International Journal of Social Sciences and Humanities Invention 12(01): 8401-8408, 2025
DOI: 10.18535/ijsshi/v12i01.01
ISSN: 2349-2031
https://valleyinternational.net/index.php/theijsshi

Role of Public Transportation in Reducing Traffic Congestion, Enhancing Connectivity, And Promoting Sustainable Urban Development in Manchester And Shenzhen

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Abstract:

The purpose of this research is to assess the strategies of Manchester, UK, and Shenzhen, China regarding the transportation infrastructure, and more specifically, the part that is played by public transport in the fight against congestion on the roads, the provision of better connectivity, and the support of sustainable growth in cities. Manchester's strategy includes using integrated PT systems, extending the Metro Link tram system, and using digital infrastructure in terms of connectivity as well as improving the experience of the users, targeting the achievement of carbon neutrality by 2038. Shenzhen has expanded its metro system and explored new ways of funding with models like "rail + property" which means that metro station development is combined with the construction of related properties to support the growth of the rail transit system and bring in revenues. Also, the incorporation of AI by the Shenzhen transportation system coupled with the electrification of the transport fleet demonstrates the city's support for green mobility solutions and environmental conservation. The research questions relate to the policy, planning, and governance aspects that have supported the implementation of PTN integration in these cities and the outcomes of these policies on the modal split, traffic congestion, and greenhouse gas emissions. Based on the TOD theory, the paper examines how Manchester and Shenzhen have integrated transportation investments with urban development plans. The study reveals that both cities have effectively expanded the modal shares of public transport and improved the journeys to reduce congested traffic. Shenzhen increased its size in the fastest way and has made the city more habitable and less polluted while Manchester has some difficulties because of the past legacies of infrastructure and the increasing use of private cars. The cases of Manchester and Shenzhen are informative of proper transportation infrastructure development, emphasizing planning, governance, and innovative financing. Thus, by focusing on public transportation and sustainable development, cities around the world can improve the connectivity, quality of the environment, and economic development as well as the creation of sustainable and successful urban societies.

Keywords: Transit, Connectivity, Sustainability, Congestion, Financing.

Introduction

Situated in the south of China, Shenzhen was established as a special economic zone in the 1980s and has ever since developed at a very fast rate(Zhu, 1994). To this end, the city has pumped a lot of resources into the development of its transport system, especially the metro system. At first, the government relied on conventional instruments such as municipal budgets and bank loans for the first phases of the metro. Nonetheless, the costs became much higher and multiplied by ten in the subsequent stages of expansion, where Shenzhen had to resort to more creative funding methods. It used the "rail + property" (R+P) model that integrates the development and funding of new metro stations with the adjacent properties (Potvin). Thus the risk as well as the profit is divided between the government and the metro companies when it comes to the costs and benefits. The R+P model has been mutually beneficial with home values going up by 23% within 400m of the metro stations and 17% within 600m thus adding value to the residents' property and income to the developers who partly finance the infrastructure. This paper also provides implications for other Chinese cities that are interested in replicating Shenzhen's R+P success in sustainable TOD (Zhou et al., 2020). Manchester, a leading digital region in the UK, has also given prominence to public transport to increase integration and the use of green modes of transport. The city has set smart and sustainable development goals including:

• Smart people: thus, ensuring that all the residents acquire the digital skills that can enable them to be active participants in the digital economy.
Digital places: offering everyone, connection and assistance.
Future prosperity: to lure new digital businesses and sectors for the creation of new digital jobs industries.

• Sustainable resilience: achieving net-zero carbon emissions and the development of digital common.

Manchester is in the process of improving the digital infrastructure to accomplish these objectives and it is now treating connectivity as a service. The city is also using data as well as monitoring spatial and sectoral smart and sustainable development impacts. Shenzhen and Manchester reveal that efficient investment into public transportation, creative funding mechanisms, and emphasis on integration and sustainability can become catalysts for the further development of cities. These cases can be useful for other cities that aim to establish efficient transportation networks that would help avoid traffic jams, improve the quality of life, and support sustainable urban development in the long run (Xie et al., 2020).

Over the last few decades, the population and urbanization especially in the large cities of the world have put pressure on the need to build better transport systems to reduce traffic jams, increase interconnectivity, and support the growth of the large cities. Two cities that have done a lot in this aspect include Manchester in the United Kingdom and Shenzhen in China. As for the two cities which are in different historical and socio-economic development processes, both have understood that public transport is one of the most important solutions to the problems of urban mobility. This paper aims to analyze the development strategies of Manchester and Shenzhen about the transportation infrastructure and the role of public transport in their achievement (Ng & Tang, 2004).

Manchester is a city which several years ago was famous for its industries and nowadays has been transformed. The revealed transport plan of the city mainly deals with the integration of different modes of transport such as buses, trams, trains, etc. through projects like the usage of the Metro Link tram to the city and furthering the use of bus priority measures. All these actions are targeted to reduce the usage of private cars, which would consequently solve the issue of traffic and reduce emissions. And, there is a methodical application of smart technologies, as well as big data solutions, which has increased the convenience and efficiency of the public transportation system(Rose, 2017).

For instance, Shenzhen was merely a fishing village in the past, however, within the span of a few decades it has become one of the biggest cities globally. The strategies adopted in the transportation infrastructure development are very good as contain big projects and new ideas. Currently, Shenzhen has one of the biggest and most developed public transport and well-developed metro, many buses, and electric cars. Hence, there is a utilization of modern technologies such as AI and IoT in enhancing the efficiency and environmental friendliness of public transport systems. Moreover, the corresponding city of Shenzhen has set an example for both Chinese and other Global cities toward a sort of shift from electric buses thereby lessening the emission of Greenhouse gases (Dong et al., 2018).

Public transport is among the essential ways of combating traffic congestion as this paper shall soon explain. In Manchester and Shenzhen, it is seen that the appropriate investment made in public transport has resulted in a big shift in mode choice for commuting. Due to credible, cheap, and easily accessible alternatives to private car use, these cities have been able to minimize congestion and therefore time spent on roads. Since the major emphasis has been placed on public transport, the cities and towns have become interlinked and as a result have offered people the opportunities to get jobs, education, and entertainment. This enhanced link can therefore help in enhancing inclusive development and ensure that those from rural areas also benefit from the fruits of modernization brought by urbanization (Li, 2015).

Besides, the promotion of the use of public transport is for the achievement of other sustainable development goals as well. Manchester is already in the process of expanding the Metro Link tram PPP and has recently begun to adopt electric buses for the battle against CO2 neutrality by 2038. Similarly, Shenzhen has also adopted the use of electric motor vehicles and has committed itself to the use of renewable energy would also reduce the emission of greenhouse gases. In this respect, both cities can address transport issues in contemporary society and at the same establish a sustainable environment. For the effective realization of the principles of sustainable and efficient urbanization and the development of transport systems in urban centers, this concept of integrated urban planning should be adopted (Moscholidou, 2022).

Significance of study

This work is useful for the analysis of the strategies for the development of transportation infrastructure in Manchester and Shenzhen as it demonstrates the modern trends in the development of urban transport systems. By comparing Manchester's focus on digital connectivity and Shenzhen's practice of transit-oriented development and its new financial approaches 'rail + property', the study finds out how urban cities can efficiently tackle the issue of traffic congestion, enhance air quality, and stimulate the economic growth by investing in efficient public transport. These findings are crucial for urban planners and policymakers around the world, as they provide real-life examples of how to implement smart technology, encourage public-private partnerships, and synchronize transport development with sustainability objectives. Furthermore, the study highlights how transport infrastructure can lead to sustainable and sustainable cities that can support rapid urbanization without harming the environment and can be used as future models for other cities.

Research Questions

What are the policy, planning, and governance issues that have facilitated the development and integration of PT systems in Shenzhen and Greater Manchester as part of their sustainable urban growth plans?

What effects have the public transportation expansion and integration in Shenzhen and Greater Manchester had on model share,

traffic congestion, and greenhouse gas emissions in these cities?

Theoretical and Conceptual Framework

Transit-Oriented Development (TOD)

A type of urban development that aims at increasing the residential, business, and recreational areas that are within easy access to public transport. A light rail transit station in a downtown node with high residential, employment, and retail density low automobile dependency, and poor street design. The densest areas are identified to be within a 1/4 to 1/2 mile catchment radius from the central transit stop (Cervero, 2005).

Transit-oriented development (TOD) is a concept of urban planning and design that aims to develop a city in a compact and mixed-use manner with pedestrian accessibility to quality transportation systems (Khaderi et al., 2021). The key principles of TOD include:

- Packing people's work, homes, shopping, and other necessities within a 10-minute walk of transit stops
- Designing new neighborhoods that are compact, pedestrian-friendly and bike-friendly to minimize the need for automobiles.

For instance, encouraging the use of both residential, commercial, and institutional land uses to increase the ridership of transit at all times of the day.

Streets and public spaces are designed for people to walk, to cycle, not to drive cars.

TOD seeks to produce 24/7 urban spaces with shorter travel distances, better access to services and jobs, and lower emissions. This involves ensuring that land and transportation are planned in a way that development is focal on the transit stations. Issues related to the current implementation of TOD have been identified even though the concept has been successfully implemented in various cities across the world (Ibraeva et al., 2020).

The success of TOD relies on the context of the city and the characteristics of the Transit-oriented development (TOD) is a concept that underlines the connection between the density and land use and transport planning targeting the establishment of mixed-use centers based on transit lines. This theory is particularly helpful because it directly explains the process of how cities like Manchester and Shenzhen can purposefully enhance their transportation systems to increase mobility and enable sustainable urban expansion (Liu et al., 2020). Here's why TOD is suitable for this paper:

Integration of Land Use and Transportation: As a theory of development, TOD is based on the idea of integrating transportation investments with goals related to urban development, for instance, containment of urban sprawl, provision of mixed land use, and improvement of accessibility to transit systems (Xu et al., 2021).

Promotion of Sustainable Mobility: TOD supports people to use non-automotive means of transport like walking, cycling, or the use of public transport. This is in line with your paper's goal of alleviating traffic congestion and decreasing the emission of greenhouse gases (DeCoursey & Athey, 2008).

Impact on Urban Form and Livability: TOD principles include, creating vibrant centers with good walkability and accommodating local affairs as well as sustainable causes such as social equity and environmental conservation, which are core aspects highlighted in your evaluation of Manchester and Shenzhen's transport strategies (LUCKY, 2021).

Policy Planning and Governance factors

Autonomous Vehicles and Smart Mobility

The two cities could consider Self-driving cars (SDCs) and Intelligent transportation systems (ITS) to improve their transport systems. Here, these cities could help meet the common need to lessen the reliance on private cars, improve traffic organization, and ensure fair distribution of opportunities to use transport services. Mobile applications and platforms of smart mobility could assist with smart organization and management of traveling and inform users in real time (Paiva et al., 2021).

Micro Mobility and Active Transportation

It may be that both Shenzhen and Manchester could look to enhance the alternatives that are available about micro-mobility and active transport to make more appropriate modes of transport. Measures that could help included expanding the state of cycleways and pedestrian infrastructure, establishing bike and e-scooter sharing, and implementing city center car-free zones. This means that if micro-mobility is integrated with the public transport system then the residents can use both means in transporting them from one point to another. Green Energy and Electrification (Olabi et al., 2023).

To reduce the level of harm that transport has on the environment, Shenzhen or Manchester could transition to green energy and electrification more quickly. This could for instance be investment in electric charging infrastructure, promotion of the use of electricity to power transport such as buses and taxis, and methods of providing transport energy through the use of renewable energy. Shenzhen has made a lot of effort on this in terms of transport for instance the electric bus which the city hosts the largest number of globally.

Integrated Land Use and Transportation Planning

Thus, the experience of Shenzhen and Manchester in terms of transportation infrastructure improvements can be enriched with more

integrated strategies of land use and transportation planning. This could include the integration of the provision of new residential and/or commercial land uses with the provision of new public transport facilities, the encouragement of transit-oriented development, and the provision of transportation infrastructure in a way that enhances other economic and social objectives. These cities, if they integrate transportation and land use planning, can enhance the quality of life, sustainability, and equality. Thus, the identified new concepts can help Shenzhen and Manchester to strengthen their positions as pioneers of new ideas in the sphere of transportation infrastructure and sustainable urban development (Ng et al., 2022).

The improvement and connection of PT systems in Shenzhen and Greater Manchester have been shaped by many policies, plans, and governance structures. The national policy framework has been quite enabling in Shenzhen in particular. The National Urbanization Plan of China is one of the central government policies that support the construction of sustainable cities. In addition, being a Special Economic Zone (SEZ) Shenzhen has been able to implement policies with ease and develop at a very fast rate. Shenzhen has been given this special status that has allowed it to come up with new policies and attract investments towards transport development (Hu, 2019).

Shenzhen planning is a combination of both urban and transport planning where the two are intertwined. Transportation is integrated into Shenzhen's urban planning, particularly in the aspects of developing TOD zones to promote transit-oriented development. Comprehensive master plans for transportation have been prepared which entail a well-integrated and extensive network of metro, bus, and bike-sharing systems that are spread all over the city. This concept of integrated planning helps ensure that the transportation systems/feeders are in harmony with the urban growth (Wesson, 1966).

Decision-making authority in Shenzhen is very much centralized with the local government playing a dominant role. The government especially the local government has the responsibility of coordinating and implementing transportation projects. Other aspects of governance also include public-private partnerships (PPPs) through which the private sector is engaged in the provision of funds and management of public transport services. This collaboration has been quite useful in enhancing the provision and development of efficient public transport systems (Roumboutsos et al., 2013).

Shenzhen has also been very advanced in the integration of new technologies. The city has integrated applications of smart technologies such as traffic control and real-time information on public transport. Also, Shenzhen has invested in the electrification of transport with electric buses and taxis being used frequently on the roads to improve environmental conservation(Gabriel & Galvão).

Supportive policies are also significant in Greater Manchester as a policy environment. The devolution agreements have given Greater Manchester much control over its transport policies thus coming up with better solutions. Strategies like the Greater Manchester Strategy are meant to cut down on greenhouse gases and encourage the use of sustainable transport.

Aligning with Broader Environmental Goals

Coordinated planning of transport in Greater Manchester is done by the Integrated Transport Authority called Transport for Greater Manchester (TfGM) which controls all kinds of transport to provide an intermodal system.

The Strategic Transport Plan and the Greater Manchester. Transport Strategy 2040 contains the long-term plan and policy direction for the transport system. This strategy is useful in meeting today's demands while at the same time preparing for future growth (Blakeley & Evans, 2023).

However, Greater Manchester possesses a strong governance system which is the GMCA that allows for decision-making across all the ten councils. This involves the public as well as the stakeholders as they are considered part of the planning process. Thus, the transportation network caters to everyone's needs and choices within society (Ward et al., 2015).

Examples of such investments include Metro Link which is the largest light rail system in the UK, electric cars, and smart ticketing systems. Also, sustainable infrastructure such as cycling and walking paths has been developed to support public transport as well as encourage the use of active mobility to reduce the use of cars (Enoch et al., 2004).

Shenzhen and Greater Manchester have similarities in the aspects that have boosted the development of public transport systems. One major concern is the sustainability of the two cities in that both have committed to moving away from the use of private cars and emissions. The availability of the metro, bus, and cycling options ensures that there is smooth integration of the transport systems and improves the transport network. The most important factor that can be identified as a common characteristic is the large-scale modernization of the public transportation infrastructure with the help of funding from the government, public-private partnerships, and international loans or grants (Zheng & Austwick, 2023).

Some issues are still present, for instance, how to support growth and development while preserving the environment, how to manage technological changes, and how to get the public interested. Nevertheless, well-coordinated and comprehensive public transport systems in Shenzhen and Greater Manchester reveal that proper supportive policies, strategic planning, effective governance, and modern technology can help to overcome the problems of the megacities and develop them sustainably.

Public Transportation Expansion and Integration Efforts

The PT development and integration in Shenzhen and Greater Manchester have brought about major changes in modal share, traffic congestion, and greenhouse gas emissions, although there are differences in their strategies and results.

Shenzhen with the fast development of the city and economic growth has set bold objectives to improve the public transport system. The city has also focused on the construction of a large subway system with well-connected bus lines and other efficient means of transport. This has led to the enhancement of accessibility and connectivity of the public transportation system which has in turn raised the modal share of public transport greatly. Today, a considerable number of Shenzhen's inhabitants are users of these services, which has an impact on the number of private cars (Li et al., 2022).

Hence, traffic congestion in Shenzhen has been reduced to some degree. The well-developed and efficient metro systems and even the bus networks have ensured that people prefer to use public transport as opposed to using their cars, especially in the morning and evening rush hours. The use of this modal shift has not only enhanced the flow of traffic but also helped in reducing greenhouse gas emissions from the transport sub-sector. Thus, Shenzhen has followed the guidelines of China's ecological and city planning policy, specifically regarding the decrease in the use of automobiles that run on fossil fuels (Jiang et al., 2023).

Also, Shenzhen has adopted the management of utilizing electric vehicles in the public transport fleet, in line with the general strategies that China has put in place to tackle pollution and encourage green transport solutions in cities. These measures have not only enhanced the quality of air in Shenzhen but also have given Shenzhen credit for being a global city in providing sustainable transport facilities.

Greater Manchester

On the other hand, Greater Manchester has not relied on the construction of new and extensive networks but on how to improve the link between the already existing ones. The city region has also provided funds for better buses, better cycleways as well as an expansion in trams to make it easier for the suburbs to connect with the main city. These measures are designed to cut the use of cars, enhance accessibility, and eliminate traffic jams (Hodson et al., 2013).

The changes made to modal share in Greater Manchester have been steady and mostly have had a positive effect. Looking at the Metro Link tram system for example, this has given the people another means of transport that is better than the use of cars especially when going to work from other towns. Nonetheless, there are still issues in encouraging more people to shift from private cars to public transport even though there is the potential to do so; this is because much of the developed areas have been designed and built with car infrastructure (Senior, 2009).

Traffic congestion in Greater Manchester has proved to be somewhat unpredictable. Although funding has been made for trams and buses to reduce traffic on certain roads, there are still traffic jams in certain areas at certain times. This underlines the requirement for continual enhancement in the planning and spending on transport networks to enhance efficiency and minimize congestion. Regarding greenhouse gas emissions, Greater Manchester has focused on encouraging people to use bicycles and their feet and improving public transport. Nevertheless, there are still problems in the city region concerning the decrease of emissions from transport, especially since the number of private cars remains high (Sherriff et al., 2020).

Nevertheless, there are still problems in the city region concerning the decrease of emissions from transport, especially since the number of private cars remains high.

Shenzhen and Greater Manchester have strived to improve the efficiency of public transport, combating traffic jams, and curtailing emissions of Green House Gases. Shenzhen has expanded metro and electric Bus transportation, which has elevated the public transport model share and decreased traffic congestion, thereby, enhancing the city's air quality and environmental friendliness. On the other hand, Greater Manchester has paid much attention to network integration and multimodal transport, which has produced more ambiguous outcomes in terms of congestion and emissions reduction.

In the future, more funding for sustainable transport infrastructure, as well as supportive measures to encourage the use of public transport and discourage car use, will be essential for both cities to improve their urban mobility and environmental performance.

Discussion

To understand the transportation infrastructure development strategies in Manchester and Shenzhen about the use of public transport to decongest traffic and improve connectivity and urban growth, the following main differences can be observed in their approaches. Manchester which is famous for being an industrial revolution city has chosen a coherent approach based on the integration of different means of transport. The city has invested much consideration towards the aspect of connectivity through the extension of the Metro Link tram system as well as improvement measures on bus priority. It would also help in the reduction of the use of private vehicles, which in turn would help in reducing traffic jams and improving the quality of the air. Also, the effective provision of basic infrastructure and quality services reflects Manchester's vision of attaining carbon neutrality by 2038. This involves the use of technology to deliver internet, and hence connectivity, beyond being a product to being a service that is critical for the development of economic and social infrastructure.

On the other hand, Shenzhen for instance, a fishing village was to become one of the global world's economic hubs and needs radical change in transport systems. The development of the city's metro system and another model known as the 'rail plus property' (R+P) also helped in the development of the city. This model combines the development of metro stations with the nearby real estate projects, which provide mutual advantages for all the parties involved and help finance important infrastructure improvements. The integration of new technologies such as AI and IoT in the management and operations of public transport systems in Shenzhen has

also enhanced the authorities' efficiency and sustainability goals. For instance, the city's electrification of the bus fleet on a very large scale has put the city on the map as the leading city in the provision of environmentally friendly solutions through green mobility.

Thus, both cities are focused on solving the problem of traffic congestion by investing in public transportation. Manchester's vision in expanding the current infrastructures and implementing smart technologies reflects the improvement of connectivity and effective management of movement. At the same time, Shenzhen has one of the most extensive metro and bus networks in the world and has heavily invested in green transport, which has changed the movement of people in the city and decreased the use of private cars and, therefore, emissions.

The outcomes of these efforts on modal split, traffic congestion, and greenhouse gas emissions are also not consistent. The public transport system in Shenzhen has expanded at a very fast pace and has consequently positive effect on modal choice with a large number of people using efficient means of transport. This shift has helped in the decongesting of the road during peak hours and has led to the reduction in the emission of greenhouse gases thus meeting the national targets on sustainability. On the other hand, the approach of Greater Manchester to encourage the usage of multimedia transport and enhance accessibility still has a problem in decreasing the total emission as the number of private car use increase.

Therefore, Manchester and Shenzhen can be considered as the cities that chose different but efficient ways of developing the transportation infrastructure. Manchester offers a fully developed, integrated, and digital approach to urban development and management based on the concepts of interconnection and sustainability to increase the city's strength and wealth. These include the expansion of Shenzhen's rapid transit and the creative approaches to funding it that signal this city as a global trendsetter for sustainable transport solutions that are efficient and environmentally friendly. The above case studies can help cities around the world learn the right strategies for developing sustainable transportation systems to enhance mobility and reduce congestion as the world's population increasingly moves to urban centers.

Conclusion

Thus, the transportation infrastructure development strategies of Manchester and Shenzhen present successful examples of how to tackle the problem of urban mobility and support the further development of the city. The two cities have realized the importance of public transportation in managing traffic, increasing integration, and decreasing the negative effects on the environment; however, they have done so through different strategies due to their different situations and needs.

Manchester is a city that has originated as an industrial city, yet today it strives to become a city of the future by promoting integration and innovation in transport solutions. The extending of the Metro Link tram system and upgraded technologies are some of the ways that the city is working to reduce the number of private cars on the road and hence enhance air quality. Thus, Manchester approaches connectivity as a service and uses intelligent technologies to improve the quality of life for commuters while working toward the city's goal of carbon neutrality by 2038. This proactive strategy can be viewed as one of the most progressive strategies for using the transportation infrastructure to ensure the city's economic stability and the well-being of the population.

On the other hand, Shenzhen has evolved from a fishing village to one of the world's leading economic centers with fast-paced urbanization and mega-infrastructure projects in transportation. The efficient transport system of the city along with the new financing models like the 'rail + property' model depicts the city's dedication towards the sustainable transport infrastructure. Thus, the practice of connecting metro station developments with the neighboring real estate projects in Shenzhen has not only increased the transport network but also brought an economic boost and a dynamic city life. Shenzhen has also adopted artificial intelligence and electrification of its transport fleet which makes it a leader in the provision of green mobility solutions while at the same time cutting down on emissions and setting standards for future urban developments.

Nonetheless, both Manchester and Shenzhen have the same goals of increasing the modal share of public transport, decreasing traffic jams, and decreasing the emission of greenhouse gases. Both cities stress the role of integrated planning, effective governance, and sustainable financial framework for the transportation vision. Manchester's strategy is based on building upon current infrastructure and applying digital solutions to increase productivity and satisfaction. On the other hand, Shenzhen's aggressive growth plan and early integration of green technologies present a clear vision of sustainable urbanization and environmental conservation.

The outcomes of these strategies in modal share, traffic congestion, and emission relate to the city in which they are being applied and the time within which they are being implemented. Shenzhen has increased its public transport infrastructure at a very high rate and this has resulted in in modal changes and a decrease in traffic congestion thus enhancing the quality of life and environment in the city. On the other hand, the transformation of Greater Manchester in the reduction of private car use is a continuous process, which is affected by the current shifts in the urban context and previous infrastructure developments. Despite the progress made in the integration of multimodal transport and sustainability, the level and speed of achievement in the two cities underscore the challenges and possibilities of urban transport planning.

Reflecting on the future, it is possible to identify the lessons that can be learned from the cases of Manchester and Shenzhen for other cities facing similar urban mobility problems. Thus, the development of transport infrastructure should be approached from the perspective of related land use planning, technological advancements, and sustainable funding sources. Through effective

investment in public transport, technology applications, and PPP, cities can increase connectivity; reduce pollution; and stimulate inclusive economic development.

Thus, Manchester and Shenzhen present examples of improvements in public transport that can not only help solve current urban problems but also create the basis for sustainable, efficient, and comfortable cities for the future. The experiences of these cities demonstrate the need for progressive policies, flexible governance, and creative approaches in designing sustainable and integrated urban transport systems as the world becomes more urbanized.

Disclosure Statement

The author(s) declared no potential conflicts of interest concerning this article's research, authorship, or publication.

Acknowledgments

I want to express my sincere gratitude to Wen Chen for their invaluable guidance and support throughout this research. Their expertise and insightful feedback were essential in shaping the direction of this paper.

Funding Sources

I appreciate the resources provided by the key National Social Science Fund project: Research on Modernization of Governance System and Governance Capacity in megacities (22AZD141).

National Social Science Foundation General Project, Research on the Development of Western Urban Politics. (20BZZ055).

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The views and opinions expressed in this paper are those of the author alone and do not necessarily reflect the views of any institution.

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