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Editorial

Towards Smart and Sustainable Urban Electromobility: An Editorial Commentary

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In the age of anthropogenic climate change, developing smart and sustainable transport systems is among the most popular urban policy debates. Given that the future of urban mobility must be based on renewable energy resources, planning on how to move towards smart and sustainable urban electromobility is critical, and forms the rationale of this paper. In this editorial commentary: (a) The important role of smart and sustainable transport systems in addressing urban and environmental challenges is discussed; (b) The need for and the drivers of smart and sustainable urban electromobility are presented, and; (c) The key issues for establishing a new research agenda for smart and sustainable urban electromobility are listed. The editorial commentary also highlights the overall contributions of the papers of the Special Issue on the state-of-the-art and future perspectives in smart and sustainable urban development.

Today, we are living in a rapidly urbanizing world that accommodates human populations beyond the carrying capacity of our planet [1]. In many developed countries, at present, urbanization levels have reached as high as 80–90%. While generally urban densification is the desired form of growth, only a fraction of urban development is happening in the form of infill development [2]. Most of the growth is expansion towards greenfield—i.e., urban fringes and peri-urban areas—that is ending up forming a large metropolitan conurbation [3]. The result is an unsustainable sprawl and a serious threat to highly sensitive urban ecosystem services [4].

The perils of globally common expansionist urban development patterns are not limited to pollution and urban ecosystem loss only [5,6]. Anthropogenetic climate change, deforestation, biodiversity loss, socioeconomic inequalities, increased natural disasters and health hazards are among some of the consequential negative externalities of such development types [7]. There is, hence, an urgent need for rethinking the sustainability of urban systems and finding ways to reshape, if not rectify, our urban spaces to minimize the undesired consequences of unsustainable anthropogenic activities [8].

For instance, the combination of private motor vehicle dependency, sprawling urban form, and vehicle combustion engine technology makes urban transport one of the major contributors to global greenhouse gas (GHG) emissions [9,10]. Addressing urban transport externalities, whether it is environmental or societal, is a highly challenging task [11,12] It requires sound government policy, commitment, and determination, along with automotive industry transformation and community behavioral change and support [13].

Advanced technological innovations also offer invaluable opportunities to help urban administrators tackle the challenges in establishing smart and sustainable urban transport systems [14]. For example, developments in transport technologies have brought intelligent transport systems a long way from automated traffic signalization to autonomous and connected vehicles [15]. Today, these smart mobility systems are in service in a growing number of cities across the globe—especially in the form of autonomous public shuttle buses [16].

Nonetheless, technological innovations alone are not adequate to turn our transport systems into truly smart and sustainable ones. A critical component of smart and sustain-

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able urban transport is from which source energy of the vehicle is obtained. Electrification in this sense is a good example, as electricity produced from fossil fuels is not sustainable at all [17]. Thus, an electric vehicle is only as sustainable as the source of its power—whether it comes from fossil fuels or renewables, such as solar, wind, tidal and so on [18].

The mode of transport will have to invariably be powered by renewable energies due to serious environmental and societal pressures we are facing today [19]. Electric vehicles, also including hydrogen fuel cell electric vehicles, are an important step towards achieving the smart and sustainable urban transport goal. However, the current global market share of electric vehicles is only about 1%. Besides in many countries, even including developing nations, this figure is very low, such as 0.4% for Australia [20]. Similarly, renewable energy is only responsible for about 29% of global electricity generation, where in many countries this figure is much lower than 20% [21].

Nevertheless, increasing global pressures, especially during the 26th UN Climate Change Conference of the Parties (COP26), have pushed many climate action passive countries, including Australia, for a pro-climate policy change. For example, most recently, the Australian Government adopted a 'technology-led approach' to emissions reduction as one of the most prominent national climate change strategies—others include emissions reduction incentives, regulating emissions, and reporting on emissions [22]. Subsequently, government subsidies for technocentric solutions to sustainability issues, including electric mobility or electromobility uptake, will soon start to become commonplace [23].

In recent years, exponential technological advancements, under the pressure of climate crises, have given birth to many innovative solutions not only in the automotive and energy sectors, but also in urban infrastructure and construction sectors [24,25]. Examples include autonomous and connected vehicles, smart roads and highways, Mobility-as-a-Service (MaaS), photovoltaic solar energy conversion, battery storage of photovoltaic systems, smart grids, smart buildings, and smart homes, and so on [26–29].

Bringing sustainability to urban transport systems via electrification that is sourced from renewables is widely seen as a novel approach [30]. Nonetheless, vehicle electrification is only the tip of the iceberg. In other words, an electric vehicle is not the only required component of electromobility. Achieving electromobility, in the context of sustainable urban transport, also requires system thinking. This includes, but is not limited to, road infrastructure, power transfer systems, renewable energy generators, urban form, user behavior and so on [31–34]. Figure 1 illustrates the main drivers of smart and sustainable urban electromobility.

So far, numerous studies highlighted the challenges of electric vehicle uptake ranging from the cost of the vehicle, distance travelled with a single charge, availability of superfast charging stations, government incentives, battery life, second-hand market, source of electric energy, and so on [35–37]. Besides the vehicle cost issue, the second obstacle concerns vehicle charging matters [38].

The most recent attempts to address the limitations of smart and sustainable urban electromobility see it as an ecosystem that goes behind the vehicle alone, incorporate state-of-the-art technological solutions to the charging problems [39]. To be precise, the installation of a flexible dynamic wireless power transfer system on the main roads facilitates efficient, safe, on-demand, reliable and bi-directional power transfer to electric vehicles [40,41]. In such an ecosystem, another requirement is to develop incentive-based demand management for electric vehicles, including V2G and G2V transfer of power while maintaining stability of the electricity grid, V2G and G2V [42,43].

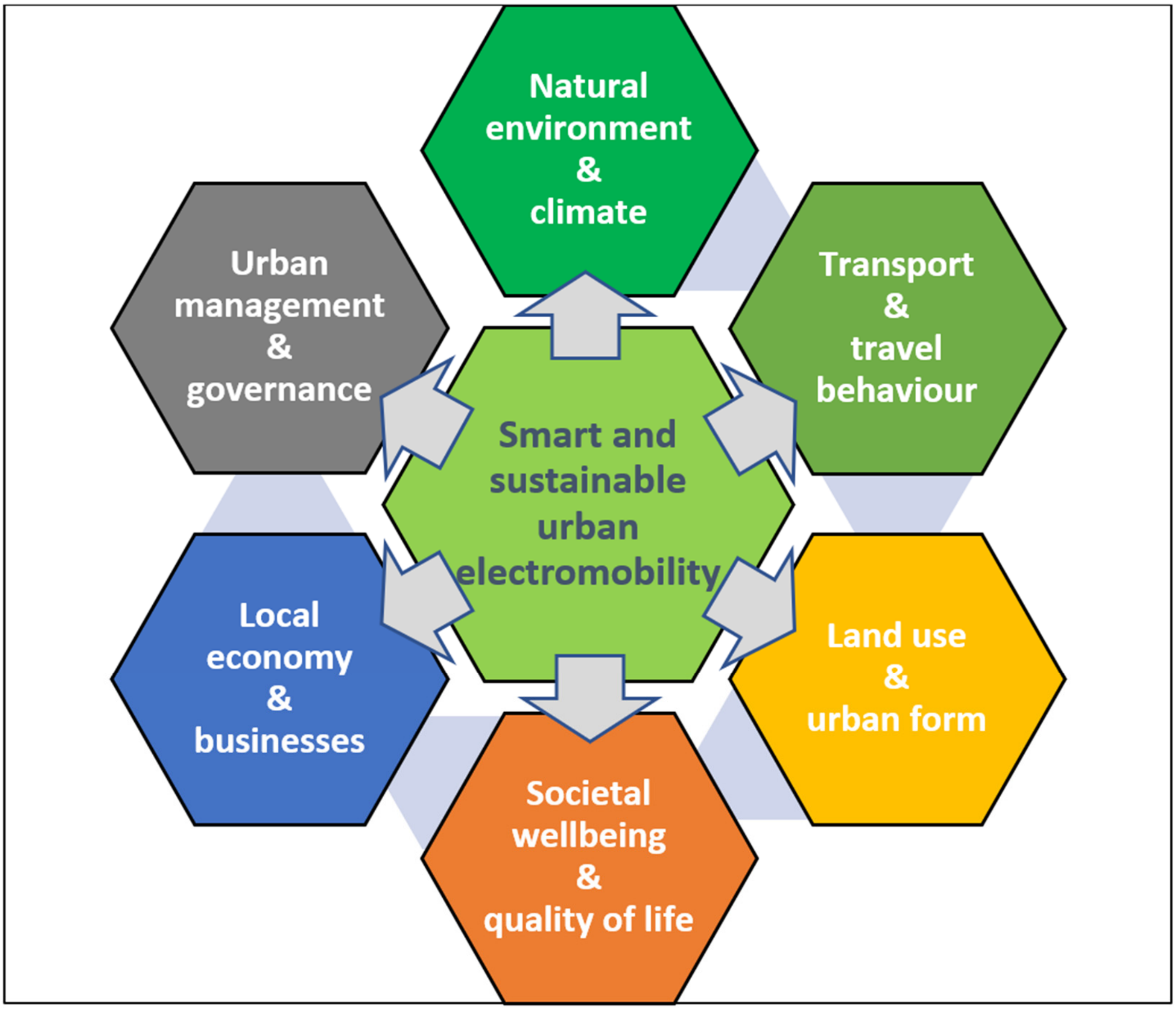

Figure 1. Drivers of smart and sustainable urban electromobility.

Along with the innovative vehicle and power technologies, sustainable electromobility also requires the development of an efficient transportation network with multi objective optimization framework incorporating electrical demand incentives, electric vehicle communication and charging and/or discharging, and urban infrastructure constraints [44–47].

Additionally, redevelopment or restructuring the urban form and main land use destinations, as well as understanding the underlining factors and changing traveler behaviors, accordingly, are important elements of a smart and sustainable urban electromobility ecosystem [48–50].

Given the urgency of establishing smart and sustainable transport systems in cities across the globe, there is a need for thoroughly exploring efficient methodologies towards a smart and sustainable urban electromobility transformation without burdening transportation and electrical grids. Besides, the need for developing technologies, infrastructures, and systems to support the mobile energy needs of urban mobility networks is becoming evident [51]—e.g., Mobile-Energy-as-a-Service (MEaaS).

In this regard, the following questions will be helpful in forming a much clearer view of how to plan for smart and sustainable electromobility in our cities. These questions also contribute to establishing a new research agenda for moving towards smart and sustainable urban electromobility.

- Why is smart and sustainable urban electromobility needed, and how can it help in addressing some colossal urban and environmental problems?

- Which technologies, infrastructures and systems are needed for developing smart and sustainable urban electromobility networks?
- When can smart and sustainable urban electromobility become relatively affordable for wider adoption in cities?
- Where are the most suitable locations to trial and operationalize smart and sustainable urban electromobility systems?
- Who are the key stakeholders of smart and sustainable urban electromobility to support the development and uptake?
- What do experts, authorities, service providers, electric vehicle users, and community at large think on smart and sustainable urban electromobility?
- How can the development and adoption of smart and sustainable urban electromobility systems be incentivized and regulated?

Against the above editorial commentary, the Special Issue on the state-of-the-art and future perspectives in smart and sustainable urban development supports the efforts in improving research and practice in smart and sustainable urbanism. The Special Issue contributes to the conceptual and practical knowledge pools to improve the research and practice on smart and sustainable urban development by bringing an informed understanding of the subject to scholars, policymakers, and practitioners. It offers insights into smart and sustainable urban development by conducting in-depth conceptual debates, detailed case study descriptions, thorough empirical investigations, systematic literature reviews, or forecasting analyses. The Special Issue, hence, forms a repository of relevant information, material, and knowledge to support research, policymaking, practice, and transferability of experiences to address the urbanization and other planetary challenges.

The Special Issue includes the following 20 commentaries, viewpoints, case reports, reviews, and research papers with the input of 76 urban scholars from across the globe:

1. Yigitcanlar, T. Towards Smart and Sustainable Urban Electromobility: An Editorial Commentary.
2. Ullah, I.; Shah, M.; Khan, A.; Maple, C.; Waheed, A.; Jeon, G. A Distributed Mix-Context-Based Method for Location Privacy in Road Networks.
3. Gulati, B.; Weiler, S. Risk, Recessions, and Resilience: Towards Sustainable Local Labor Markets through Employment Portfolio Analysis.
4. Cai, C.; Guo, Z.; Zhang, B.; Wang, X.; Li, B.; Tang, P. Urban Morphological Feature Extraction and Multi-Dimensional Similarity Analysis Based on Deep Learning Approaches.
5. Niemann, L.; Hoppe, T. How to Sustain Sustainability Monitoring in Cities: Lessons from 49 Community Indicator Initiatives across 10 Latin American Countries.
6. Taylor, J.; Jokela, S.; Laine, M.; Rajaniemi, J.; Jokinen, P.; Häikiö, L.; Lönnqvist, A. Learning and Teaching Interdisciplinary Skills in Sustainable Urban Development—The Case of Tampere University, Finland.
7. Guo, N.; Chan, E.; Yung, E. Alternative Governance Model for Historical Building Conservation in China: From Property Rights Perspective.
8. Boguniewicz-Zabłocka, J.; Capodaglio, A. Analysis of Alternatives for Sustainable Stormwater Management in Small Developments of Polish Urban Catchments.
9. Gurieff, N.; Green, D.; Koskinen, I.; Lipson, M.; Baldry, M.; Maddocks, A.; Menictas, C.; Noack, J.; Moghtaderi, B.; Doroodchi, E. Healthy Power: Reimagining Hospitals as Sustainable Energy Hubs.
10. Slater, K.; Robinson, J. Social Learning and Transdisciplinary Co-Production: A Social Practice Approach.
11. Salvia, R.; Egidi, G.; Salvati, L.; Rodrigo-Comino, J.; Quaranta, G. In-Between 'Smart' Urban Growth and 'Sluggish' Rural Development? Reframing Population Dynamics in Greece, 1940–2019.
12. Serrano, I.; Calvet-Mir, L.; Ribera-Fumaz, R.; Díaz, I.; March, H. A Social Network Analysis of the Spanish Network of Smart Cities.

13. Song, Y.; Stead, D.; de Jong, M. New Town Development and Sustainable Transition under Urban Entrepreneurialism in China.
14. Fieuw, W.; Foth, M.; Caldwell, G. Towards a More-than-Human Approach to Smart and Sustainable Urban Development: Designing for Multispecies Justice.
15. Malek, J.; Lim, S.; Yigitcanlar, T. Social Inclusion Indicators for Building Citizen-Centric Smart Cities: A Systematic Literature Review.
16. Wijesiri, B.; Bandala, E.; Liu, A.; Goonetilleke, A. A Framework for Stormwater Quality Modelling under the Effects of Climate Change to Enhance Reuse.
17. E, J.; Xia, B.; Buys, L.; Yigitcanlar, T. Sustainable Urban Development for Older Australians: Understanding the Formation of Naturally Occurring Retirement Communities in the Greater Brisbane Region.
18. Lim, S.; Malek, J.; Yussoff, M.; Yigitcanlar, T. Understanding and Acceptance of Smart City Policies: Practitioners' Perspectives on the Malaysian Smart City Framework.
19. Sabatini-Marques, J.; Yigitcanlar, T.; Schreiner, T.; Wittmann, T.; Sotto, D.; Inkinen, T. Strategizing Smart, Sustainable, and Knowledge-Based Development of Cities: Insights from Florianópolis, Brazil.
20. Yigitcanlar, T.; Cugurullo, F. The Sustainability of Artificial Intelligence: An Urbanistic Viewpoint from the Lens of Smart and Sustainable Cities.

This collection of these 20 papers focused on answering the following overall questions of this Special Issue: (a) What are the critical theoretical and conceptual underpinnings and analytical and policy frameworks of smart and sustainable urban development? (b) What are the critical methodological and technical approaches for the evaluation and forecasting of smart and sustainable urban development? (c) What are the critical technological progresses, developments, and trials concerning the quadruple bottom-line development of smart and sustainable cities? (d) What are the critical global best and good practice smart and sustainable urban development case investigations, demonstrations, and reports? (e) What are the critical smart and sustainable urban development planning, design, applications, and governance models to deliver desired urban outcomes? (f) What are the critical premises, pitfalls, implications, and impacts concerning the future of urbanization and smart and sustainable urban development?

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