urban areas with population more than 30,000 were obliged to conduct a SUMP by 2022, with a time horizon of at least 10 years. The current overview is based on the web-search of the SUMPs of 76 municipalities in Greece. The search showed that the availability of information on the internet depends on the case and ranges from isolated announcements to detailed SUMP websites (as it is foreseen by the national law) with specific deliverables and dissemination material. Each SUMP refers to the specific mobility and accessibility challenges of each city, considering its size, location, spatial features and socio-economic development goals. Despite the different contexts, all SUMPs aim for boosting sustainable urban development by decreasing private car dependency and promoting active and public transport. Furthermore, a common characteristic of many Greek SUMPs is that they include proposals for shared micromobility systems. A closer reading of most of the available SUMPs suggests that the proposed measures to promote shared micromobility are somewhat vague, without explaining the complementarities with the public transport system nor the safe integration to the transport network, as suggested by the EU policy. Moreover, reference to MaaS is scarce, while there is no coverage of the issue of autonomous mobility. Overall, the current SUMPs of Greek towns and cities cover some aspects of the EU vision to promote urban sustainability through NMS, but not in a systematic way and without fully adopting the different dimensions of the relevant EU policy.

## Framework of opportunities, challenges and planning recommendations

If appropriately adapted to the local conditions, trends and aspirations, new technologies and innovative approaches can contribute towards addressing the problems of mobility and accessibility and accelerating the shift to urban sustainability. On the other hand, the adoption of NMS may not be so effective in the long run, if based on general recommendations without specific measures to ensure the acceptance and support by the public and stakeholders, the integration and contribution to the existing infrastructure, services and operations and the assessment of impacts on sustainable urban development.

According to the conceptual approach of the Urban Mobility Innovation Index 2021 (UMii, 2021),

the challenges for the adoption of innovation in urban mobility can be catecorised into three types:

- Readiness, in terms of the clear strategic vision for the future, the setting of tangible goals and the institutional and operational capacity, as well as the data and knowledge base, to reach them.
- Deployment, i.e. the actual implementation of innovation by addressing regulatory obstacles, attracting investment and engaging the public and stakeholders in participatory actions.
- Liveability, in terms of the assessment and evaluation of the impacts on mobility and accessibility, socio-economic development and environmental sustainability.

The challenges for the integration of NMS into the transport system of Greek cities is based on the above conceptual framework. The opportunities and challenges are described in Table 4, from the perspective of: citizens and society; spatial development; built and natural environment.

In order to address the above challenges and take full advantage of the opportunities offered by NMS, recommendations are presented below, deriving from the current transport planning trends, as well as from the SUMP guidelines (Rupprecht Consult (ed.), 2019). In terms of public participation, most of the implemented SUMPs in Greece focus on public consultation for the analysis of the current situation and the collection of opinions regarding the planned interventions. A stronger participatory approach in all SUMP stages, including the adoption of specific roles and responsibilities in the implementation, monitoring and evaluation of the suggested policies and measures is proposed to ensure that the citizens, as end-users, and the stakeholders share the city's vision for NMS and engage to its realisation. Towards this purpose, inclusiveness of different social groups should be ensured by developing a systematic participatory planning approach and by combining physical and digital participatory tools, as suggested by the international practice (REA, Aalto University, 2024); (Staffans, Kahila-Tani, & Kytta, 2020). Supported by stakeholders and users, city authorities should be able to design more ambitious and innovative strategies, considering the whole array of available NMS solutions and capitalising on their competitive advantages. However, the potential disruptions and uncertain impacts related to NMS (Mubiru & Westerholt, 2024), require the development of an action plan for sustainable mobility, which would support the SUMP implementation. This action plan should ensure the effective coordination of planning, funding, application and evaluation processes in the context of the balanced development of the multimodal urban transport system. It should also account for the complementarities between the national, regional and local planning institutional and planning frameworks in all related disciplines, such as mobility, environment, climate, energy, land use, welfare, production, commerce etc. Local knowledge and expertise should be fully incorporated into the mobility plans by involving, for example, initiatives for local mobility management plans and contributions by the scientific community, such as the local research institutes and university departments.

## Conclusions:

The current paper provides a comprehensive analysis of the strategic orientations of the EU regarding NMS and urban mobility. Moreover, it assesses the adoption of NMS by Greek cities, according to their SUMPs, and highlights the related opportunities and challenges. Finally, a series of planning recommendations are proposed to enhance the current practice of the Greek SUMPs.

The promotion of sustainability has been a constant goal of development policies for more than three decades. Cities, attracting a great share of population and socio-economic activity, generate a significant impact on the social, economic and environmental aspects of sustainability, while they play a pivotal role in the implementation of policies to accelerate the shift towards environmentally friendly, low-carbon, energy efficient and socially inclusive development. The acceleration of the "sustainability shift" is nowadays considered necessary, due to the emergence of the climate crisis, and possible, due to the technological advancements of Industry 4.0. The urban transport system is one

of the sectors that receive the increasing attention of policy makers, with the integration of new and innovative mobility services perceived as the means to develop effective, affordable and low-emission travel choices for all. The augmented focus of EU transport policy on NMS is evident from the analysis of the "Sustainable and Smart Mobility Strategy" and the "New EU Urban Mobility Framework". The implementation of the corresponding policy priorities at the urban level in EU should be described in the SUMPs, which comprise the strategic planning frameworks of cities regarding transportation and mobility. In the case of Greece, the overview of the SUMPs shows a strong commitment to enhance sustainability, as well as to adopt NMS, mainly in the form of shared micromobility. However, there are persisting challenges for the adoption of mobility innovation in Greek cities. These challenges can be summarized into conflicting policies and measures, gaps in infrastructure, data and governance, limited know-how and resources, poor citizen awareness and low interaction with the local community. These challenges can be considered as barriers for the effective integration of NMS in the multimodal urban transport system and the full exploitation of their potential. The examined SUMPs also lack ambition in terms of taking advantage of all possible NMS solutions which are currently practiced or developed worldwide. The starting point for addressing those challenges from the planner's perspective is the stronger engagement and commitment of the local community in terms of stakeholders, users and experts. Stronger public participation though appropriately designed physical and digital participatory planning tools can contribute to this purpose. In addition, a detailed action plan may support the implementation of the SUMP by organising and coordinating priorities, jurisdictions and funding opportunities. The results from the current analysis can be used by local authorities to increase their understanding of the key-issues regarding the advantages and challenges related to NMS and their potential to promote sustainable urban development. Based on the proposed background, similar analyses can be conducted in other countries in Europe and other parts of the world, as both the enhancement of sustainable urban development and the evolution of NMS are global concerns. As a follow-up research, the analysis of challenges, opportunities and recommendations for the implementation of NMS in Greek cities is planned to be validated and enhanced through surveys with the participation of local authorities, stakeholders, users and experts. The contribution of local authorities and experts will be also sought to determine the components and design the methodology for the proposed action plan.

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