

Navigating Urban Spaces: The Enablers and Barriers of Micromobility

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Abstract This policy paper examines micromobility's transformative role within urban transportation, highlighting its potential to enhance sustainability, accessibility, and livability. Micromobility, defined by lightweight vehicles such as e-bikes and scooters, presents viable solutions for reducing urban congestion, emissions, and improving public health. Despite these advantages, significant barriers hinder widespread adoption, including regulatory ambiguities, insufficient infrastructure, safety concerns, and public skepticism. Additionally, the paper explores "Micromobility as a Service" (MaaS) as an emerging model promoting shared, accessible, and integrated urban mobility options. Synthesizing insights from the European Green Deal, SAE J3194™ standards, and the LIFE2M (2022) project, this analysis identifies key enablers for micromobility's expansion: technological innovations like hybrid supercapacitor technology, shifting consumer preferences towards shared mobility, and proactive urban planning strategies. The paper further outlines persistent challenges facing micromobility and MaaS implementation, recommending policy interventions to address these barriers. These recommendations include harmonizing regulations, targeted infrastructure investment, and strategies aimed at improving safety and public perception. Ultimately, the paper advocates for collaborative policy frameworks among stakeholders to leverage micromobility and MaaS as cornerstones of sustainable urban development.

Keywords: Policy framework, Mobility as a Service (MaaS), Micromobility, Urban Mobility, Sustainable Transportation, Urban Planning, Environmental Impact, Transportation Barriers, Safety Regulations

Introduction

The rise of micromobility offers substantial urban advantages, such as reduced traffic congestion, lower emissions, improved air quality, reduced noise pollution, and enhanced public health through increased physical activity. Furthermore, micromobility complements public transit systems by addressing connectivity gaps, notably between transport stations and final destinations.

Despite these benefits, micromobility adoption remains limited due to safety concerns, insufficient infrastructure, and regulatory complexities. The ITF emphasizes substantial investment in dedicated, protected micromobility infrastructure networks, safer vehicle designs, lower operating speeds, and robust data collection to mitigate these challenges. Improved regulatory frameworks are also essential to support micromobility's broader integration into urban transportation systems.

This paper examines key factors influencing micromobility adoption identified through EU initiatives, discussing both critical enablers and persistent barriers. It highlights policy strategies to enhance the role of micromobility in sustainable urban development.

Methodology

This policy paper employs a qualitative analytical approach, synthesizing existing literature, regulatory standards, and recent EU project findings to explore micromobility adoption in urban environments. The analysis incorporates the SAE J3194™ classification framework to clearly define and categorize micromobility vehicles, ensuring clarity and consistency throughout the discussion. Key policy documents, notably the European Green Deal and insights from the (LIFE2M, 2022) project, are systematically reviewed to identify enablers and barriers to micromobility implementation. Emphasis is placed on technological innovations, specifically hybrid supercapacitor technologies, and their role in enhancing the economic viability and practicality of micromobility. Additionally, the research evaluates the growing phenomenon of Micromobility as a Service (MaaS), considering its potential and limitations. Through an integrated review of reports by the International Transport Forum (ITF) and related scholarly articles, critical infrastructural, regulatory, and safety challenges are outlined. Finally, the methodology involves synthesizing recommendations aimed at policymakers and stakeholders, proposing targeted interventions to foster micromobility integration into urban transport systems, thus aligning with sustainability and urban livability objectives.

1. Enablers of Micromobility

Micromobility adoption is driven by technological advancements, shared mobility trends, shifting consumer preferences particularly among Millennials and significant venture capital investments. Innovations like dockless vehicle-sharing systems increase flexibility, affordability, and accessibility, fostering micromobility's attractiveness. Developments in battery technologies, strongly supported by the European Green Deal's goal of climate neutrality by 2050, significantly enhance electric mobility's sustainability and economic feasibility (Ruggieri, 2021). Additionally, hybrid energy storage systems (HESS) combining supercapacitors and batteries offer rapid charging capabilities, prolonged lifespan, and improved vehicle performance. Supportive urban policies aimed at reducing congestion and emissions further enable micromobility's growth by facilitating dedicated infrastructure investments and regulatory frameworks (POLIS, 2019).

2. Barriers to Micromobility

Despite clear benefits, micromobility faces substantial challenges that limit widespread adoption. Safety concerns (Comission European, 2021) stemming from inadequate infrastructure, mixed-traffic risks, and insufficient dedicated pathways represent critical barriers. Practical issues such as limited cargo space, cost concerns related to vehicle rental and maintenance, registration complexities, and geographical coverage constraints further impede micromobility's attractiveness. Additional barriers include adverse weather conditions, poor road maintenance, limited availability of safety equipment (helmets), vehicle damage and theft risks, health limitations among certain populations, and COVID-19 sanitation concerns (Abduljabbar, 2021). Addressing these barriers through comprehensive policy initiatives (Oeschger, 2020), enhanced infrastructure investments, and improved operational practices are crucial for the successful integration of micromobility in urban transportation systems.

3. Mobility as a Service

Transportation significantly contributes to urban pollution, predominantly due to internal combustion vehicles. Electrification and compact micromobility vehicles such as e-bikes and e-scooters offer solutions by reducing congestion, emissions, and noise pollution (Sayed, 2023). Shared micromobility schemes, which now exist in over half of European cities, provide flexible, efficient urban transport. According to New Mobility Atlas, dockless micromobility services are available in 1,200 cities across 66 countries, operated by over 150 companies, with rapid global growth indicating strong potential for continued adoption.

Conclusion

Micromobility represents a significant opportunity to transform urban transportation systems, addressing critical challenges related to congestion, emissions, public health, and urban livability. As demonstrated, the widespread adoption of lightweight vehicles such as e-bikes and e-scooters, supported by Mobility as a Service (MaaS) schemes, offers sustainable solutions aligned with global environmental objectives, including the European Green Deal and United Nations Sustainable Development Goals. Key enablers, such as technological advancements in battery systems and hybrid supercapacitors, user-centric shared mobility platforms, and proactive urban policies, play pivotal roles in accelerating micromobility uptake. Nevertheless, persistent barriers primarily infrastructural inadequacies, safety concerns, regulatory ambiguities, and practical limitations continue to limit broader integration into daily urban mobility practices. Overcoming these barriers requires targeted interventions, including comprehensive investment in dedicated and safe infrastructure, harmonization of regulatory frameworks, and enhanced user experience through better vehicle design and service accessibility. Future policy should focus on fostering collaboration among policymakers, urban planners, private-sector stakeholders, and communities to ensure micromobility effectively complements existing public transportation systems. This integrated approach will not only enhance urban mobility but also actively contribute to sustainability, equity, and improved public health outcomes in cities worldwide.

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