Advances in 21st Century Human Settlements

Vien Thuc Ha
Hieu Ngoc Nguyen
Hans-Joachim Linke *Editors*

Proceedings of the 8th International Conference on Sustainable Urban Development

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Advances in 21st Century Human Settlements

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This Series focuses on the entire spectrum of human settlements – from rural to urban, in different regions of the world, with questions such as: What factors cause and guide the process of change in human settlements from rural to urban in character, from hamlets and villages to towns, cities and megacities? Is this process different across time and space, how and why? Is there a future for rural life? Is it possible or not to have industrial development in rural settlements, and how? Why does 'urban shrinkage' occur? Are the rural areas urbanizing or is that urban areas are undergoing 'ruralisation' (in form of underserviced slums)? What are the challenges faced by 'mega urban regions', and how they can be/are being addressed? What drives economic dynamism in human settlements? Is the urban-based economic growth paradigm the only answer to the quest for sustainable development, or is there an urgent need to balance between economic growth on one hand and ecosystem restoration and conservation on the other – for the future sustainability of human habitats? How and what new technology is helping to achieve sustainable development in human settlements? What sort of changes in the current planning, management and governance of human settlements are needed to face the changing environment including the climate and increasing disaster risks? What is the uniqueness of the new 'socio-cultural spaces' that emerge in human settlements, and how they change over time? As rural settlements become urban, are the new 'urban spaces' resulting in the loss of rural life and 'socio-cultural spaces'? What is leading the preservation of rural 'socio-cultural spaces' within the urbanizing world, and how? What is the emerging nature of the rural-urban interface, and what factors influence it? What are the emerging perspectives that help understand the human-environment-culture complex through the study of human settlements and the related ecosystems, and how do they transform our understanding of cultural landscapes and 'waterscapes' in the 21st Century? What else is and/or likely to be new vis-à-vis human settlements – now and in the future? The Series, therefore, welcomes contributions with fresh cognitive perspectives to understand the new and emerging realities of the 21st Century human settlements. Such perspectives will include a multidisciplinary analysis, constituting of the demographic, spatio-economic, environmental, technological, and planning, management and governance lenses.

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Preface and Acknowledgements

It is with great pleasure to present the proceedings of the 8th International Conference on Sustainable Urban Development (ICSUD). As an annual event organized by the Sustainable Urban Development Study Program at Vietnamese-German University, ICSUD serves as a dynamic platform for fostering knowledge exchange and collaborative networking among academics, researchers, policymakers, and representatives of non-governmental organizations in the field of urban development. The 2022 conference marked 10th anniversary of the Sustainable Urban Development Study Program (SUD) that took place at the newly established campus of Vietnamese-German University in Binh Duong Province, Vietnam.

The theme "*Innovative and Inclusive Urban Growth Models*" was chosen to resonate with the current scholar discussions and the National Urban Agenda on finding new growth models to sustain the growth after 30 years of rapid urbanization. Innovations should not be centered on technology alone; it should include new governing and business models to enable and sustain the growth among different interest groups, within and crossing disciplines such as design, planning, or mobility. Better growth models not only ensure environmental integrity but also promote social cohesion and economic prosperity.

The conference gathered distinguished speakers, scholars, and participants from various backgrounds in urban studies-, urban planning-, and urban development-related fields. Participants shared their new findings and experiences over three key cross-disciplinary themes including "governance", "climate change resilience", and "mobility". Of the 22 papers submitted, 16 papers were selected to publish in this Springer Nature Conference Proceedings under 3 chapters including Governance Based Transforming Growth Models, Climate Change Resilience Based Transforming Growth Models, and Mobility Based Transforming Growth Models.

We were privileged to have esteemed support from organizing teams. We specially thank for the diligent efforts of the Organizing Committee from Vietnamese-German University led by Dr. Vien Thuc Ha, Dr. Hieu Ngoc Nguyen, and Dr. Dao Thi Bich Van. We deeply express gratitude for the great work and support of Prof. Hans Joachim Linke and his team from the University of Darmstadt. We show gratitude

for the financial support from Fredrick Neuman Foundation and the personal contribution of Prof. Andreas Stoffers. We acknowledged the contribution of the scientific board members who had contributed numerous works for the conference paper and the later proceedings. Their commitments were pivotal in creating a vibrant and intellectually stimulating conference environment. We extend our heartfelt gratitude to all committee members for their untiring work and support.

We would also like to express our sincere appreciation to all individuals and organizations who have contributed to the success of the conference. The participants, with their diverse backgrounds and expertise in urban studies-, urban planning-, and urban development-related fields, played a crucial role in enriching the academic discourse and laying the foundation for future collaborations and advancements in the field.

We would like to acknowledge the assistance provided by the conference staff, volunteers, and all those who contributed their time and effort to ensure the smooth operation of the event. Their dedication and professionalism were invaluable in creating a welcoming and stimulating conference environment.

Lastly, we express our appreciation to all the authors who contributed their research papers to this proceeding's publication. Their contributions have made this proceeding a valuable resource for further research, innovation, and policymaking in sustainable urban development. May the insights, ideas, and recommendations shared during ICSUD contribute to the advancement of *inclusive and resilient urban growth models* that will shape our cities in the future.

Binh Duong - HCMC Vietnam — Vien Thuc Ha
Binh Duong - HCMC Vietnam — Hieu Ngoc Nguyen
Darmstadt, Germany — Hans-Joachim Linke

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Governance Based Transforming Growth Models

20-Minute to Health-Oriented City: The Case of Ho Chi Minh City

Hieu Ngoc Nguyen, Anh Thai Pham, and Son Nam Pham

Abstract Building a 20-minute city is a desire but a big challenge for any city in the car-booming era. When the city became a metropolis, commuting choices narrowed when travel distance increased while alternative means of public transport were limited. The cost of pollution and congestion due to car transformation urge city authority to act; however, it seems that different vectors of growth such as mobility choices and property development could hardly match the planning schemes, resource for infrastructure development, and governing capacity. This article discusses alternative solutions to build a 20-minute city in the existing development pattern in Ho Chi Minh City in the context of resource limitation. Using an analytical framework to explore possibility to avoid car in the existing urban form, population and service density, land use changes and urban growth pattern, the authors argue how E-bike could increase the accessibility to jobs, housing, and service as well as reduce pollution and expenses for both households and city authorities. The discussion implicated a strategy to enable health-oriented city by developing service-oriented zones where green mobility, integrated planning, and new urban design to be supported by an innovative and inclusive governing model.

Keywords 20-minute city · Active transportation · Time-based strategy · Smart growth models · Integrated urban planning

1 Introduction

Ho Chi Minh City is transforming into an urban region with concern on the mobility. Sprawling and shifting to cars from scooters lifted-up the congestion level, especially in the arterial roads where suburban commuters have less choices to reach the city centers. The increasing commuting distance to jobs and basic services, extension

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of highways, and higher car affordability add up to the car-dependent region from transformation.

Public health became a critical issue during this transformation. The shift to cars only helped affordable groups living in the periphery to avoid pollution. Higher income commuters still use scooters for jobs and services due to congestion in the city center.

There are alternative solutions to a health-oriented society nowadays. Different approaches to combat regional growth from Transit-Oriented Development to smart growth to improve accessibility to jobs and services [1, 2]. Most solutions require to integrate transport and urban planning and attack the higher volume of traffic from demand management instead of supply. In general, regional transformation in the car-booming era requires a structural change to promote active transport.

Of the discussions nowadays, time-based strategies became a fashion in many cities; however, this is a highly challenging issue. The 15- or 20-minute city was chosen to call for integrated actions from public transport to last mile solutions [3, 4]. They shared lessons from car dependency and sprawling suburban problems. They also shared the concerns of integrating efforts from planning to implementation, from decision-makers to enterprises and societies.

The following article discusses opportunities to adopt time-based strategies to transform the city and region toward health-oriented growth in Ho Chi Minh City. The solution proposed to synergize development efforts to transform cities to service-centric zones to cluster the growth at shorter distance to the main destinations within 20 minutes of commuting. The proposal pivoted on the three alternatives to shift transport modes, guiding proper urban renewal target the public health from 20 minute approachability using greener and active transportation vehicle such as E-assisted bicycle. The reduction of emission was calculated based on the projection of new average distance travel, new modal shares, and the new population distribution in the expanding urban space.

As zone solution became the main approach, the division of zones was carefully chosen to ensure the effectiveness of measures and their practicality. Each zone was chosen with a combination of accessibility to equal population size, rather than the population size or area themselves. The zone also reflected a changing distribution of population and travel demand by 2040 from the 2020 perspective and the potential growth from the inertia projected from 2010.

2 Literature Review

The 15-minute city is a new concept but it had its roots in the tradition and development framework concentrate on the proximity to develop city center and enhance the local products for local needs. In this model, transport mode plays a central role to promote ensuring people may cycle, walk, or use other green vehicles for their routines. This aligns to the paradigm shift from Jane Jacobs to revitalize city centers from free-wheel suburbia toward net-zero mobility when changing of means

and commuting time [5]. Nowadays, the specific time slogan: 15-, 20-, or even 30-minute city reflected a more flexible and tailored-made objectives to transform city's mobility and structure according to their development contexts (population size, urban form, or public transit and infrastructure) [3].

Most of these time-based strategies relied upon four transforming dimensions including density, proximity, diversity, and digitalization. Density means not only a higher number of populations over space, but also maximized supply of urban services for higher demand. Proximity is aimed at reducing travel distance to satisfy citizens' basic needs with better social connection, more efficient use of resources, and lower impacts to urban environment which is detrimental to public health. Diversity implies the mixtures of land use and building types to nurture local economy and housing as ecosystems for all income groups. In return, density and proximity reinforce city attractiveness from its diversity.

Recently, new enablers such as technologies, climate change, and the recent COVID pandemic also support faster transformation. Digitalization-enabled multiple solutions to organically enhance services for better people participation, increase road safety for non-motorized transport (NMT) with tracking and tracing vehicles over the "cloud". The saving of greener mobility will reduce greenhouse gas to support mainstream policies of climate adaptation [3]. NMT or similar means of vehicle will become the right choice for pro-environment groups that significantly contribute to the survival of the earth and human beings [6]. The COVID reinforced the need for health-oriented cities as walking or biking could increase city competitiveness [7]. In not too long distance, active transport is better than public transportation due to lower cost, better safety, easy route connectivity, and timing [6].

From the perspective of implementation, there are diverse strategies to implement the concept to match their development contexts. Paris center is a well-known case to exploit well-established physical infrastructure to promote active mobility [8]. Similar approaches were applied in Europe (Milan, Barcelona) to revisit its historical use of city centers. The spread of active mobility adopted in Bogota (Colombia) helped a chain of cities to share an integrate plan [9, 10]. At larger scale, Shanghai metro area adopted its Master Plan from 2017 to 2035 to target "*15-minute community life circle*". The city of Portland (USA) did not have propaganda in terms of minutes, but their "*Complete neighborhood*" scheme was to increase accessibility to services within 20 min using walking and cycling [4]. In short, each city found their own chance to implement the concept matching their development context (see Table 1).

Application of the concept requires better integration of efforts. In the case of Milan, 15-minute cities adopted multiple strategies to regenerate the railway and surrounding open spaces as well as commercial space. The surrounding areas were integrated with downtown services (public square, restaurant-open cooking, office, vineyards-green terraces, and event spaces) to make a pleasant place. The station zone was integrated with larger neighborhoods and up to the city scale via the circle line of green buffer where residents can reach the TOD zone from within 15-min walk to neighborhoods (Fig. 1).

In the case of Singapore, multiple strategies were introduced to enable time-based strategies. The efforts to change the workplace-home patterns to more time efficient

Table 1 Highlighted cases to adopt time-based urban models

Cities	Continents	Strategies	Details	Outcomes
Paris, France	Europe	Conversion	Place: school playgrounds to be transformed into parks; bike lanes add-ins Time: free to access after school hours	–
Milan, Italy	Europe	Conversion		
Singapore	Asia	Goals within city Master plan	20-minute towns 45-minute city	On-going to improve existing infrastructure, which enhances transportation service
Lagos, Nigeria	Africa	Conversion	Schools à food markets in pandemic	Commuting time decrease
Shanghai, China	Asia	Goals within city Master plan	15-minute community life circles	–
Bogota, Columbia	South America	Conversion	Bike lanes (84 km)	–
Portland	North America	Plan	Complete neighborhoods	–
Melbourne, Australia	Oceania	Goals within city Master plan	20-minute neighborhoods	–

Source [3, 4, 9–15]

(reaching destinations within 20 min in the town scale and 45 min in city scale) were designed and implemented with integrated, collaborative, and participatory plans. Through the multiple solutions of addressing first-last mile problem and making use of mass transit system, authorities and people worked together on multiple strategies such as Autonomous system, Dynamically Routed Services (DRS), rail and biking expansion, Transit Priority Corridors (TPCs), and point-to-point mobility (P2P) schemes. The recent striking strategy was to expand the cycling network from 400 to 700 km before 2040 and to ensure new employment centers enabling people to commute less [13].

However, lessons learnt from the cases may not reflect barriers for changes. What we learnt in each case was what works in their context; however, we could hardly learn why some were not chosen. Change is not easy when people abandon their comforts. Besides, change should overcome efficiency, the lifestyle, or the habit. When cities were adapted to the extent that scooter riders could sit on their moped to buy groceries and take their children from their door to school, people tended to excuse their inactive mobility due to economic and habitual reasons[1] [17, 18]. We should accept this to design a proper framework for changes.

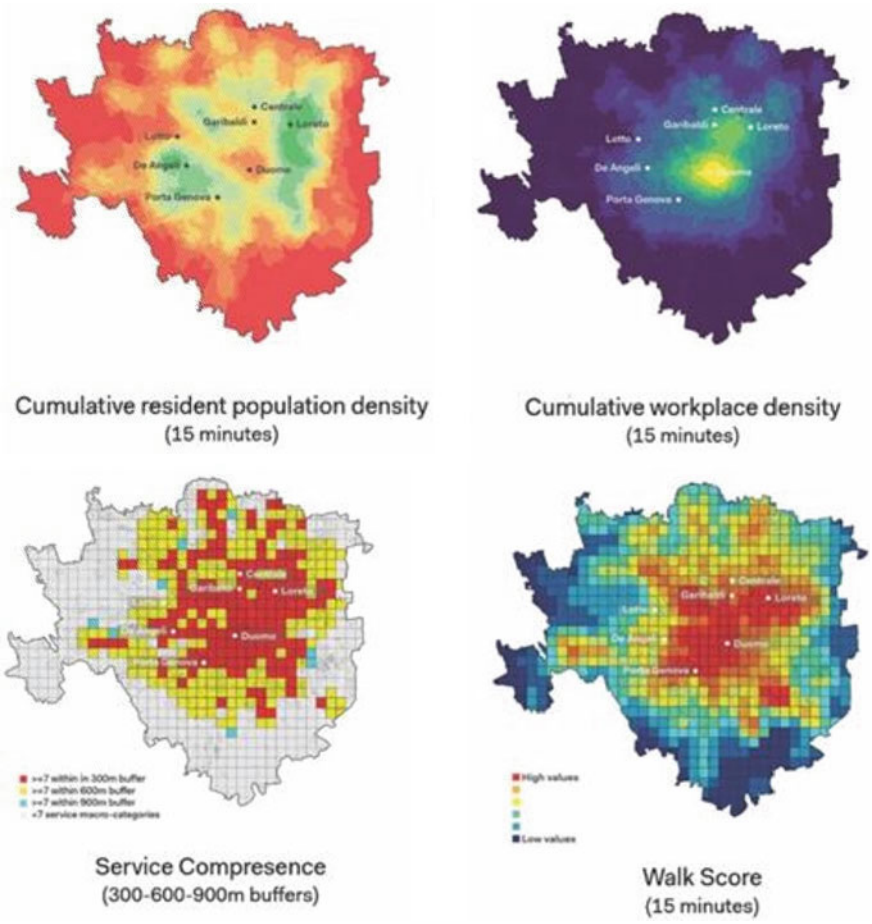

Fig. 1 Milan 15-minute city model from various aspects. *Source* [16]. *Notes* From left to right: 15-minute access model to: cumulative resident population density, cumulative workplace density, service compresence 300–600–900 m buffers, and the walk score

3 Ho Chi Minh City Transport Development Situation

Over the past three decades, the Ho Chi Minh City transport system fell behind the development needs. The land dedicated for traffic is well below the demand in both Central and Suburban Districts [19]. Near saturated level of service occurs during the day and over-saturated situations are common during the rush hours in both city center and arterial roads in the periphery. Note that given the two-digit growth of cars over the past two decades, the car ownership level is still the early transformation from scooter to car (about 7% of households using cars at the year 2021) [20]. We

imagine how severe the transportation situation would be if more people switched to cars because of longer travel distance, severe pollution, and higher level of income.

The threat of car transformation was compelling over the existing poor transport infrastructure. Low road density in the densifying new districts[2] and narrow road system unfit for cars[3] explained critical congested city mobility problems. Increasing private vehicles and the low share of public transport exaggerated the situation. The number of motorbikes keeps increasing from the saturated level (7.44 million–nearly one scooter per person) and higher rate of car increase (1.9 times over past 5 years) pushed harder to the already overburden city transport infrastructure [21].

The reliance on regional infrastructure also faced with barriers in resource mobilization and other reasons. Over past three decades, the city footprint increased nearly four times that spill over seven provinces surround [22]. However, the regional infrastructure has not developed to match the multi-nodal regional model (as planned in the regional and transport development plan) [23]. No ring roads were completed with either suspended status or under patchy development over the past 10 years. Satellite cities and suburban towns have poor links to the large urban core as no rapid transit or expressways were developed from the adopted the master transport plan in 2013 [24]. The first metro line delayed more than 10 years with uncertain date of completion at the year 2024. The demand for financial resource was compelling; but barriers came from other areas such as site clearance, outdated planning, and incentive policies [25]. In short, the transit system and regional infrastructure could not be improved quickly (Fig. 2).

Given that we could develop the metro system on time, the desire of mass transit system may not function as good as expected due to the existing urban form. Besides the fact that city has high informal economy, Ho Chi Minh City was built upon years of adapting to scooter dependency with over 91% travel needs over 2 km [28]. Private vehicles are preferred because roads and lanes are made for them, not for walking. Apart from that, the accessibility to station plazas may reduce the ridership of the urban rail network. A preliminary analysis showed that only 17% of current building apartments are within a walking radius of 8 planned metro lines, and less than 25% population within the walking range, which is well below this figure in Tokyo or Shanghai of 80% [29]. Although the suburban area has potential to build new high-rise building apartments; however, the walking radius of current 27% (new districts) indicates that metro system alone does not significantly improve the situation, especially during the next decade [21] (Fig. 3).

Meanwhile, the city's targeted higher goals for sustainable development. In 2021, the Prime Minister adopted a task to revise the Ho Chi Minh City Master Plan to cope with the fundamental changes [30]. The new plan asked the city to sustain its development from a lower profile of overloaded transport and basic infrastructure, pending socio-economic problems, and higher threats from climate change and geopolitical uncertainties. Those who accept the plan should live with low commitment on large-scale infrastructure projects. Therefore, we should look for solutions that fit to availability of resources and capacity.

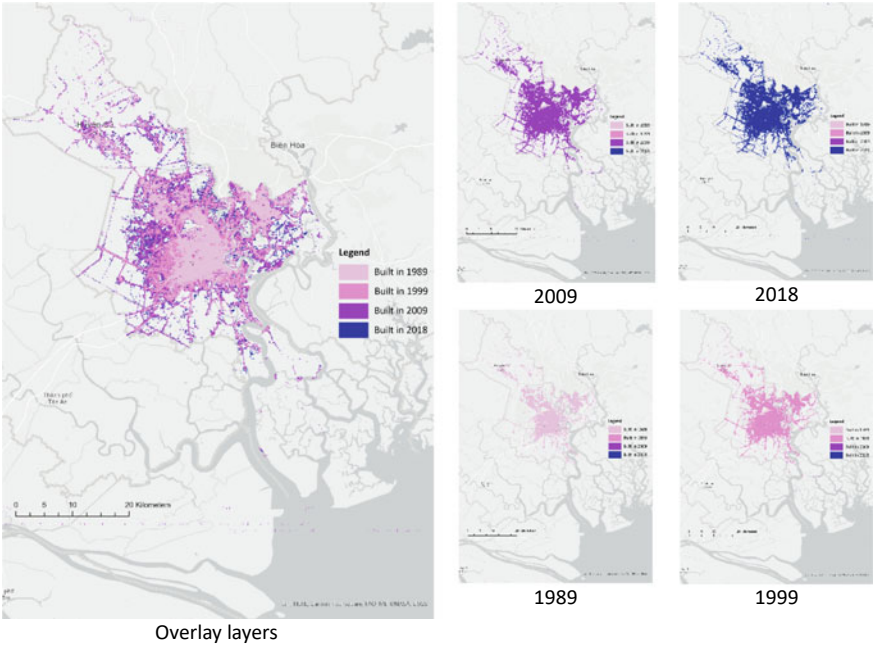

Fig. 2 Land conversion in Ho Chi Minh City from 1987 to 2018. *Source* [26, 27]

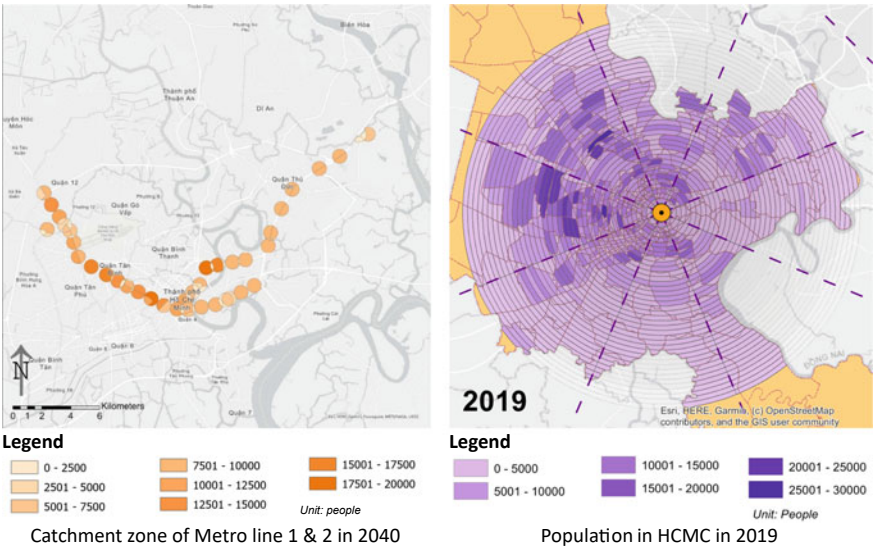

Fig. 3 Limited metro line's catchment in Ho Chi Minh City space. *Source* Authors

4 Alternative Solutions and Strategies

The basic solution to transform the mobility needs is to make use of existing short travel distance in the city proper to jobs and services with proper green and clean means of transport. The "*service-centric*" Zoning strategy was the main solution to reduce commuting distance in most of the city space. Applying to Ho Chi Minh City region, a 5 km radius zone circling the CBD would fit both the current travel pattern to the center and the average riding distance of Ho Chi Minh City (over 7 km in 2017).

This pattern allows residents in each zone to reach most of the zone and adjacent ones within 5 km or 20 minutes by the existing dominant vehicle (scooter). If traveling to the city center from the periphery or vice versa at off-peak or normal traffic situation, the distance will be 20 km or 40 min (at the traveling speed of 30 km/h). On the city scale, the city will be divided into 27 zones where commuters in the urban districts can reach its central service within 20 min. Each zone ranges from 1000 ha (urban centers) to 10,000 ha (rural or suburban) to house from 200,000 to 500,000 residents. Commuters could reach the surrounding zones if living near the border of the zone at the similar time (see Fig. 4).

The reduction of emissions to compare the impacts of the alternative solution was calculated following the Bosserhoff method [31]. The emission from individuals was a product of emission from vehicle per kilometer,[4] the average trips generated by individuals in Ho Chi Minh City (3.5 trips per person daily following recent research about vehicle occupancy in 2019), and the average commuting distances (~7.4 km) [21, 32, 33]. Besides the emission from personal vehicles, commercial/public vehicle's emissions were also calculated using the current transport mode

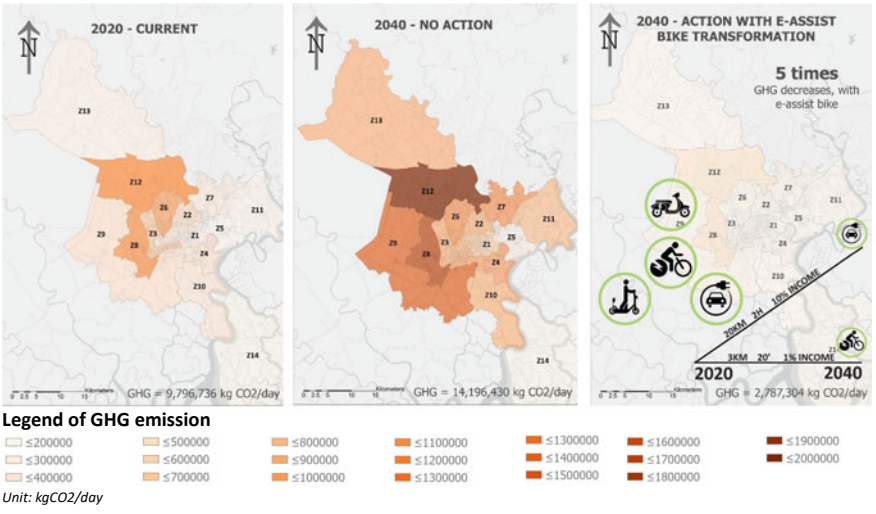

Fig. 4 Emission reduction with E-assist bike transformation at city scale. *Source* Authors

share. The emission in 2040 was calculated using a changing structure of modal share and an assumption that personal average trips per day and commuting distance will not change significantly (see Table 2).

As cities are transforming rapidly to urban regions, the biggest threat is to satisfy the mobility or accessibility needs in a larger spatial scale, with longer and higher cost, under slowly improved transport infrastructure during the car-booming era. If a time-based strategy is chosen, then there are multiple choices to be made from mode choice to exploitation city infrastructure and urban form to affordability of the transforming measures.

This zone strategy is expected to improve health through the reduction of emission together with the mode share transformation. The localized jobs and services within the zone enable commuters to restrain using cars at the long run. Shorter travel distance enables commuters to use active transport modes such as bike or E-assist bike. A scenario of new mode share by 2040 (see above) illustrated that the emission level may reduce 5 times (2700 Tons of GHG versus14,000 per day by 2040) if E-assist bike was the first choice in the mixed mode to commute within the zone. This choice may also reduce 10 times individual traveling costs (from about 10% of household income to 1% if shifting from the car to E-bike). The travel time may also reduce significantly from 2 h per day (if using car to cover 20 km distance) to 20 min (using E-assist bike or E-scooter to cover 5–10 km distance).

The zoning solution is a part of strategic transformation to more active transport modal share. To make the gain, a multi-modal transformation strategy shall be adopted to match the affordability of the stakeholders in the economy. A new structure of mode share chosen for the city in 2040 consists of UMRT, E-car, E-scooter, and E-assist bike. Each mode of transport has its advantages on certain travel distance and function; however, from the perspective of health-induced benefits for individuals and society, we can rank them by enablers to use them in the back-to-back format.

Table 2 Transport mode share 2040 scenario and 2020 mode share

Mode share	2040_Action		2040_No action		2020	
	General %	Detail %	General %	Detail %	General %	Detail %
Public	30		30		10	
Rail	30	9.0	30	9.00		0
Bus	60	18.00	60	18.00		
Taxi	10	3.00	10	3.00		
E-private	60		60		80	
E-bike	70	42.00	90	54.00	90	72
E-scooter	20	12.00	0	0.00	0	0
E-car	10	6.00	10	6.00	10	8
Others	10	10	10	10	10	
		100.00				

Source Authors

Table 3 shows that E-assist bike could be the best solution to individual health and societal environment.[5] E-assist bike could be strategic choice to form the backbone of transport mode for individuals from teenagers to retired ones commuting daily to shops, schools (bringing one kid along), and jobs within 20 minutes.

The choice of E-assist bike also fits the urban zones where the chance to widen the streets is small. In fact, the urban form of built-up area in Ho Chi Minh City grew to support scooters, so E-assist bike also fits well to the existing conditions. Analysis at Zone 2 showed that a rider at the center of this zone could reach a catchment of 160,000 person within 5 minutes riding and up to over 400,000 persons by 20 minutes riding. Within that time limits, the rider can also access the two richest targets of jobs and services (CBD and the airport) (Fig. 5).

However, E-assist bikers may be concerned about their safety in using slower mode, pollution impedes their health during riding time, and hot weather conditions may discourage office workers. To address these concerns, the following integrated approaches are proposed:

1. Better accessibility to destinations (jobs, home, and service network) via the land use and building approach.
2. Better commuting on roads (separated lanes, speed limits, managing at intersections, setting up biking corridors, and parking convenience) via transport management approach.
3. Better health environment (improve shading and reduce pollution level from controlling the health hazard emission level from vehicles and industries at specific zones and the city centers) via environmental approach (Fig. 6).

Table 3 Strategic modal choices and enablers

Factor	UMRT	E-car	E-scooter	E-assist bike
Land use Access jobs Access services Building form	+1 +1 +1	−2 −1 −3	+2 +3 +2	+1 +3 +3
Commuting Time Cost to home Cost to city Easy riding Transfer/park	+1 +2 −2 +2 −2	−3 −3 −3 −3 −3	+3 +2 +2 +2 +2	+2 +3 +3 +1 +3
Others Emission Safety Weather and air pollution Exercise Carrying passengers Carrying goods	+1 +2 +3 +2 −2 −2	−1 +3 +3 −3 +3 +3	+2 −1 −1 −2 +2 +2	+3 −2 −2 +3 −1 +1
Total	7	−15	20	21

Source Authors

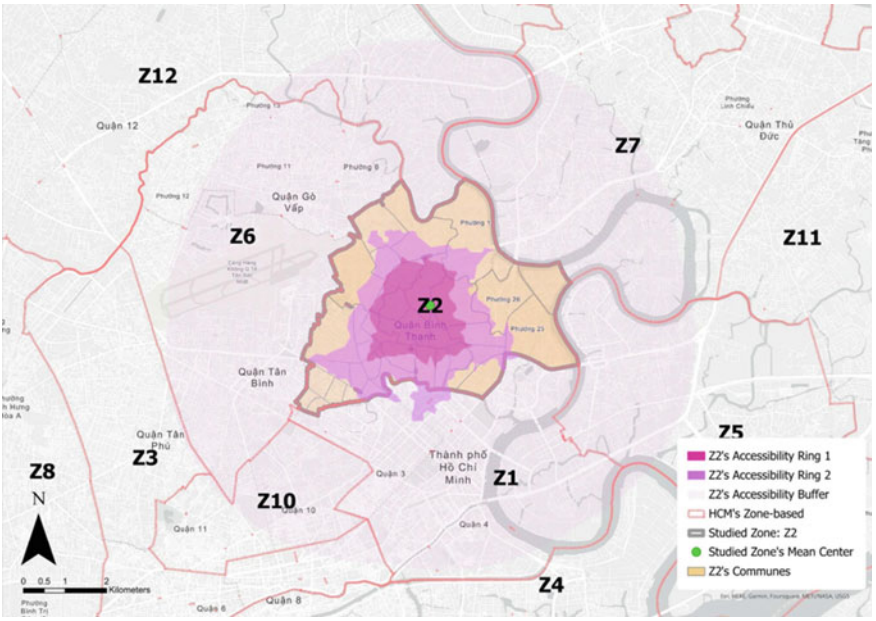

Fig. 5 Time-based accessibility analysis at Zone 2 using E-assist bike. *Notes* Accessible ring 2: 10 minutes by E-motorbike equals 20 minutes by E-assist bike. Accessible ring 1: 5 minutes by E-motorbike equals 10 minutes by walking. *Source* Authors

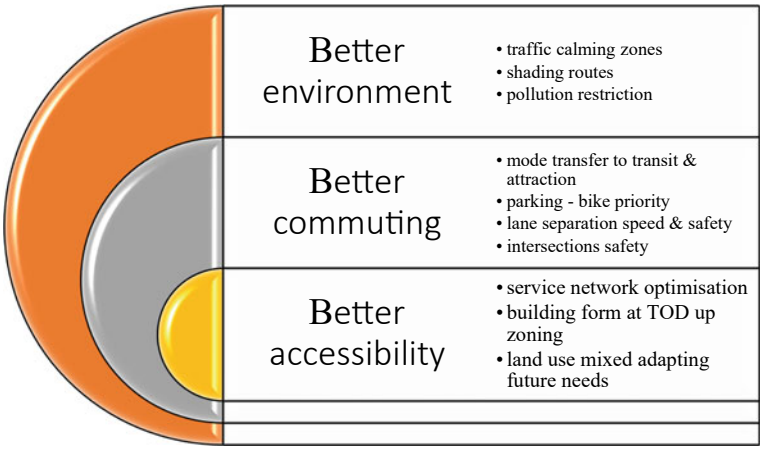

Fig. 6 Strategic approaches to health transformation. *Source* Authors

These approaches should be integrated in each zone and city space to help stakeholders navigating a successful transformation. Figure 7 highlighted actions to health-oriented society coming from both sides, including:

1. Make the most out of existing land use pattern and urban form, and improve shading on street network and service network distributions to streets favor commuters using bikes.
2. Enable stakeholders to take advantage of technological changes (electrification, automated vehicle, and renewable energy), digital and new trending economies (circular, home working, minimalism, eco-friendly lifestyle), and investment on

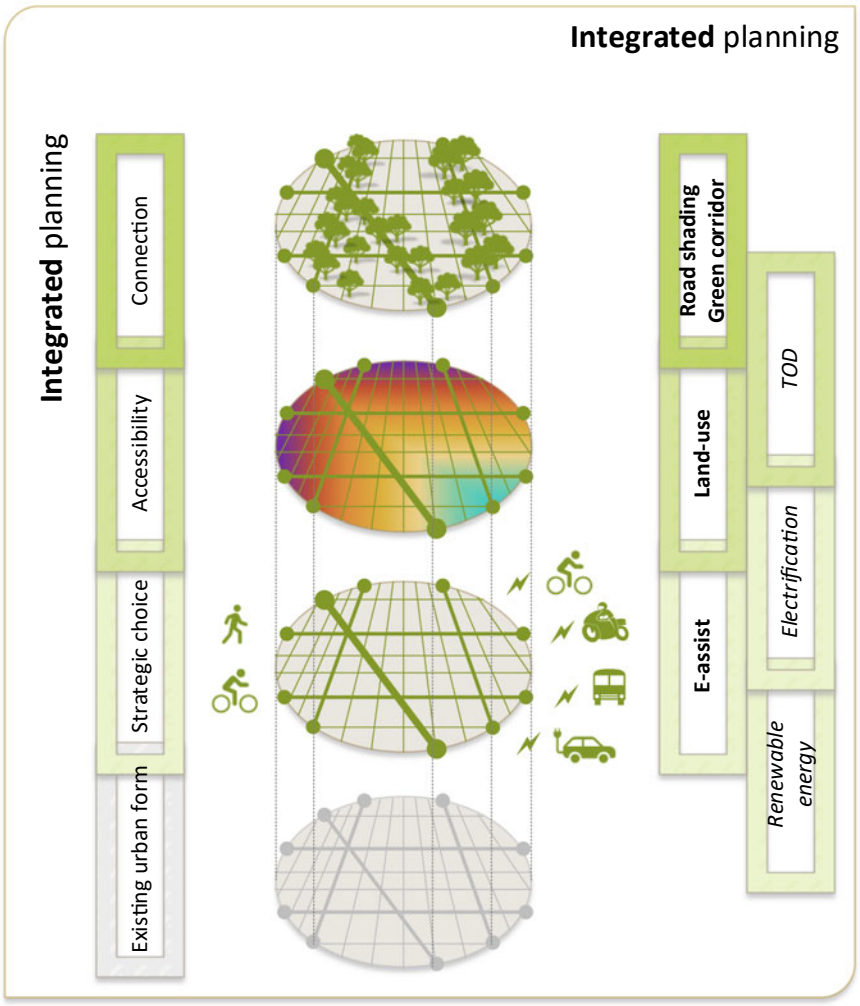

Fig. 7 Integrated solutions to transform the time-based strategy. *Source* Authors

transit system at both city and regional scale (Transit Oriented Development–TOD) (see below).

The integration shall be implemented flexibly to maximize the local features. In the city center, E-assist bike support could be the priority to take advantage of the downtown and TOD zones. To encourage bikers to ride without "*E-assist*", the authority shall reinforce innovative measures from shading (trees and any means to improve shading and reduce heat, noise, pollution, and dust) to favorable parking solutions and discouraging the abused of motorized vehicles, especially cars (combined measures on lanes separation, speed limits, and parking high charges and restriction).

However, in the newly established urban districts or rural ones, E-scooter or E-car may take a higher mode share to match the local conditions. Similarly, in the better planned zone with better access to future transit infrastructure development, walking and biking shall be favored with the above-mentioned measures; however, in poorer planned areas, we may have to adopt a higher share of E-scooters. The rural districts with low connectivity to transit system shall adopt a larger share of motorized vehicles (including E-cars) to maximize the economic opportunities and long-distance commuting demand.

5 Conclusion

The paper supplied evidence for planners to guide the city transformation toward healthier and competitive and sustainable society. The time-based strategies were developed upon practical zoning and flexible modal share solutions to meet the 20-minute target. The importance of affordability and practicality was considered, given the slower than expected mass transit system development. The innovative strategy of multi-modal oriented (MOD) instead of TOD reflected city was driven by scooter for more than half a century. The active transport should make use of the existing structure and technologies (electrification, digitalization, circularization, etc.) to "*intercept*" the compelling demand during the car-booming era in the fast-growing urban region.

Health-oriented cities were incrementally and collaboratively improved through innovative and integrated efforts. Better health was improved not only from more active transport, but also lower pollution due to shorter commuting to destinations with efficient and nature-friendly transport modes. More E-assist biker transformation will save huge resources for future growth and spare more space for unpredicted uncertainties from political change or climate change.

The proposed solutions of integration in planning and implementation are demanding; however, they were built from reality. The multi-level approaches to integrate actions asked people to change their behavior with huge benefit of convenience and affordability. The green cover and shading solutions are cheaper than road widening or building tunnel solutions. The flexible and zoning solutions could spread the opportunities and cost to local businesses and individuals. This would create

profound impacts on public finance and structurally reinforce society to become resilient and inclusive.

Assumptions in calculations may limit the claims on benefit or value, given that there are complicated and changing factors to predict the future. However, this article illustrated a bigger picture for framing priority and actions toward healthier society from the current situation. The choice of 20 minutes or 40 minutes to the city center from the periphery could become an icon for united actions against harmful threats of excessive use of cars and fragmented growth. Anyway, Ho Chi Minh City should create its opportunities from their undeniable problems and threats.

Let's do it together and do it now.

Notes

1. Average daily steps in Vietnam are only 3600 compared with 6880 in Hong Kong.
2. 2.01 km/km^2 in the new urban districts in 2017, only 8.8% of land dedicated for transport.
3. 50% of the 4000 km road length is less than 7 m.
4. Average emissions of selected vehicles are 45 g/CO_2/Pax-km for motorcycle, 9.2 g/CO_2/Pax-km for E-scooter, 135 g/CO_2/Pax-km for diesel car, and 34 g/CO_2/Pax-km for E-car.
5. This analysis assumes higher middle-income commuters will use cars more often if they must travel longer distance without better alternatives, while the lower middle-income group will shift to cars when they could afford in the next decade(s). Also, the highest income group and some of the lowest income commuters (10% + 10%) keep their current choice.

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Public–Private Partnerships (PPPs) for Smart Transport Infrastructure Development: A Promising Approach and Potential Risks

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Abstract There is a growing body of literature examining the benefits and downsides of smart transport infrastructure development. Particularly, the integration of advanced technology regarding the Internet of Things (IoT), Big Data, and Artificial Intelligence (AI) within smart transport infrastructure systems provides promising solutions in coping with significant problems of urban cities, including rapid population growth, environmental pollution, and traffic jam. However, the lack of expertise and huge financial funding for smart transport projects may create potential risks during the implementation and operation stage in practice. Even though recent studies have provided some suggestions for the use of hybrid Public–Private Partnership (PPP) models for financial rising and allocation, there still have been some "unknown" aspects of smart transport infrastructure projects that are not completely captured with high consideration and detailed evaluation. Thus, this study aims to investigate the potential risks of applying PPP models for smart infrastructure development through reviewing articles indexed by Scopus, Web of Science, PubMed, and ScienceDirect from 2010 until the present. The initial results released that 19 critical risks were categorized into five main groups (political-legal, technological-technical, economic-financial, social, and environmental) that highly contribute to the success of smart transport infrastructure implementation.

Keywords Public–private partnership · Smart transport infrastructure · Risk management

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1 Background

1.1 The Need for Smart Transport Infrastructure Development

The proportion of the world's population residing in cities by 2030 is predicted to grow to over 60% [1]. This degree of urbanization will create challenges across the board, including transportation. Cities around the world are already noticing the impacts of this shift in both developed and developing countries [2]. The concept of smart cities has developed over the last two decades and has been the subject of much academic research. A smart city generally aims at increasing operational efficiency, increasing information sharing with all stakeholders and improving the well-being of citizens using ICTs [3]. Technologies are used to improve the performance of many aspects of the smart city, including transportation, which is a major difficulty and source of much public complaint.

Public transport systems are playing an increasing role in large cities, and increasing the capacity of a system is expensive and takes time. As noted by Yang et al. [4], current policy strategies for sustainable urban growth are inadequate. As they say, "…most 'smart city' projects seek to find cost effectiveness within existing structures, which have not been built in keeping with the sustainability goals" [4]. As the demand for public transportation grows exponentially in the world's largest cities, along with growth in population density and lack of availability of land, public transportation networks have become increasingly congested, especially during peak hours. Thus, traveling times become longer, resulting in inefficiencies and reduced productivity. Rapid urbanization, as well as rapid motorization, brings challenges. Exponential growth in the number of private vehicles has escalated the requirement to come up with smart public transport systems in order to address congestion issues [5]. Many major cities around the world are experiencing challenges in managing transportation networks which are huge, expensive, and complex. Sustainable development must be supported by smart transportation infrastructure, with increased participation of the public and user-friendly interfaces giving real-time urban data.

One method proposed to reduce congestion is that of transportation demand management (TDM), and automated fare collection data can be helpful in the design phase of management systems for public transport demand. Travel demand management can help increase the efficiency and effectiveness of public transportation, including introducing price discrimination to reduce travel during peak periods and providing free transport in off-peak times. Peak surcharges have been implemented in many large cities worldwide, including Washington, London, Tokyo, and Sydney. Reward programs have also encouraged people to travel in nonpeak periods [6].

Of course, credible public transportation requires planning. It also requires effective governance. Factors involved in exacerbating difficulties include population growth, cost of various alternatives, lack of resourcing, geographic issues, affordability, constraints regarding land, and difficulties in acquiring land, often from private ownership [3]. Public–private partnerships (PPPs) is one method by which

the transportation sector can be expanded [7]. PPPs are our long-term arrangements between a government and a private agency generally with the private capital financing the project up front and then taking revenue during the PPP contract [8]. Such ventures can promote better quality infrastructure with optimal risk and cost allocation [9]. While there may be different specific arrangements, common features include and a long-term commitment resulting in specific goods or services [10]. As noted by Calderini et al. [11], PPPs are appropriate ways to overcome the shortages in public finances often experienced. Various forms of PPP have been suggested for use in smart city projects, but drawbacks in high transaction costs, the lengthy time between conception and completion, political risk, and lack of finances have limited the application of this approach. In its favor, the exchange of information from private actors to public actors (who generally have less experience) is a very positive feature of such approaches.

1.2 Debates on PPPs Selection for Transport Infrastructure Development

PPPs have received increasing academic attention in relation to transportation infrastructure. In their meta-analysis, Chen et al. [7] examined studies in this field in terms of performance, contracts, risk, value for money, and institutional factors. They make the point that a comprehensive understanding of the performance of PPPs is not easily obtained because of limited data due to commercial confidentiality reasons. In their consideration of the risks involved, they highlight the appropriate allocation to private and public partners. A study by Sinha and Jha [12] reports on the use of PPPs in the National Highway development project of India in 1998 and subsequent use of PPP procurement throughout the transportation sector there. They draw attention to disputes over land acquisition and other approvals from government and the need therefore for dispute resolution clauses within agreements. They comment that PPPs are complex in their nature and can suffer from many unexpected circumstances with frequent disputes. Some studies have used a case study approach to look at the various risks. Thus, Grimsey and Lewis [13] and Chung et al. [14] described the risk scenarios existing within specific case studies. Other studies have been based on surveys of the professionals' perceptions of PPP undertakings.

Studies of investors have also been carried out, and a study by Demirag et al. [15] investigated the perceptions of investors in the finance industry and concluded that risks are a common concern that may vary; their respondents focused on the need to control these risks through ensuring or allocating risks to others. They also noted that investors prefer to partner with firms with whom they have some background. In addition, a study by Chen and Hubbard [16] investigated the market for PPPs in China and looked at differences in risk perception between the public and private sectors and between practitioners and academics. They found that PPP project risks

commonly held to be important included government intervention, poor decision-making by public agencies, and corruption. The question of how risks should be managed has also been investigated, generally using surveys. Thus, Bing et al. [17] surveyed experts on preferred risk allocation in the UK and found that both macro- and micro-level risks should be kept by the public sector or at least shared with their private partners, according to the respondents. On the other hand, meso-level risks should be borne by the private sector.

There are many risks when PPPs are selected and undertaken in developed and developing countries. This situation is mirrored when we consider smart transport infrastructure PPPs.

2 Research Method

The literature review was undertaken in three phases. Firstly, a comprehensive literature review identified potential risks during metro railway project implementation. The Scopus, Web of Science, PubMed, and ScienceDirect databases were selected, and the following strings of TITLE-ABS-KEY were used, including 'Smart Transport Infrastructure'; AND 'Project Development' to provide a holistic picture of smart infrastructure project development over the world. The initial search retrieved 279 articles for subsequent refinement. The scope was then narrowed with the following string searched: 'Smart Transport Infrastructure'; AND 'Project Development'; AND 'Investment Models' within the specific time from 2010 to 2022 with popular and well-known publications. This period was selected because of the significant contributions of scholars to smart infrastructure literature. The second phase of the literature review refined the search. Abstracts and introduction sections were analyzed, and articles of a specific technical nature were not considered. This second phase produced a sample of 126 research outputs. In the third phase of the literature review, papers selected in the second phase were read, and those relevant to the 'smart' factor and associated investment models, mainly focusing on public–private partnership models. Next, a qualitative content analysis was undertaken to identify the advantages and potential risks of PPP model selection for smart transport infrastructure projects. The final database consisted of 57 papers published in international journals, books, conference proceedings, or other research outputs.