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The Future of Urban Mobility: Electric and Shared Transportation

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ABSTRACT

As cities worldwide grapple with population growth, congestion, pollution, and limited resources, the transformation of urban mobility is imperative. This paper examines the evolving dynamics of urban transportation through the lens of two converging trends: electrification and shared mobility. Historically dominated by private car ownership and fossil fuels, urban transport systems are undergoing rapid change due to environmental, technological, and societal shifts. Electric vehicles (EVs), including buses, cars, and micro-mobility devices, offer cleaner alternatives to traditional combustion engines, while shared transportation models ranging from car-sharing and ride-hailing to bike and scooter-sharing optimize vehicle use and reduce congestion. This integration of electric and shared systems, supported by policy initiatives, digital platforms, and infrastructure investments, is reshaping city landscapes, reducing emissions, and redefining accessibility. Despite challenges in cost, regulation, and adoption, the synergy between electric and shared transport modes offers a sustainable pathway for urban mobility, aligning economic efficiency with environmental responsibility.

Keywords: Urban mobility, electric vehicles (EVs), shared transportation, sustainability, ride-hailing, micro-mobility, car-sharing, smart cities.

INTRODUCTION

Urban mobility encompasses a myriad of transport patterns that involve the movement of people and goods throughout urban areas. The significance of urban mobility arises from the growing necessity for efficient and sustainable transport solutions that can accommodate the dense and complex fabric of the modern city landscape. Current mobility projections indicate a potential fourfold increase in passenger-kilometres between the years 2005 and 2050. This substantial growth corresponds to an increased reliance on personal vehicles, a trend that poses significant sustainability challenges due to the array of negative externalities associated with such transportation modes. Furthermore, both electromobility and shared transport constitute fundamental components that are crucial for the future of urban mobility. Electromobility, while not a recent concept, has yet to achieve widespread mass adoption despite its potential environmental benefits. On the other hand, shared transport was introduced in the 1970s as a means to enhance the efficiency and sustainability of urban mobility, yet its diffusion has remained limited for several decades. It is only in more recent years that shared transport systems have gained popularity and become more widespread in urban settings, highlighting the evolving dynamics of transportation methods in response to urban challenges [1, 2].

Historical Context of Urban Transportation

The rise of electric and shared transportation, along with digital technologies, is transforming urban mobility by lowering emissions and resource consumption. Transportation-network companies (TNCs) like Uber and Lyft are changing traditional models, promoting on-demand mobility and underscoring the link between electric and shared transport. Global greenhouse-gas emissions from transport rose nearly 70% from 1990 to 2015, with road transport and aviation responsible for over 95% of direct CO2 emissions. In 2019, one in four cities faced congestion over 300% higher than free-flow conditions, causing an average delay of 22 minutes per trip. Traffic congestion worsens health problems due to road-

transport air pollutants, leading to an estimated 107,000 to 262,000 premature deaths globally each year. These issues question the sustainability of current urban mobility models. Two pivotal trends are poised to reshape future urban transport: the adoption of electric vehicles (EVs) and a shift toward access over ownership. The rapid electrification of transport is promising for urban sustainability. This access model promotes alternatives like shared transport and ride-hailing, even as vehicle dependency remains high, with rising car ownership in major cities. The combination of electrification and sharing may significantly influence urban infrastructure, though the full implications of these changes are still largely unknown [3, 4].

Current Trends in Urban Mobility

The evolving nature of urban transportation gives rise to a number of ongoing trends and themes. The concept of city life is rapidly transitioning from individual ownership to collective access, and from combined manual and fuel-based means to driverless and electric alternatives. Transportation systems evolve from stand-alone entities to integrated components within larger ecosystems. These shifts indicate substantial reach and amplitude. Shared and electric transportation are driving the majority of new developments in the contemporary urban mobility setting. Both play a pivotal role in the cross-cutting political theme of economic, social, and environmental sustainability. Policy representatives have openly expressed interest in the improvement of both forms. Electric and shared transportation continuously appeal to industry leaders as profitable sectors. Everyday citizens have displayed a commitment to their adoption and usage. The prevalence of shared electric vehicles (EVs) continues to rise at an unparalleled pace. New third-party platforms have expanded the coverage of peer-share and car-sharing programs, allowing individuals to travel with near unbridled autonomy. Ride-hailing businesses achieve growing popularity by swiftly delivering passengers to specific destinations. Variations on the shared concept emerge as well: micro-mobility, single-occupant vehicles, and shared transit. Uber, Lyft, Zipcar, bike-share, and scooter-share represent only a fraction of the available options, and innovative prospects develop at a nearly monthly frequency. The automotive sector likewise experiences a palpable resurgence. Industrial titans return to prime positions in the public eye by collaborating with creative partners to develop new forms of shared and electric vehicles geared toward urban and suburban markets [5, 6].

Electric Vehicles in Urban Settings

Electric vehicles are now common in urban areas, generating no pollution, such as particulates or nitrogen oxides. Cities like London, New York, and Paris have become testing grounds for advanced electric vehicle operations. These vehicles can be adapted for different categories, from two-wheelers to large trucks and buses. Improved battery and motor technologies have enhanced their performance and range. Opportunities for electrification exist in owned vehicles, taxis, and ride-hailing services, particularly in urban settings where operations are predictable. Specialized vehicles like delivery and municipal vans are easier to electrify due to manageable routes, reducing infrastructure needs. Research indicates that electric mobility services can meet travel demand without requiring ownership. Ride-hailing services have shown that exposure to electric vehicles correlates with a greater willingness to buy them. The rise of autonomous vehicles using advanced sensing and intelligence adds to the electric mobility appeal. When paired with connected vehicle systems, these autonomous electric vehicles promise an enhanced driving experience, potentially boosting battery electric vehicle market shares. Companies like Tesla, General Motors, and Waymo are developing autonomous electric vehicles, suggesting that the future of personal mobility will integrate electric vehicles with new mobility technologies [7, 8].

Shared Transportation Models

Shared transportation models appear in different configurations. Modes such as car-sharing and ride-hailing services cater to longer-distance travel and interregional connectivity, while micro-mobility options—encompassing bicycles, e-bikes, and e-scooters address the demand for short-distance, intra-urban journeys. Such shared mobility platforms, leveraging digital connectivity, meet diverse travel needs and possess the potential to transform overall urban mobility and spatial landscapes. Car-sharing, for example, has attracted millions of users worldwide and generally yields positive effects on energy consumption and greenhouse-gas emissions, particularly when low-polluting vehicles are employed. The advent of automated shared-mobility services further complicates system design; questions arise regarding appropriate fleet sizing and operation strategies, with attendant impacts on mobility patterns, urban form, and environmental outcomes. While automation can reduce the requisite fleet size and parking infrastructure, it may simultaneously elevate travel demand and energy consumption, draw new user groups into the market, and exacerbate traffic congestion unless managed with care. Because these shared models rely heavily on electric vehicles, they naturally integrate with electrification efforts in the urban transport sector [9, 10].

Integration of Electric and Shared Transportation

Electric mobility and shared mobility schemes are both transportation innovations providing cost-effective solutions for urban travelers. Individual private electric vehicles (EVs) imply electrification, whereas shared EV systems and car-sharing schemes exhibit different vehicle ownership structures. The integration of long-term EV car leases with car-sharing systems has been studied to meet travel demands efficiently. Car-sharing systems allow users temporary rental of vehicles for specific trips, serving as an effective alternative to private car ownership and encouraging sustainable transportation. Newly launched car-sharing schemes have been applied to deliver electric car-sharing operations that diminish maintenance and aggregation costs. Hybrid models such as long-term lease and car-sharing are employed to balance the cost-effectiveness and sustainable benefits of vehicle electrification and sharing. However, these approaches require full integration of motion planning and charging strategies to avoid overstock and power outages. Several charge scheduling schemes have been developed to address the battery swapping problem for such systems. The combination of EVs, sharing, and ride services suggests that most urban transport trips will soon incorporate all three components, vastly improving the sustainability and efficiency of urban mobility [11, 12].

Impact on Urban Infrastructure

Electric and shared transportation exert a profound impact on cities. Electric vehicles, with limited range and the need for frequent charging, influence urban form and travel patterns. Charging infrastructure requires space and strategic placement that shape movement and access. Wide availability at residences and public locations facilitates adoption. Shared mobility and especially fleets of highly automated electric vehicles transform a city's original street layout into one suited for service rather than private possession. The transition to electric and shared transport invites a broader view of urban mobility and a reassessment of yesterday's patterns. As the two concepts become highly intertwined, the need for a holistic urban strategy grows. Individual ownership becomes a less reliable measure of success, because electric vehicles may be privately owned but shared, and shareable vehicles are often privately owned and privately driven. Both context and conditions drive evident preference for integrated rather than exclusive models [13, 14].

Policy and Regulation

Government agencies around the world play an incredibly crucial role in facilitating and supporting the significant transition to electric and shared mobility options. This responsibility is especially important in large cities, where the rapid adoption of these sustainable alternatives is becoming increasingly feasible and practical for residents. Policymakers and government officials actively work to foster the development and seamless integration of both electric and shared modes of transport, placing a substantial emphasis on sustainability and environmental responsibility to combat pollution and reduce carbon footprints. Legislation in many regions often provides various incentives to encourage the use of lower-carbon vehicles and consistently promotes the innovative concept of vehicle sharing. There are a large number of initiatives focused specifically on electric shared mobility solutions that aim to enhance the efficiency of urban transport systems. Consequently, it is no surprise that the overwhelming majority of shared vehicles being introduced in major urban areas today are electric. This is largely because government support vigorously drives the adoption of cleaner and more sustainable transportation options in these densely populated and increasingly congested environments [15, 16].

Environmental Impacts

Electric and shared transportation modes have a notable influence on the environmental effects of urban mobility. The development and deployment of electric cars are shaped emphatically by the availability of rapid-charging infrastructure and access to dedicated lanes, which also mitigate penalties in door-to-door travel times. The overhead in door-to-door travel times partly constrains the average number of daily trips that can be undertaken by car-sharing users in urban settings and, consequently, the maximum modal share attainable. Circumstances become more favourable when an integrated public transport system provides a suitable point of access, offering an opportunity that emerges naturally when electric and shared vehicles are bundled under the same service. Environmental benefits stem directly from the widespread adoption of electric-powered vehicles, which naturally curb local emissions and noise pollution, while the dispatching of shared vehicles by the fleet operator optimizes their kilometer performance and utilization rate. Ultimately, electric and shared mobility modes provide a radically different framework for urban transport, contributing decisively to the achievement of ambitious sustainability targets [17, 18].

Economic Considerations

Urban mobility encompasses a wide range of trips that utilize various modes of transport, including private cars, public transportation, cycling, walking, electric scooters, and other models of mobility within the confines of an urban agglomeration. This concept integrates the spatial structure of the urban layout, which includes the arrangement of key destinations within the city, alongside the transport infrastructure that connects these destinations effectively. It also involves the transport technologies and numerous modes of transportation that facilitate these trips, creating a complex system of urban connectivity. Moreover, the cost associated with new transport technologies represents a crucial economic factor that significantly influences the willingness of potential users to adopt and embrace innovative modes of transport and services. While electric and shared transport modes present promising benefits to enhance urban mobility, they necessitate substantial investments in infrastructure. Additionally, these new models may come with elevated service charges, which could ultimately deter users from utilizing these modes and limit overall demand for them. Therefore, understanding the interplay between costs, infrastructure investment, and user adoption becomes essential for developing functional urban mobility solutions [19, 20].

Technological Innovations

The natural evolution of urban mobility generates a wide range of innovations that significantly improve and ultimately replace many existing transportation systems and traditional business models. The advent of technological innovation allows for the introduction of new systems to fulfill specific requirements that cannot be adequately addressed by the available existing options; furthermore, disruptive innovations often only need to satisfy a particular niche in order to establish their overall value in the market. The rapid advancements in electric vehicles (EVs) and wireless mobile communication technologies have accelerated the development and widespread expansion of new mobility options such as peer-to-peer (P2P) carsharing and Vehicle-for-Hire (VfH) journeys; interestingly, the latter have been experiencing more rapid growth than many other traditional transportation modes currently available. As a result of these trends, consumers are increasingly adapting their travel behavior and readily adopting novel services that function as complements or effective substitutes to the existing alternatives they previously used. The ongoing changes in urban transportation landscape are indicative of the larger trends toward greater efficiency and convenience within the overall mobility ecosystem [21, 22].

User Acceptance and Behavior

Both electric and shared transportation modes will have limited impact on urban sustainability without adequate and widespread user acceptance. Despite a pronounced consumer awareness of sustainability and significant concern regarding the environmental impact of the motor vehicle, the dominant preference in society still favors outright individual car ownership. Continued widespread acceptance of the private car would severely constrain the ability of future megacities to grow while managing harmful externalities. The acceptance and use of electric technology for private motor vehicles is improving rapidly. Sales continue to grow, supported by robust menu- and performance-based demand models. Early adopters tend to be higher-income consumers, families with two cars, or environmentally minded households, although high exposure alone may hinder acceptance of the technology. By contrast, adoption of shared transportation modes by the broader public has been significantly slower than expected, despite the significant investment by public and private agencies over the past decade. These observations are consistent with economic and behavioral analyses that indicate users require low-cost, low-effort service with both quality and flexibility comparable to private vehicles to be willing to initiate significant changes with typical patterns often characterizing public and private transit. Shared use of automobiles also requires rising levels of trust among strangers and a willingness to entrust everyday mobility to a class of services that remain unproven in terms of safety and reliability [23, 24].

Future Trends in Urban Mobility

Urban mobility the movement of people and goods within cities continues to evolve in response to societal, economic, and environmental challenges. Widespread adoption of electrified and shared transportation modes is already transforming urban infrastructure and usage patterns worldwide. The recent COMPETT project anticipates that technology innovation, the sharing economy, and regulation will accelerate these trajectories. Globally implemented strategies could further hasten the pace of change, but adaptation will remain the primary obstacle to a widespread transition. By 2050, over two-thirds of the global population will be urban. The number of megacities urban areas with at least 10 million inhabitants is projected to double from 33 in 2018 to 43. Urbanization is held responsible for increased congestion, pollution, and reduced air quality. Electrification, driven by public policy and economic factors, presents an opportunity to mitigate emissions and improve sustainability. For example,

Norway's significant progress in vehicle electrification has led to more than 50% of new car sales being electric or hybrid. Implementation remains most complete on a country level, but regional deployment stimulates transition in other sectors [25, 26].

Global Perspectives on Urban Mobility

Globally, the development and the character of public transport and urban motorization vary considerably, with Latin American and Asian cities developing on the premise that the automobile is part of the solution to urban transport problems and car ownership is an important status symbol. European cities are moving the other way they tend to be earlier adopters of innovations and are keener to consider alternative, low-carbon modes and more sustainable urban form. China's urban network has been developing around what will be a world-leading bus rapid transit system, and its seven million urban electric vehicles represent the largest fleet of electric vehicles at the moment. Electric cars and shared transportation models such as car-sharing, ride-hailing, and micro-mobility, including e-bikes, e-scooters, and e-mopeds, are set to play major roles in driving this change. Whole new options for electric vehicles are emerging and theargument that electric vehicles must be shared is also gaining support. The demise or steady decline in the viability of privately owned vehicles is further supporting the case for new electric vehicle business models [27, 28].

CONCLUSION

The future of urban mobility is unmistakably electric, shared, and interconnected. Electric vehicles significantly reduce urban pollution and dependence on fossil fuels, while shared transportation models enhance the efficiency and equity of urban transport systems. The confluence of these two innovations enabled by digital technologies and supported by proactive policy frameworks has the potential to alleviate congestion, lower carbon emissions, and promote sustainable urban development. Nevertheless, realizing the full benefits of this transformation requires strategic infrastructure investment, regulatory alignment, and inclusive planning to ensure accessibility for all urban residents. As urban populations continue to rise, the integration of electric and shared transportation is not merely a trend but a necessity for building resilient, livable, and future-ready cities.

REFERENCES

1. Åkerman J, Kamb A, Larsson J, Nässén J. Low-carbon scenarios for long-distance travel 2060. Transportation Research Part D: Transport and Environment. 2021 Oct 1;99:103010.
2. Lenz B. Development of the Global Mobility Sector. InPowerfuels: Status and Prospects 2024 Dec 6 (pp. 11-39). Cham: Springer Nature Switzerland.
3. Wong YZ, Hensher DA, Mulley C. Mobility as a service (MaaS): Charting a future context. Transportation Research Part A: Policy and Practice. 2020 Jan 1;131:5-19.
4. Vij A. Understanding consumer demand for new transport technologies and services, and implications for the future of mobility. InData-driven Multivalence in the Built Environment 2019 Jul 2 (pp. 91-107). Cham: Springer International Publishing.
5. Cai W, Wu X, Zhou M, Liang Y, Wang Y. Review and development of electric motor systems and electric powertrains for new energy vehicles. Automotive Innovation. 2021 Feb;4(1):3-22.
6. Bogdanov D, Ram M, Aghahosseini A, Gulagi A, Oyewo AS, Child M, Caldera U, Sadovskaia K, Farfan J, Barbosa LD, Fasihi M. Low-cost renewable electricity as the key driver of the global energy transition towards sustainability. Energy. 2021 Jul 15;227:120467. sciencedirect.com
7. Glazebrook G, Newman P. The city of the future. Urban Planning. 2018;3(2):1-20.
8. Li M, Jia Y, Shen Z, He F. Improving the electrification rate of the vehicle miles traveled in Beijing: A data-driven approach. Transportation Research Part A: Policy and Practice. 2017 Mar 1;97:106-20.
9. Roblek V, Meško M, Podbregar I. Impact of car sharing on urban sustainability. Sustainability. 2021 Jan 18;13(2):905.
10. Mavlutova I, Kuzmina J, Uvarova I, Atstaja D, Lesinskis K, Mikelsone E, Brizga J. Does car sharing contribute to urban sustainability from user-motivation perspectives?. Sustainability. 2021 Sep 24;13(19):10588. mdpi.com
11. Alam T, Gupta R, Nasurudeen Ahamed N, Ullah A, Almaghthwi A. Smart mobility adoption in sustainable smart cities to establish a growing ecosystem: Challenges and opportunities. MRS Energy & Sustainability. 2024 Sep;11(2):304-16. researchgate.net
12. Jamjuntr P, Techawatcharapaikul C, Suanpang P. Adaptive Multi-Agent Reinforcement Learning for Optimizing Dynamic Electric Vehicle Charging Networks in Thailand. World Electric Vehicle Journal. 2024;15(10):453.

13. Latinopoulos C, Patrier A, Sivakumar A. Planning for e-scooter use in metropolitan cities: A case study for Paris. Transportation research part D: transport and environment. 2021 Nov 1;100:103037. [HTML]
14. Kim H, Hartmann N, Zeller M, Luise R, Soylu T. Comparative tco analysis of battery electric and hydrogen fuel cell buses for public transport system in small to midsize cities. Energies. 2021 Jul 20;14(14):4384.
15. Dhankhar S, Sandhu V, Muradi T. E-Mobility Revolution: Examining the types, evolution, government policies and future perspective of electric vehicles. Current Alternative Energy. 2024 Jan;6(1):E24054631308595.
16. Pollák F, Vodák J, Soviar J, Markovič P, Lentini G, Mazzeschi V, Luè A. Promotion of electric mobility in the European Union—Overview of project PROMETEUS from the perspective of cohesion through synergistic cooperation on the example of the catching-up region. Sustainability. 2021 Feb 1;13(3):1545. mdpi.com
17. Dlugosch O, Brandt T, Neumann D. Combining analytics and simulation methods to assess the impact of shared, autonomous electric vehicles on sustainable urban mobility. Information & Management. 2022 Jul 1;59(5):103285.
18. Kovačić M, Mutavdžija M, Buntak K. New paradigm of sustainable urban mobility: Electric and autonomous vehicles—A review and bibliometric analysis. Sustainability. 2022 Aug 3;14(15):9525.
19. Elassy M, Al-Hattab M, Takruri M, Badawi S. Intelligent transportation systems for sustainable smart cities. Transportation Engineering. 2024 Jun 1;16:100252.
20. Thombre A, Agarwal A. A paradigm shift in urban mobility: Policy insights from travel before and after COVID-19 to seize the opportunity. Transport Policy. 2021 Sep 1;110:335-53.
21. Kashem MA, Shamsuddoha M, Nasir T. Sustainable transportation solutions for intelligent mobility: a focus on renewable energy and technological advancements for electric vehicles (EVs) and flying cars. Future Transportation. 2024 Aug 12;4(3):874-90.
22. Abro GE, Zulkifli SA, Kumar K, El Ouanjli N, Asirvadam VS, Mossa MA. Comprehensive review of recent advancements in battery technology, propulsion, power interfaces, and vehicle network systems for intelligent autonomous and connected electric vehicles. Energies. 2023 Mar 22;16(6):2925. mdpi.com
23. Basu R, Ferreira J. Sustainable mobility in auto-dominated Metro Boston: Challenges and opportunities post-COVID-19. Transport Policy. 2021 Mar 1;103:197-210.
24. Roca-Puigròs M, Marmy C, Wäger P, Müller DB. Modeling the transition toward a zero emission car fleet: Integrating electrification, shared mobility, and automation. Transportation Research Part D: Transport and Environment. 2023 Feb 1;115:103576. sciencedirect.com
25. Gu D, Andreev K, Dupre ME. Major trends in population growth around the world. China CDC weekly. 2021 Jul 9;3(28):604.
26. He C, Liu Z, Wu J, Pan X, Fang Z, Li J, Bryan BA. Future global urban water scarcity and potential solutions. Nature communications. 2021 Aug 3;12(1):4667. nature.com
27. Ou S, Hsieh IY, He X, Lin Z, Yu R, Zhou Y, Bouchard J. China's vehicle electrification impacts on sales, fuel use, and battery material demand through 2050: Optimizing consumer and industry decisions. Iscience. 2021 Nov 19;24(11).
28. Zhao Y, Jiang Z, Chen X, Liu P, Peng T, Shu Z. Toward environmental sustainability: data-driven analysis of energy use patterns and load profiles for urban electric vehicle fleets. Energy. 2023 Dec 15;285:129465.

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