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School of Design and the Built Environment

**Land Use and Spatial Planning from a Sustainability Perspective:
Designing the One-Minute City**

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**This thesis is presented for the Degree of
Doctor of Philosophy of Curtin University**

July 2022

DECLARATION

To the best of my knowledge and belief this thesis contains no material previously published by any other person except where due acknowledgment has been made.

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ABSTRACT

The main way to raise land revenue in China is via optimization of the land use and spatial planning to increase the overall land/floor area for sale. This is neither novel nor rare in new town development or urban redevelopment, particularly in times of economic fluctuations. A pursuit of income from land either through acquisition and infrastructure provision or solely from economic expansion often comes at the expense of liveability in the city and the well-being of its inhabitants. While land revenue can be increased through planning, it cannot be done properly without embedding sustainability. This PhD thesis by publication (comprising four journal papers and a book chapter) puts forward the overarching research question of this study whether sustainability features such as traffic calming can increase land value.

During the search for sustainability requirements that increase land value, particularly during the COVID-19 pandemic, the vision for a hyper-local city emerged. Such city is found to be positively linked to street recovery and land value creation as a way to respond to the pandemic crisis, climate change and other problems in the city, such as traffic congestion and overcrowding. Contrary to supporting increases in land/property prices for improved economic benefits (which would exacerbate the urban and planet maladies under the present regime of orthodox planning and paternalistic governance), this research offers insights into land use and spatial planning with the wider notion of land value creation from a sustainability perspective. The key finding of this study is the One-Minute City, a proximity-centred spatial pattern. Focussed on small interventions, this socially driven approach in sustainable urban development not only can increase land value but also can help safeguard living environments and boost life satisfaction of the urban dwellers. The thesis helps build an understanding of the benefits of such an approach using practical case studies in China and Australia. It also offers principles and policy recommendations for the implementation of the One-Minute City concept.

ACKNOWLEDGEMENTS

Completing this doctoral research would not have been possible without the understanding, support, and assistance of my family, friends, and colleagues. Nevertheless, firstly I would like to express my appreciation to my Principal Supervisor, Professor Dora Marinova. As Professor of Sustainability and former Director of the Curtin University Sustainability Policy (CUSP) Institute, Dora has extensive interest and immense knowledge in the broad field of sustainability of which I could only get a glimpse, far beyond my research area of sustainable cities. With more than 370 refereed publications as well as 70 PhD students who have graduated under her supervision, Dora is so productive that Scopus lists her as Australia's top author and 23rd in the world in the area of sustainability for the period 1991-2021. I am extremely lucky to be the prospective 71st PhD graduate and grateful for Dora's advice, support, and care throughout the duration of the research, particularly during the COVID-19 pandemic crisis.

I would also like to express my gratitude and appreciation to my Supervisor Professor Jeffrey Kenworthy who advises me, most of the time, far from Germany yet whose support and guidance are always there day and night within an arm's reach. Jeff has made considerable contribution for the development of an extensive international comparative databases on urban transport and land use in cities worldwide around the theme of "automobile dependence". His book with Peter Newman *Cities and Automobile Dependence* (1989) has been described as 'one of the most influential planning books of all time'. It is indeed a big surprise for such a big name to join the team, thanks Dora for this terrific arrangement.

My gratitude also extends to my Supervisor Dr Xiumei Guo, who is Dora's first PhD student originally from China and thus is sort of like a big sister to me. I would never forget the very first overseas phone call from Xiumei, the scrumptious Chinese dish she made for me, the festive New Year parties held in her backyard, and the funding opportunity she and Dora gained for my Royal Street case study. Without Xiumei, it would be hard-pressing to imagine this cross-border journey and for this, I will be eternally grateful.

DEDICATION

I would like to dedicate this thesis to my beloved wife Bella (Jingbo Sheng), whose patience, understanding and support have made this study journey possible. By the way, I am more than happy that she has found her real interest in life and demonstrated her talent and potential in jewellery design rather than urban design.

I must say thank you to Eric (Zeyu) and Charlie (Zeyue), my two incredibly lovely boys. Without your invaluable company--learning and growing together, I would have completed my PhD two years earlier. No matter what, thanks for the mercy of not breaking my laptop, and now it's yours.

Last, but not least, I am forever indebted to my parents and parents-in-law, not just for giving us life but also for letting us go after our dreams. It's good to be your son, and hopefully you have been enjoying parenting as well. I can't wait to get reunited after the ambush of COVID-19.

STATEMENT OF CONTRIBUTION OF OTHERS

All of the written materials submitted as part of this PhD by Publication were conceived and coordinated by Liang Wen. The majority of the calculation and writing for each publication was undertaken by Liang Wen.

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PUBLICATIONS INCLUDED AS PART OF THIS THESIS

PAPER 1 (Peer reviewed journal article):

Wen, L.; Li, Z and Guo, X (2021). Exploring Chinese Feng Shui culture for achieving sustainability. *International Journal of Information Systems and Social Change (IJISSC)*, 2021, 12(3), 15-26; doi: 10.4018/IJISSC.2021070102—published.

PAPER 2 (Peer reviewed book chapter):

Wen, L.; Guo, X.; Kenworthy, J.; Marinova, D (2018). Urban Agriculture—A Case Study of Ningbo Eastern New Town of China. In Guo, X., Marinova, D. (eds) *Sustainability and Development in Asia and the Pacific*, pp. 85-102(2018); https://doi-org.dbgw.lis.curtin.edu.au/10.1142/9789813236004_0006--published.

PAPER 3 (Peer reviewed journal article):

Wen, L.; Kenworthy, J.; Guo, X.; Marinova, D (2019). Solving Traffic Congestion through Street Renaissance: A Perspective from Dense Asian Cities. *Urban Science* 2019, 3, 18; doi:10.3390/urbansci3010018—published.

PAPER 4 (Peer reviewed journal article):

Wen, L.; Kenworthy, J and Marinova, D (2020). Higher Density Environments and the Critical Role of City Streets as Public Open Spaces. *Sustainability* 2020, 12, 8896; doi:10.3390/su12218896—published.

PAPER 5 (Peer reviewed journal article):

Wen, L.; Marinova, D.; Kenworthy, J and Guo, X (2022). Street Recovery in the Age of COVID-19: Simultaneous Design for Mobility, Customer Traffic and Physical Distancing. *Sustainability* 2022, 14, 3653. <https://doi.org/10.3390/su14063653—published>.

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FUNDING SOURCE ACKNOWLEDGEMENT:

This research is supported by an Australian Government Research Training Program (RTP) Scholarship.

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PREFACE

Under the challenge of global warming and with the continuing threat of the COVID-19 pandemic in addition to the complex, wicked urban problems, the (un)sustainability issue looms. We can neither ignore nor afford not to acknowledge it, especially in China's new town development considering its unprecedented massive scale and profound regional and global impacts. As a city planner and also a father, I feel obliged to do something for our children and the planet because "we do not inherit the earth from our ancestors, we borrow it from our children" as the ancient proverb reminds us. Instead of leaving the thinking to the few powers that be and watching endless failures of governments, world leaders, multinationals, professionals, and policy makers in dealing with the planetary crisis, each and every earth dweller needs to step up to do their bit, collectively overcoming the seemingly insurmountable challenge.

As a senior planner with ten years of practical experience in China in new town development and five years in urban planning and design, I deeply understand that one of the major problems with China's new towns is a lack of sustainability, particularly socially and ecologically, despite their glamorous physical appearances and outstanding economic achievements. That is why I chose Curtin University Sustainability Policy (CUSP) Institute, a leader in sustainability research, to work on real sustainability and distinguish it from greenwashing. As such, the driving force behind undertaking this PhD study is the hope to find out, by first-hand experience in both China and Australia, what could have been omitted—active citizenship for instance, or the possible wrong things, for example car dependence, that could have been copied during China's emulation of Western patterns and practices in city planning and governance over the last four decades.

Frankly speaking, this motivation derives not just from a reflection on the real purpose of planning as a practitioner but also from my personal quest for the meaning in life as an average Joe. After all, we all have different roles to play in life and everything is connected one way or another. In other words, there can be a thousand ways to interpret the meaning of life and happiness, and correspondingly

a truly sustainable new town milieu ought to be in place to facilitate such self-realization, affording a thousand ways to help bring it about in reality.

Undoubtedly, this research has been inspired by my birthplace Ningbo, a beautiful, thriving, and down-to-earth coastal city in East China. Historically being the hub of the maritime Silk Road that linked the East and West dating back to the Tang Dynasty a millennium ago, today's Ningbo boasts the busiest port in the world handling "Made in China" way beyond the traditional silk, tea, and china. The ever-growing bilateral exchange—in iron ore and higher education in particular—with Western Australia is just an epitome of this broad trade network. As part of this time-honoured tradition of trade and exchange, at the end of 2015, I set foot in Perth for an arduous academic journey. Before long, I started feeling homesick despite the company of my family and the WeChat in hand, and more so during the COVID-19 lockdown trapped in the most isolated mainland city on the planet that is six thousand kilometres away from my hometown (Figure A).

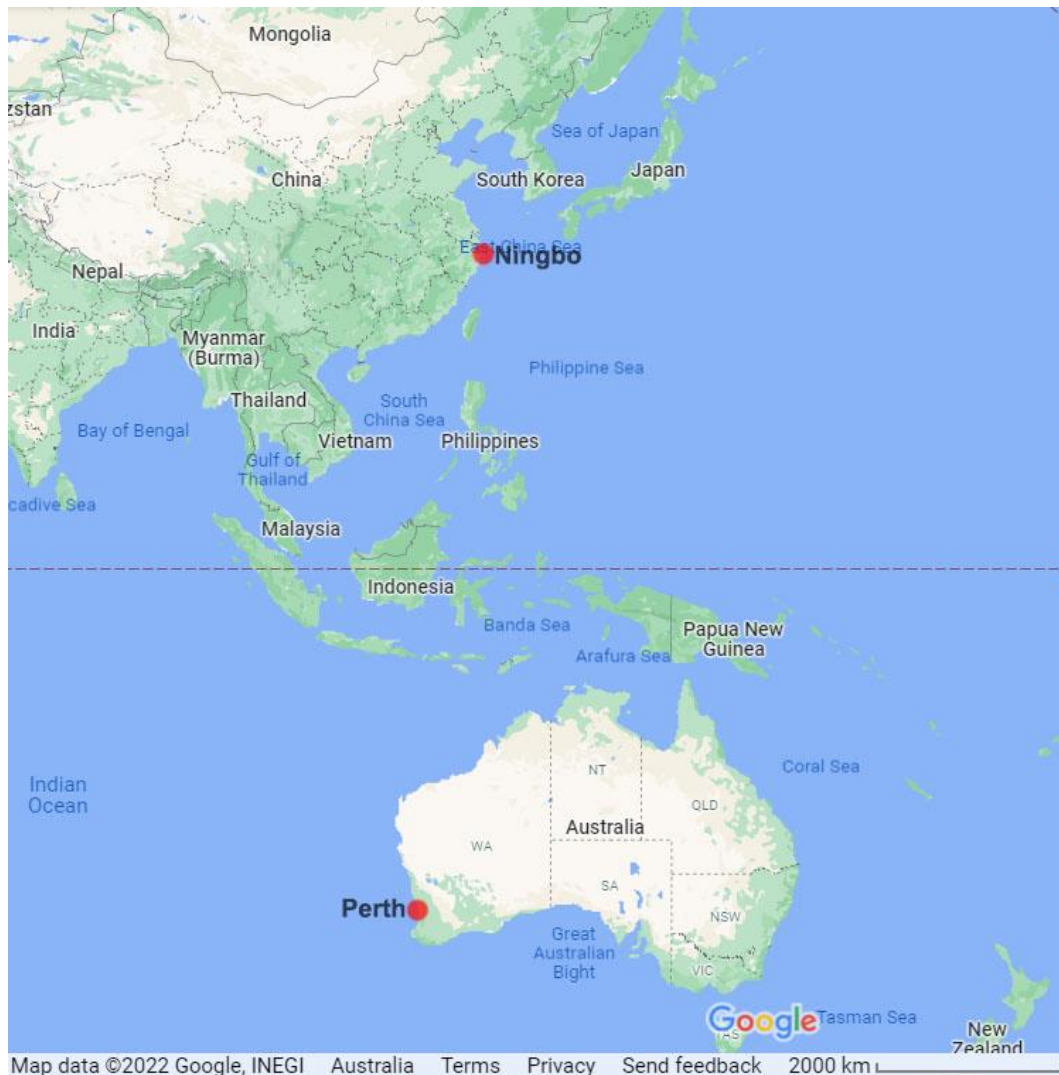


Figure A: Two cities in two countries, Map source from Google, modified by author

The feelings of nostalgia invariably revolved around two unique places in my life. One is the ancient town called Yinjiang where I was brought up. This breathtaking settlement by the mountain and streams used to be the capital of the Ningbo Region till 1200 years ago when a then new town was established 25 kilometres down the Yin River where today’s old downtown of Ningbo is situated. The other is the Eastern New Town (ENT) where I have worked for a decade as a young urban planner witnessing its emergence as a new city centre only four kilometres east of the present downtown of Ningbo (Figure B). I am privileged and proud to have the deepest people-place tie--rooted in these two magnificent localities which have seen my growth, family love, friendship, and early career development. These invaluable memories and the experiences gained from these two distinct human settlements--ancient and modern, have been accompanying me

all the way to Australia and will continue offering me psychological comfort and academic inspirations in the journey for finding a sustainable spatial pattern and the logic behind new town development.

I hope this thesis offers some solutions that help preserve the beauty of nature and vibrancy of human life. It also represents the efforts of a long journey of publishing the research findings as they appeared contributing towards understanding how sustainability can help inform and regenerate the urban fabric while protecting human well-being.

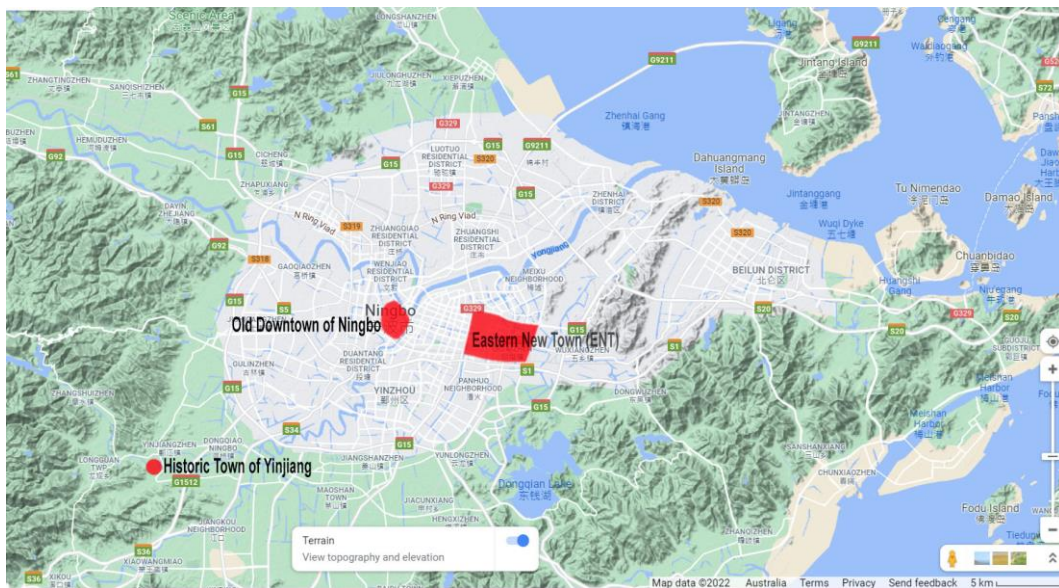


Figure B: A tale of two towns, Map source from Google, modified by author

INTRODUCTION

Chapter 1. Background

The central role of the city for achieving the well-being of the planet as well as its dwellers has been widely recognized in the discourse of sustainable development (Caprotti, 2014; Krähmer, 2021). This is in part due to over 60% of the global population being projected to be living in cities by 2030 (Jain & Espey, 2022), along with their ever-growing economic significance and ecological impact. In addition, new urban development, particularly new towns/cities via advanced urban design and cutting-edge technology, has been expected to avoid traditional urban maladies such as rampant sprawl and overcrowding while generating more balanced land value—incorporating social and ecological value into economic one—to ensure decent living within the ecological limits of the planet (Verheye, 2007; Özdilek, 2011).

With its British origin as an alternative to the overcrowded and disease-ridden industrial cities, the modern new town movement continues throughout the world (Merlin, 1980), and has been a major form of urban growth and a key strategy of city making in China (Wang, 2022). The term new town mentioned in this paper is a general concept covering a wide range of urban development often built around the existing city on green field or rural land (Fu and Zhang, 2016; Wang, 2022). It includes but is not limited to the eco-city, low-carbon city, or smart city, mostly with some form of government initiative. Since China's opening up in the 1980s, new towns have been sprouting up as economic engines across the country from the coastline to the inland and have been used to attract investments, accommodate population and modernize the city (Lin, 2014). Graphic details about this trend have been made available in Han and Wang's work (2013). Yet, most new towns have been modelled after their Western counterparts, including automobile urban fabric (Istrate and Chen, 2022), and have been paying undue attention to economic performance especially concerning land value as well as the high-rise image of the city (UNDP China et al., 2015).

In the following sections, a land value issue will be presented which has been worrying many of those concerned with Chinese new towns. The major concerns include traffic congestion, crowding, unaffordable housing, lack of street life, loss of place identity and genuine community. It is then followed by a general critique of current land use/spatial planning in China's new town development in regard to the challenges it faces when it is geared towards stimulating growth and city making. It should be pointed out that the introduction of China's new town development is only because of my background as a practitioner with accumulated experiences in city planning and building. It does not necessarily mean this PhD research would only focus on new towns/cities in China. Rather, it will cover a wide range of topics concerning urban research across the world, exploring a universal sustainable spatial pattern than merely targeting new towns or old cities in particular localities or countries. Space limitations restricted me to go into depth on all concepts found in the literature in this thriving interdisciplinary research area. As such, this thesis will be cutting straight to the chase, trying to tell a long story short, yet (hopefully) without losing the theoretical focus.

1.1 Dilemmas of New Towns in China

China's new towns are mostly newly built urban areas, developed through government initiative and planned schemes taking various forms in the course of time. From the exported-oriented "development zones and industrial parks...during the reform era, and to the new city centers with mixed land use and composite functions of the 21th century" (Wang, 2022, p30), a fiscal issue or local debt crisis surges. As a fundamental policy commonly formulated in China, the revenue from land sales, in most cases, is the only source of income for the local government and is used to cover the various costs of new town development, such as land and housing acquisition, the provision of infrastructure and public facilities, including roads, schools and parks, and administration overheads (The Ministry of Finance of China et al., 2006; Banister, 2010). Consequently, when the property market is struggling, China's new towns are experiencing difficulty as well, because of plunging revenues from land and property sales (Lu and Sun, 2013). Since the costs mentioned above are relatively fixed and even getting higher as time goes by, it

would be difficult to reduce these expenditures (Yuan, 2014; World Bank and DRC of China, 2014). Owing to the decline in revenue, funding shortage for land acquisition and infrastructure provision would consequently hinder the advancement of new towns.

Although the authorities which govern new towns can raise money in many ways, such as introducing Build-Operate-Transfer (BOT) projects or Public-Private-Partnerships (PPP) to attract private investors or raising money in the capital market by means of land mortgage, fund or bond issuing, each solution has its limitation and costs. Platforms such as financial institutions and development corporations, be it private or state-owned, have been deeply involved in this land-based financing for infrastructure provision and property investment in China's rapid urbanisation (Lu & Sun, 2013; Wu, 2022). Fundraising using these local government financial vehicles (LGFVs) has already resulted in alarming debt crises for local governments and this "situation has been worsening as the real estate and land market cool down..." (Wang, 2022, p34). The financial pressure might be relieved temporarily but cannot be dispelled completely as the debt has to be paid off eventually with the revenue from the land, due so far to the absence of property tax in China (International Finance, 2021).

In comparison, increasing the land value and revenue via optimization of the land use and the spatial plan comes with little or no cost at all and is thus deemed as a convenient approach to financing. This is primarily because the potential for land revenue in the new town lies in the amount of land for real estate and the total floor area that is planned or allowed to be built, both of which are essentially determined by land use and spatial planning (Chen, 2012; MLR of China, 2014; World Bank and DRC of China, 2014). In addition, spatial planning (land use planning included) dictates the intrinsic properties of a plot of land such as its location, lot size, designated use, floor area ratio (FAR) and building height allowed. These critical land attributes can decide the basic price of a lot of land under certain circumstances.

It is understandable that local authorities aim at utilizing spatial planning to exploit the potential of land to sell more and build more in order to accommodate more population and bring more economic benefits, as long as this practice neither

compromises the ecology nor lowers the living standards of residents. Notwithstanding this, it is not uncommon in plan implementations/revisions to see such practices as a reduction in neighbourhood roads here and a reduction in urban green open spaces there, in an effort to increase the land reserve for real estate, or simply raising the FAR or building height without much consideration to their ecological or social consequences.

1.2 Challenges of New Town Planning

Increasingly tied up with the property market and engaged in land speculation, most new towns in China essentially serve as branding tools to attract capital for real estate development (Curien, 2014). These new settlements are essentially built on wheels without many desirable characteristics as envisioned in the 15-or 20-minute cities/communities. They do not offer lively human-scaled urban spaces that are relatively free of exhaust fumes, accessible and safe for children and seniors with daily necessities within a short walk from home (Domenico et al, 2022; Logan et al, 2022; Tolley & Tranter, 2022; Pinto & Akhavan, 2022), in their land use and spatial plans, despite in some cases, branding to the contrary (Chien, 2013; Song et al, 2020). That is why many local governments do not even monitor their so called eco-friendly or low-carbon city projects, not to mention meeting key sustainability standards (Miao & Lang, 2015; de Jong et al., 2016).

Unsurprisingly, quite a few unsustainable features have come into view. Among the most evident is the sprawl of skyscraper suburbia with its cramped cityscape, which is characterized by the prevalence of apartment compounds and ubiquitous heavy private motorised traffic. In comparison to the low-rise, low-density suburban expansion commonly seen in the West, the indulgence in high-rise housing in China coupled with overdependence on private cars, results in more crowdedness and prolonged traffic congestion (Figure 1). The term “dense sprawl” was coined by William Fulton to describe high-density sprawl in US cities like Los Angeles (Eidlin, 2005). This phenomenon has not only been associated with higher environmental and health costs linked to air pollution, noise, mental disorders,

traffic injuries and deaths, but also has caused the proliferation of the “nonplace” phenomenon and declining community distinctiveness and cohesion (Wen et al, 2020). In essence, to paraphrase Dimitriou (1992) there is a mismatch between urban form and transport because the high-density characteristic of Chinese new town development, inevitably requires high dependence on public transport, walking and cycling and not private cars.

Figure 1: Congested cityscape in Ningbo Eastern New Town



(Source: https://www.sohu.com/a/317682776_467457 accessed: 30/03/2022)

Figure 1 depicts a congested cityscape in the form of a horizontal traffic jam and vertical crowdedness of high-rise buildings. It also indicates the new town syndrome--“a thousand cities with one face” (Abramson, 2011, p67). According to Wang (2022, p34),

“[A]s new towns adopt the same set of planning strategies and spatial aesthetics, experience a lack of street life and social vitality as a result of planning oriented toward industrial efficiency or real estate profitability and developed wholesale at a rapid pace, and undergo increasing sociospatial segregation, since the new towns comprise largely gated communities and are built for middle- to upper-class citizens. sic”

Another profound yet less visible feature is the departure between the use of value and market price of land/property, the distinction of which will be elaborated in Chapter 2. For the past two decades, it was the best of times for those early buyers and developers who revelled in the booming of the property market. For those who came late with a tight budget, it was the worst of times because they had to carry the heavy financial burden, possibly for the rest of their lives to pay off their debt owing to higher mortgage repayments and wage stagnation (Nelson, 2018). More often than not, migrant workers, who have spent many years of sweat building the new city, cannot even afford a tiny bathroom in an apartment unit that they had built, let alone those unemployed and living in poverty.

Contrary to the soaring housing prices, the use value of property is lagging behind. The common characteristics of present gated communities and city space in China and beyond are the “[m]onotony and the economic desert of the streets” (Cozzolino, 2018, p18) and the vast underused open spaces devoid of human activity and residents’ participation. The dwellers’ enthusiasm in planting, for instance, is thus limited within their own apartments and individuals’ business initiatives are increasingly pushed away from home. As MacDonald et al. (2014, p108) put it, “[a]re we constructing buildings for profits or are we building homes for people to transform spaces into real places with their culture, emotions, talents, stories and lives?”

Chapter 2. Literature Review and Research Gap

The emergence of unsustainability features in the built environment such as the dense sprawl of new towns and the unbalanced use/exchange value of land/property as previously mentioned, indicates a general decline of the land value in terms of the overall walkability and openness of city streets, shareability and participation of urban space, affordability and diversity of housing and business options etc. (Jacobs, 1961; Gehl, 2010; Moroni & Chiodelli, 2014; MacDonald et al, 2014; Oliveira, 2016; Foster & Iaione, 2016). Considering other broader emergencies including COVID-19 and future pandemic crises and climate change, it is critical to explore the relationship between land value, sustainability and planning in the first place. The rest of Chapter 2 presents the research gap this study is attempting to fill in urban planning after the deconstruction of land value and a revisiting of sustainability principles.

2.1 Deconstructing Land Value

The value of urban land can be influenced by numerous factors and among those the most salient is land use and spatial planning, particularly in greenfield development. They regulate the physical attributes of the land, which are directly related to the use value of a parcel of land as well as the total revenue of a new town in a certain urban context, as previously mentioned. As a commodity, a plot of land must be able to satisfy the needs and wants of the land user by its properties, including lot size/shape, floor number/area permitted, and designated use--for residential or commercial purpose. The use value is realized through the consumption of land--the direct and actual utility the property produces for its user, be it a homesite for a family or an office site for a dentist (Pivo, 1984; Haila, 2016; Turnbull, 2017).

Realizing this, a consensus on building densely to maximize land value has been reached between property developers and local councils. This is not limited to China but also evident in other countries such as Canada and England and is often realized through planning obligations (McAllister, 2017). As a result of their planning application and negotiation, developers often obtain a planning permission

to build more and higher “beyond the maximum permitted in zoning in return for the provision of facilities, services or matters” (Friendly, 2020, p1). However, this high densification in the deal-making process, as Friendly (2020) revealed in the case of Toronto, Canada, may result in “pet projects by individual councillors” (p4) and end up solely enhancing developer’s property values by providing “art and park space rather than community centres and affordable housing” (p8).

Secondly, spatial planning plays a pivotal role in forming the locational attributes of the land which influence the value of a single site as well as the aggregate land value of a new town. The classic location theories, such as central place theory and bid rent theory in their “explanation of urban location in terms of centrality” (Parr, 2017, p151), illustrate well how accessibility and distance to the CBD shape the spatial layout of retail industry (Cheshire and Sheppard, 1995). Likewise, a domicile that is located in a high-quality school district with daily shopping needs satisfied within a short walk in an attractive and safe setting, tends to yield higher land value. In essence, land value lies in proximity - the distance to market for retailers or the distance to amenities for residents. Hurd (1924) points out: “Since value depends on economic rent and rent on location, and location on convenience, and convenience on nearness, we may eliminate the intermediate steps and say that value depends on nearness” (Lloyd & Dicken, 1977, p43).

To overcome the friction created by distance, however, modern cities choose to pursue speed rather than nearness which especially disadvantages walking and cycling and naturally favours cars and motorcycles. Built on automobile fabric that features single and separated land uses out of reach on foot (Jacobs and Appleyard, 1987), present mobility-centred spatial structure actually pulls land value down by turning its back on neighbourhood streets along with the many prime locations that small retailers and residents rely on. This transport and zoning practice not only reduces the commercial value of the entire neighbourhood, but also lowers the value of residential land due to the loss of vibrancy and attractiveness and the rise of pollution, noise and security issues. John Whitelegg, the author of "Mobility: A New Urban Design and Transport Planning Philosophy for a Sustainable Future", argues further. “Mobility measured crudely in terms of how many kilometres we move around every day has nothing whatsoever to do with

quality of life, rich human interaction, satisfaction, happiness and a detailed knowledge and familiarity with places and the things we chose to do in those places.” (Quoted in Ethan Goffman’s book review, 2015, n.p.)

Additionally, land use policy and spatial planning also exert influence on the exchange value of land which is decided by the economic forces of demand and supply and is realized when the land is rented or sold (Pivo, 1984). Since the economic value of land is defined as “the opportunity cost of leaving unimproved land undeveloped” and is determined by the best land use (Tideman & Plassmann, 2018, p69), it has been found that the acceptance or rejection of the interim/informal land use, land title or tenure may greatly affect the market price of land (de Vries & Voß, 2018). This is because such an approach changes the opportunity cost, often measured by an alternative land use and also the expected future returns from current urban land (Wendt, 1957). Moreover, large land holding, and land hoarding have been increasingly employed by big developers and new town authorities which wait to sell or build until the land price is significantly high enough to secure a substantial profit. This practice disrupts the demand for and supply of land which further pushes up land price. Decoupling of market price and use value indicates a detrimental trend in the land/property market which is increasingly present, such as the stock market absorbing all sources of profit-seeking capital.

It appears that land use and spatial planning have become a financial tool focusing more on the price and revenue from land than on its utility. According to Madanipur (2001, p180), “[a]s urban space is treated as a commodity, the conflict between exchange value and use value has a major impact on the shape of cities and the life of citizens”. Hence it comes at the expense of those who value real dwelling or seek prime business location. Such unsustainable practices have narrowly defined land value merely from an economic perspective without factoring in the ecological and social importance. From healthy food, clean air and water to the social and emotional value attached to a property, landscape or neighbourhood, “these intangible indicators are not incorporated directly in market values...” (de Vries & Voß, 2018, p385).

Can sustainability be a key value driver for urban land development? Will sustainability principles be readily available to guide and reshape our current

undesirable trajectory? To answer these questions, it is necessary to revisit the sustainability principles and find out how they can inform our understanding and practices.

2.2 Revisiting Sustainability Principles

Sustainability was defined by the Brundtland Commission as “meeting the needs of the present without compromising the ability of future generations to meet their own needs” (World Commission on Environment and Development, 1987, p8). Almost three decades later, the United Nations (2015) released the “2030 Agenda for Sustainable Development” “as a plan of action for people, planet and prosperity” in order to “shift the world onto a sustainable and resilient path” (p5). The central part of the document is the 17 Sustainable Development Goals (SDGs) (see Figure 2) along with 169 detailed targets, which are “integrated and indivisible and balance the three dimensions of sustainable development: the economic, social and environmental” (UN, 2015, p5).



Figure 2: 17 Sustainable Development Goals
(Source: <https://www.globalgoals.org/resources/>)

While ambitious and uplifting, the extremely broad concept of sustainability suggests complexity and unpredictability of the wicked problems that cities need to

deal with. In Steidle's words (2021, n.p.), "[t]he 17 Sustainable Development (SDGs) topics each align with the description of wicked problems re-positioned as goals." The immense global challenges such as hunger and poverty, regional conflicts, and climate change (see Appendix A: Our world today) indicate the incapability of present global governance during the non-linear, dynamic epoch of the Anthropocene (Bai et al, 2016).

As a stand-alone goal on cities and urban development in the 2030 Agenda, SDG11-- "make cities and human settlements inclusive, safe, resilient and sustainable" (UN, 2015, p26) – sets out 10 specific targets (see Appendix B). It includes providing access to affordable housing, sustainable transport, green and public spaces, and enhancing "inclusive and sustainable urbanization and capacity for participatory, integrated and sustainable human settlement planning and management..." (UN, 2015, p26). It is not surprising that SDG11 also aims for a reduction in the negative environmental impact of cities, to promote "...resource efficiency, mitigation and adaptation to climate change, resilience to disasters" (UN, 2015, p26)

However, the policy-oriented SDG11 neither points out the root causes that have made current urban development unsustainable, nor provides a sketch of what a sustainable city could possibly look like. The sustainable city remains a complex and abstract concept and thus is left to multiple or often conflicting interpretations as to how to best utilize urban land and raise its value in a balanced way. From traffic congestion and a housing crisis to lack of open space due to competition between different land uses for finite urban space, these chronic problems at a city level also imply the weaknesses of modern city governance.

Also characterised by too much generalization and poor application, quite a few practice-oriented sustainability guidelines exist, failing to answer the question of how such principles can be incorporated into everyday urban development. For example, what would be the specific requirements, such as community gardens and edible landscape that can be further developed from the principle of food security and production in guidelines such as the Policy Guide on Planning for Sustainability and its latest draft (APA, 2000; Hodgson, et al., 2011; Rosa, et al., 2014; APA, 2015); how can such sustainability requirements be integrated into land use

planning/zoning to create broad land value for urban inhabitants from the spatial perspective in preparation for challenges like the recent food crisis in cities such as Shanghai during the COVID-19 pandemic lockdowns? (Lovell, 2010; Badami and Ramankutty, 2015; Zhou, 2015).

Adding to the “omission” of the core principle of sustainability—local food production in the mainstream planning agenda, Edward et al. (2014) identified in the literature nine sustainability principles including encouraging higher density development, mixed use, transportation alternatives etc., and found that these key principles and the 53 relevant regulatory measures have not been well incorporated and carried out in local zoning ordinances in the USA. This dilemma is further illustrated in hard densification, a property-led urban development model that is focused more on physical form and less on social and ecological concerns. Without adequate guidance from sustainability principles, New Urbanism and Smart Growth initiatives have been eroded, often yielding to the pressure of land value extraction for the few instead of broad value creation for all (Knaap & Talen, 2005; APA, 2012).

It has been half a century since the publication of “The Limits to Growth” (Meadows et al, 1997) and no fundamental changes so far have been made to significantly alter the trajectory of the exponential growth of new cities which has been devouring the finite land and other resources at the expense of the well-being of the Earth and humankind (Krähmer, 2021). Such failures in the mainstream urban growth paradigm as in the case of the new town movement in China, only point out a cold fact that in the words of Alexander & Gleeson (2020, p360), “[i]n an age when capitalism has attained near-complete hegemony, growth-oriented societies do not know how to deliberately create a macroeconomy or urban form that produces and consumes less.”

Western knowledge so far is inadequate to respond to the complexities of urban and climate issues. As Spretnak (1999) points out “[d]espite numerous achievements, modernity however has created a rigid framework designed to maintain the western economic and social status quo which perpetuates unsustainable and destructive behaviours and reasoning, including ever-increasing consumption, anthropocentrism, mechanistic, and rationalist worldview sic”

(Raphaely and Marinova, 2018, p366). It is indeed the case of China's westernization and modernization, which represents "a lifestyle detached from nature and geared towards a high level of consumption" (Hartz-Karp & Marinova, 2017, p4; USI, 2017).

Historically, Chinese villages and towns have been guided by the Feng Shui culture and other ancient philosophy. From site selection of settlements, shelters and graves to the interior layout of dwellings and the proper location of furniture, all followed the rules of Feng Shui (Emmons, 1992; Cheng, 2011). For thousands of years, Feng Shui, the ancient sustainability guidelines, has firmly taken its roots in both the landscape of this Oriental nation and the heart of its people (Cheng, 2011), pursuing harmony between nature and humanity (de Jong et al., 2016).

Under the influence of Feng Shui, a multitude of missing sustainability features, such as flexible use of buildings and streets, collective sufficiency, and sense of belonging, could be found in the traditional fine-grained walking urban fabric (Kenworthy and Hu, 2002). This is contrary to the automobile fabric in modern cities which has been criticized for its high ecological and health costs associated with incessant concrete and asphalt expansions that have little consideration about the well-being of pedestrians (Chien, 2013). Thus, Oriental wisdom can provide some inspiration to present-day urban sustainability, and this is the foundations of the approach taken in this study.

2.3 Research Gaps

The literature review on land value and sustainability principles has certain implications which help to discover two major gaps in the research. To achieve urban sustainability, an in-depth interdisciplinary cooperation and research is required in the first place, which is problem driven, context specific and application-oriented (Hassan, 2001; Edward et al., 2014). Considering the huge impact land use/spatial planning has upon the value of urban land, accomplishing the proposed transformative shifts in urban development requires more than the mere listing of sustainability principles and guidelines under the aspirations of SDG

11. That is why sustainability and land use/spatial planning need to join hands to deal with specific land value issues from a holistic view.

Specifically, we address the land value and sustainability issues in this research via promotion of real dwelling/use value rather than real estate/exchange value. It involves the introduction of such sustainability requirements as overcoming car dependence, urban agriculture, tactical urbanism, traffic amelioration, and streets as public open space which have been drawn from various sources (APA, 2000; Knaap & Talen, 2005; Kenworthy, 2006; Newman & Jennings, 2008; APA, 2012; Edward et al., 2014) and which have been absent especially in China's new town movement.

It is then followed by a series of probes into real-world urban problems to test the requirements and to find out the root causes of and possible solutions to the current urban maladies which are negatively affecting and closely linked to land value. The urban issues to be studied generally cover the three pillars of sustainability and include inactive use of the public green space and a growing financial burden on its maintenance, traffic congestion and jobs-housing unbalance, overcrowding and housing affordability, and the struggles of small businesses under the threat of the COVID pandemic.

Another research gap concerns a missing part of the human dimension in urbanization and city governance. To achieve the broader and ambitious sustainability agenda and for the sake of a safe landing for humankind, a post-growth urbanity led by the general public ought to be envisioned because more people realise that "governments and businesses are unable to lead a degrowth transition and endeavour to live materially downshifted, post-carbon lives," (Baumann et al, 2020, p389). A growing consensus is that the growth paradigm of modern parasitic cities not just erodes the planet's natural limits but also destroys the social fabric and democracy (Nelson, 2018; Alexander & Gleeson, 2020). As Fournier (2008) put it "the ecological crisis is just one consequence..." (p536), we need "to develop mechanisms that will link up local spaces and actions into a broader political movement" (p539).

Precisely, we take care of the land value and sustainability issues by seeking alternative ways to the present top-down orthodox city-making through exploring the critical role of city streets and grassroots initiatives in broad value generation and capture. This research will demonstrate how to reclaim the citizens' right to the city and see urban streets as commons to manage collectively in response to complex urban and planetary crises (Fournier, 2013; Iaione, 2016; Foster & Iaione, 2016). To this end, it also aims at finding a sustainable spatial pattern that can facilitate the formation of such a co-created city from the somewhat fragmented and scattered de-growth movement and sharing/co-living practices (Vith et al, 2019; Holmgren, 2020; Sánchez-Vergara, et al, 2021).

Chapter 3. Research Design

This section contains the research question, aim and objectives of the thesis, and the methodologies used. It also covers the case studies and data collection which have been used to address the research question.

3.1 Research Question, Aim and Objectives

Targeting the problems of declining land value/revenue and lack of sustainability in new town development, the research question of this study is:

- How can sustainability features increase land value in urban development?

The aim of the research is to:

- Offer insights into land use and spatial planning for the wider notion of land value creation in urban development with a sustainability perspective.

The four objectives of the study (see Figure 3) are:

1. Deconstruct land value to understand its components-- (*see Chapter 2*).
2. Explore and define critical sustainability requirements-- (*see Chapter 2*).
3. Analyse sustainability requirements with real city problems-- (*see Chapter 4, and Papers 1, 2, 3, 4 & 5 for further details*).
4. Provide research insights offering recommendations for land use and spatial planning in urban development-- (*see Chapter 5*).

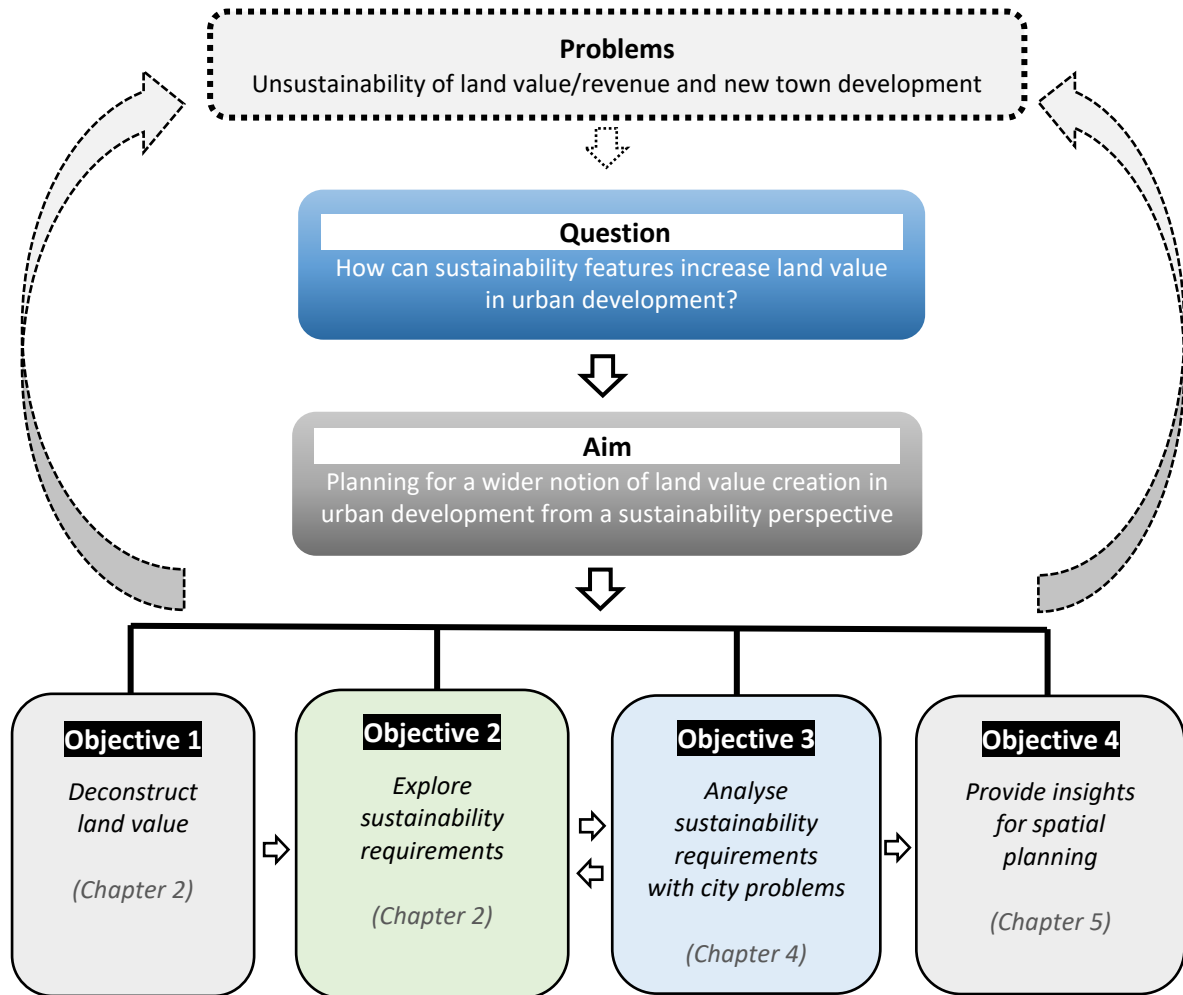


Figure 3: Relationship between the problems, research question, aim and objectives of the thesis. (Source: Author)

3.2 Research Methodologies and Methods

There are three methodologies that have been adopted in this PhD research. In addition to the literature review in relevant theoretical and empirical fields, such as traffic alleviation, self-organization and location theories, the methodologies of case study and autophotography have also been employed for in-depth investigations about real world problems and phenomena.

Specifically, autophotography has been extensively used in Paper 4 and Paper 5 for comparing and discussing street designs. As a participant-driven investigation methodology, autophotography creates a mixture of visual and narrative data. Thus, the descriptive methodological strategy employed in this research assists with the conveyance of urban density and street setting. Such vivid interpretations help to explore the mechanisms behind urban crowding in Paper 4 and the infrastructure that street recovery needs in Paper 5. As such, the method of street photography has been explored and applied which involves street pictures that have been taken mostly by the research team from different parts of the world. All photos included in Paper 5 were taken by me justifying the use of the method. Paper 4 however used photos taken overseas by the supervisors as there were travel restrictions at the time of its publication, but we still wanted to use this method.

For another, the case study methodology, reflected in Paper 2 and Paper 5, was selected to test the feasibility of certain approaches to real problems or phenomena. This enables the study to arrive at possible solutions and formulate policy recommendations for planning processes. Case studies in two different cities have been used, namely hypothesis testing for urban agriculture in ENT, Ningbo, China and street observation of Royal Street, Perth, Australia. Although urban agriculture was developed as a case study before COVID-19, it is also a solution to the issues created by the pandemic with disruptions in supply chains, lockdowns and other restrictions. Both associated with land value uplift and human well-being, these two cases have much in common in answering the research question of whether sustainability features such as urban agriculture and traffic amelioration can increase land value for the general public.

3.3 Case Studies

Two case study areas from two countries were selected to explore and illustrate how urban agriculture can possibly take roots in a dense urban environment and how small business can be expected to recover from the adversity of COVID-19 with improvements to the local street setting.

The first case is the Eastern New Town (ENT) in Ningbo, China, which has been used for the study of urban agriculture and public green space (see Figure 4). Because of my previous personal and professional engagement in ENT (described at the outset of this exegesis), the choice of ENT not only offers me access to research data, but also enables me to identify good trials and unsustainable practices in new town development. This case study generally touches all the three aspects of sustainable urban development and can be a good starting point for genuine sustainability to take root in urban China by introducing urban agriculture—one of the core principles of sustainability - in an economically viable way.



Figure 4: Ningbo Eastern New Town (ENT), China

(Source: <https://sunnews.cc/zhihu/1122280.html>)

The other case is Royal Street in East Perth, which explores the quality of local streets and their linkage to potential small business recovery during the pandemic crisis in Western Australia (see Figure 5). Because of Covid-19 restrictions, problems such as insufficient foot traffic and limited business capacity have persisted, making the contradictions between street setting and small business

increasingly pronounced. The crisis offered a rare opportunity to study the impacts of COVID-19 on the street milieu and domestic business. This case study mainly helps to cover the economic sphere of urban sustainability by investigating the unexpected health emergency and its relationship to healthy streets and the long existing customer traffic issue faced by small retailers.



Figure 5: Claisebrook Cove near Royal Street, East Perth, Western Australia
(Source: Author)

3.4 Data Collection

Table 1 presents four sources of data collection which cover Ningbo Eastern New Town planning data, field data in Perth, data offered by City of Perth, and visual data. The first concerns the Eastern New Town in Ningbo where the town plan data and data of the annual budget for park maintenance have been collected from the ENT headquarters. They are used for the estimation of the possible government budget required for the maintenance of public green space in the ENT in two scenarios, with or without urban agriculture respectively.

The author has conducted field trips in the study of Royal Street and generated the field data via mapping of shop vacancies to understand the degree to which pandemic restraints such as the physical distancing had disturbed the operation of the shops. In addition, the research team obtained map data from the City of Perth local government area for drawing and investigation.

Furthermore, visual data in the form of street photographs were utilised for comparing and discussing streets in the East Perth area and other parts of the world.

The research team, including my supervisors, took most of the photos in different parts of the world, and some of which were from Google Street View.

Table 1: Data sources

	Ningbo East New Town (ENT) planning data	Perth field data	City of Perth data	Visual data
Content	Town plan data and data from annual budgets for park maintenance	Field data about shop vacancies along Royal Street, East Perth	Maps of Royal Street, East Perth	Street photographs from different parts of the world
Source	Ningbo ENT Headquarters, China	Field investigation by the authors	City of Perth, Western Australia	Taken by authors, and from Google Street View
Use	To estimate the government budget on park maintenance with and without urban agriculture	To investigate the extent to which COVID-19 affected local small businesses	To draw maps and conduct analysis	To compare and discuss street designs

3.5 Ethics Issue

Ethics approval was not required in this research as no human participants were used in the study. All data used are legal, publicly available and are only used for this study and the research abides by the requirements of all providers. The copyright of photographs is duly acknowledged when used.

Chapter 4. Summary of Publications

This chapter introduces the five publications which form part of the body of this PhD thesis. In combination, they are aimed at delivering the four objectives of the study. The publications are available in full text as attachments 1 to 5.

4.1 Feng Shui and Sustainability—*Paper 1*

PAPER 1 (Peer reviewed journal article):

Wen, L.; Li, Z and Guo, X (2021). Exploring Chinese Feng Shui culture for achieving sustainability. *International Journal of Information Systems and Social Change (IJISSC)*, 2021, 12(3), 15-26; doi: 10.4018/IJISSC.2021070102—published.

Publication abstract:

This paper explores Chinese Feng Shui and compares it with modern sustainability principles in philosophic thinking with three major findings. Oneness has been the first discovery from the environmental perspective. Instead of being the superior, dominant species on the planet, Feng Shui seeks humans' appropriate place in nature, calling for moderate and suitable improvement of the landscape rather than reshaping and exploiting the biophysical environment for cheap land and high resource consumption. The second finding is organic holism. Economically, Feng Shui promotes self-sufficiency and circular economy practices rather than the present high-consumption, pro-growth mode that is “fundamentally incompatible with our finite and increasingly degraded planet (Baumann et al, 2020, p379)”.

Lastly, communitarianism is likely to be one of the most important findings from Feng Shui. This ancient culture values the balance of individual and collective interests which is safeguarded by the ritual and legal dual systems, creating an acquaintance society that features a degree of self-governance and generates rich social fabrics. This contrasts with today's predicament—inclusive and participatory issues that are closely linked to thin or weak democracy. Dormant citizenship and “Not in My Back Yard” opposition to an urgently needed change in the development paradigm, signal “processes of disintegration and antagonism rather

than the unified actions required by the SDGs and the sustainability agenda” (Marinova and Guo, 2018, p3).

This paper is most likely the first attempt to create a connection between modern sustainability and Feng Shui in a systematic way, offering potential for further exploring this link in future research. Undoubtedly, the time-honoured Chinese geomancy has significant implications for informing contemporary urban policy targeted at achieving sustainable development in a more balanced and harmonious way. Table 2 below summarises the contribution of this paper to sustainability.

Table 2: Contribution of Paper 1 to sustainability

	Environment	Society	Economy
Paper 1 (Feng Shui)	Oneness — harmony and bidirectional influence between nature and humanity, which calls for moderate and appropriate change of the environment	Communitarianism — safeguard of individual interests and social stability by the ritual and legal dual systems	Organic holism — circular economy that promotes self-sufficiency and discourages materialism

4.2 Park Maintenance and Planting Enthusiasm—*Paper 2*

PAPER 2 (Peer reviewed book chapter):

Wen, L.; Guo, X.; Kenworthy, J.; Marinova, D (2018). Urban Agriculture—A Case Study of Ningbo Eastern New Town of China. In Guo, X., Marinova, D. (eds) *Sustainability and Development in Asia and the Pacific*, pp. 85-102 (2018); https://doi-org.dbgw.lis.curtin.edu.au/10.1142/9789813236004_0006--published.

Publication abstract:

This research is intended to address the problems of the increasing financial burden on local government in maintaining parks and public green spaces. By conducting a hypothesis testing about introducing urban agriculture in Ningbo Eastern New Town (ENT) in China, it is found feasible to generate sufficient revenue from public green space to cover its maintenance costs through the introduction of community gardens. The finding also indicates urban agriculture’s potential and contribution to a more liveable and resilient city. As such, the introduction of urban agriculture into urban development is recommended to urban planners and city officials in China in order to fulfill its numerous benefits.

Table 3 below summarises the resolution of the problem of park maintenance tested with the corresponding sustainability requirement of urban agriculture. It is then followed by Table 4 which lists the contribution of this paper to sustainability from the perspectives of environment and society. Although this paper was produced before the COVID-19 outbreak, its ideas have been reinforced by the challenges posed by the pandemic. This is because food production in urban green space such as edible landscapes and community food gardens has provided an alternative way to ensuring food proximity and self-sufficiency in conditions that affect supply chains and threaten the overall workforce needed to maintain the industrial food system (Langemeyer et al, 2021; Simon, 2022).

Table 3: The problem of park maintenance and resolution

Problems	Proposed Solutions	Tested Sustainability Requirements	Expected Results
Growing burden of park maintenance; Inactive use of green space	Incorporating community gardens into public green space, and generating lease income to cover the cost of maintenance	Urban agriculture	Satisfied planting enthusiasm and eased financial burden on park maintenance

Table 4: Contribution of Paper 2 to sustainability

	Environment	Society	Economy
Paper 2	<ul style="list-style-type: none"> Reduce the reliance on green groceries that have high embedded fossil fuel-based food miles Develop public space stewardship 	<ul style="list-style-type: none"> Satisfy nascent planting enthusiasm and socialization needs in urban settings A trigger for the start of community initiatives and strengthening civil society 	See Table 12

4.3 Traffic Congestion and Alleviation—Paper 3

PAPER 3 (Peer reviewed journal article):

Wen, L.; Kenworthy, J.; Guo, X.; Marinova, D (2019). Solving Traffic Congestion through Street Renaissance: A Perspective from Dense Asian Cities. *Urban Science* 2019, 3, 18; doi:10.3390/urbansci3010018—published.

Publication abstract:

This study attempts to solve the modern traffic problem by using examples of dense Asian cities that are built on traditional knowledge and practices. It is found that the root cause of congestion is inefficient land use patterns and the

degradation of the traditional role streets from places to passages. Therefore, the only truly lasting and meaningful approach to traffic alleviation, which has benefits across the whole of society, is through traffic absorption by the revival of the street - aggregating production, consumption and living space on top of transport functions. It is believed that jobs-housing balance in the neighbourhood and public life in the street can substantially reduce work-related commuting and life-related non-commuting travel demand respectively. This research also introduces the idea of establishing a balance between the three city fabrics – walking, transit and automobile-dependent, and a redistribution of the travel time budget with the preferred vision of low-mobility and active lifestyle. In the end, it provides policy recommendations for linking transport and planning in a visionary debate and flexible decision process and points out that traffic amelioration requires a holistic approach and multiple lasting efforts within transport policy and beyond, always putting people at the heart of decision-making.

Table 5 below summarises the resolution of the traffic issue tested with the corresponding sustainability requirement of overcoming car dependence. It is then followed by Table 6 which lists the contribution of this paper to sustainability from the perspectives of environment and society.

Table 5: The problem of traffic congestion and resolution

Problems	Proposed Solutions	Tested Sustainability Requirements	Expected Results
Traffic congestion; Unbearable high cost of the supply-side approach to congestion alleviation	Land use and transport integration (LUTI) through street-level jobs–housing balance Streets as walkable, multi-purpose destinations	Overcoming car dependence	Absorbed motor traffic via indirect travel demand management; Significantly reduced road construction and widening

Table 6: Contribution of Paper 3 to sustainability

	Environment	Society	Economy
Paper 3	<ul style="list-style-type: none"> • Save lives and reduce pollution from motor traffic • Reclaim the space occupied by private cars for human purposes and non-motorised mobility. 	<ul style="list-style-type: none"> • Mingle all walks of life on the pavement • Revive a slower pace of street life with increased convenience 	See Table 12

4.4 Perceived Density and Crowding Easement—Paper 4

PAPER 4 (Peer reviewed journal article):

Wen, L.; Kenworthy, J and Marinova, D (2020). Higher Density Environments and the Critical Role of City Streets as Public Open Spaces. *Sustainability* 2020, 12, 8896; doi:10.3390/su12218896—published.

Publication abstract:

In an attempt to address the crowding issue that accompanies urbanization and densification, this paper advocates for city streets to be the fundamental public open space to increase spaciousness and also encourages civil initiatives to ease crowding. Introducing traffic calming and self-building practices is expected to lower perceived density and to satisfy human needs for proper shelter and a livable public realm—two of the approaches put forward for crowding easement. This research not only tackles the problems of overcrowding and lack of open space in a dense urban environment, but also touches on housing provision and affordability issues. It suggests tactical urbanism as a new city development strategy to reinstate the rights and responsibilities of citizens in taking charge of their primary living environment.

Table 7 below summarises the resolution of the crowding issue in cities tested with the corresponding sustainability requirement of streets as public open space. It is then followed by Table 8 which lists the contribution of this paper to sustainability from the perspectives of environment and society.

Table 7: The problem of urban crowding and its resolution

Problems	Proposed Solutions	Tested Sustainability Requirements	Expected Results
Urban crowding; The public realm’s current inability to provide relief from urban crowding because of vehicle-dominated streets	To reduce perceived density and/or satisfy human needs for proper shelter and a more livable public realm	Streets as public open spaces (POS) with traffic calming and tactical urbanism	Eased crowding in people’s primary living environment; Greening of the urban public realm

Table 8: Contribution of Paper 4 to sustainability

	Environment	Society	Economy
Paper 4	<ul style="list-style-type: none"> • Reimagine urban streets as POS to reduce perceived density • Create a city in the park, providing equal access to nature 	<ul style="list-style-type: none"> • Release do-it-yourself enthusiasm to satisfy human needs and to awaken active citizenship • Practice self-governance to take charge of the prime living environment and restore a sense of place 	See Table 12

4.5 Struggles of Small Business and Street Recovery—*Paper 5*

PAPER 5 (Peer reviewed journal article):

Wen, L.; Marinova, D.; Kenworthy, J and Guo, X (2022). Street Recovery in the Age of COVID-19: Simultaneous Design for Mobility, Customer Traffic and Physical Distancing. *Sustainability* 2022, 14, 3653. <https://doi.org/10.3390/su14063653>—published.

Publication abstract:

Using a case study in East Perth Western Australia, this paper analyses the recovery of small business in Royal Street from the impact of the pandemic crisis and offers solutions by addressing simultaneously the issues of urban mobility, business location and the control of infectious diseases. The analysis of the street milieu demonstrates the fragility of local business that is not adequately supported in a car-oriented environment. A key finding of this research is the One-Minute City in which daily essentials and services such as groceries and clinics are only a minute away from home without the need to drive. This hyper-local city is underpinned by various physical, digital and social infrastructure that small business urgently needs. Proximity-centred and socially driven, this new spatial pattern treats neighbourhood streets as multiple-purpose, walkable destinations that are protected from infectious diseases owing to eased indoor crowding at retail premises and reduced cross-community spread of diseases. With ameliorated traffic flow and enhanced business location, local inhabitants as well as business operators are activated to work towards their shared vision and benefit from a safer, thriving and connected community.

Table 9 below summarises the resolution of the problem of small business viability tested with the corresponding sustainability requirements of traffic amelioration and streets as public open space. It is then followed by Table 10 which lists the contribution of this paper to sustainability from the perspectives of environment and society.

Table 9: The struggle of small businesses and its resolution

Problems	Proposed Solutions	Tested Sustainability Requirements	Expected Results
Struggles of small business under COVID-19 restrictions	holistic consideration for customer traffic, urban mobility and social distancing	Traffic amelioration and Streets as POS	Improved retail location; a protective and supportive community

Table 10: Contribution of Paper 5 to sustainability

	Environment	Society	Economy
Paper 5	<ul style="list-style-type: none"> Safe, active, and healthy street environment which is pedestrian-friendly, has low carbon emissions and is protected from diseases and traffic. 	<ul style="list-style-type: none"> Street recovery by the people and for the people Mutual support and self-organization of active citizens Return of a sense of community 	See Table 12

4.6 Summary of Results

The research was developed around five academic papers (see Table 11). Except for the first paper that gives a general idea about Feng Shui and sustainability at the start of research, the remaining four publications conduct probes into major city problems or phenomena generally covering the three pillars of sustainability—economy, ecology, and society. Each paper focuses on a specific topic, namely the burden of park and green space maintenance (paper 2), traffic congestion (paper 3), urban crowding (paper 4), and the struggles of small business in the city environment (paper 5). The five publications together touch on wide-ranging subjects which include small business, customer traffic, location, congestion relief, healthy streets, housing, perceived density, open space, tactical urbanism, urban agriculture and Feng Shui (see Figure 6 for more details).

①-- “Exploring Chinese Feng Shui culture for achieving sustainability”.
②-- “Urban Agriculture—A Case Study of Ningbo Eastern New Town of China”.
③-- “Solving Traffic Congestion through Street Renaissance: A Perspective from Dense Asian Cities”.
④-- “Higher Density Environments and the Critical Role of City Streets as Public Open Spaces”.
⑤-- “Street Recovery in the Age of COVID-19: Simultaneous design for mobility, customer traffic and physical distancing”.

Table 11: Topics covered in the publications

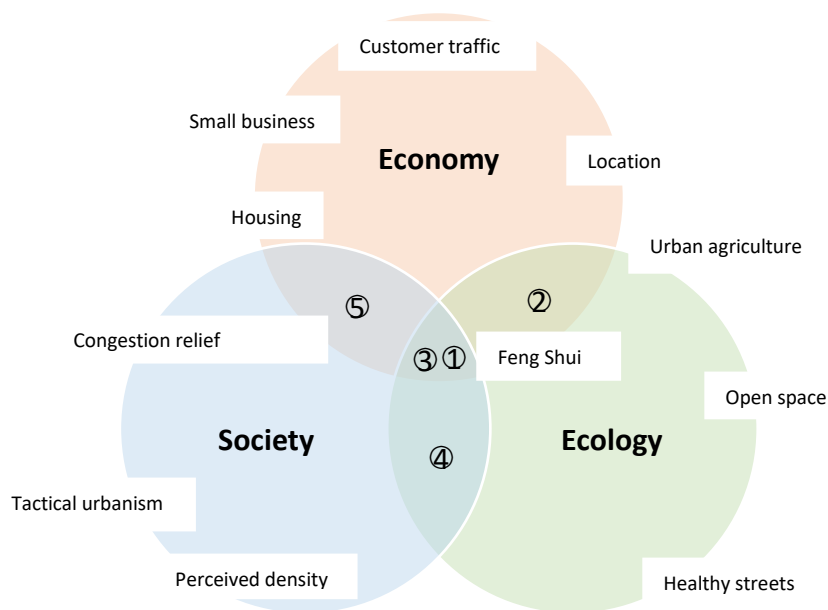


Figure 6: Five publications and their research scope in relation to the traditional depiction of sustainability (Source: Author)

The papers strive to fulfill the third research objective of testing real city problems by analysing the current status quo and offering solutions from a sustainability perspective. We can conclude from the tests that the selected sustainability requirements have great potential in increasing land value in a balanced way. They not only uplift the economic value of urban land, which is explained in Table 12, but add ecological and social value as well. Through the model of the One-Minute City, the argument and contribution of the PhD study is that streets play a crucial role in designing sustainable and healthy cities where local communities can thrive. This key point will be further explained in the following chapter.

Table 12: Summary of the five papers with their contribution to land value.

Tested Sustainability Requirements		Contribution to Land Value (from economic perspective)
Paper 1	-	① Advocate circular economy that promotes self-sufficiency and discourages materialism
Paper 2	Urban agriculture	① Reduce the budget on park maintenance ② Reduce household expenditure on fresh produce ③ Increase value of neighboring land and property ④ Promote city tourism and create jobs
Paper 3	Overcoming car dependence	① Reduce the cost of traffic congestion ② Promote street-level jobs–housing balance and cultivate street economy ③ Reduce the financial pressure from widening and constructing roads due to more mobility needs being met by cheaper non-motorised transport.
Paper 4	Streets as POS with traffic calming and tactical urbanism	① Reduce the costs linked to crowding ② Offer economic POS in the form of green grids ③ Provide affordable housing by self-building ④ Promote innovative streets that are open to entrepreneurship
Paper 5	Traffic amelioration & Streets as POS	① Reduce health risks and costs linked to unsustainable travel and shopping modes ② Reinstate city streets as the major economic terrain for small business ③ Increase prime locations to lower the cost of small business and expand domestic economic circulation and customer base ④ Conceptualise the One-Minute City for broad value creation and value capture

Chapter 5. Findings

This final chapter concludes the PhD research with key research findings, implications, limitations, and future research suggestions.

5.1 Key Research Findings

The PhD study generated a number of key findings. A critical collective finding of the research points to the rediscovery of the individual's needs and rights and their collective power in city building and especially in response to pandemics and climate emergencies. Restoring citizens' right to the city and going beyond the mainstream growth fetishism and capitalist urbanism, cannot be done without breaking away from "hard" densification--a city building approach that is obsessed with form-based design codes and in too many cases (as shown in papers 3 and 4), creation of a mismatch between dense urban environments (which should offer benefits for public transport and non-motorised modes) and a completely inappropriate automobile orientation, mainly in the pursuit of scale, speed and profit (Garde, 2020; Livingstone et al, 2021). Instead, it is desirable, in the spirit of a de-growth urban transition, the sharing city and co-city, to start with a socio-ecological or "soft" approach that does not abandon density *per se*, but embraces a walking fabric and values living closely in real proximity, collective sufficiency and genuine community spirit (Wen et al, 2021).

Another major finding is the critical role of city streets as the vehicle for the realization of individual's needs, rights and their collective power. It is the neighbourhood street where change starts without which the broader and ambitious sustainability agenda, including a more sustainable city and community, and climate justice, runs the risk of being empty talk and no action. This point has been well illustrated in the research in this thesis, from the street renaissance to solve traffic congestion, to the critical role of city streets as POS to relieve overcrowding, and to the street recovery to help small businesses survive and prosper from the harsh climate of pro-car capitalist urbanism and the COVID pandemic. A foremost suggestion of the research in this thesis is therefore that land use and spatial planning need to shift attention to the ordinary city street as the place, be it small or informal, to help claim citizens' right to the city and to facilitate in finding

everyone's niche and fulfilling their dreams of a better place to live. To put it another way, if the ordinary street comes alive for residents, then the extraordinary will take care of itself.

The final most salient and unifying research finding is the One-Minute City, developed from the research on land value and sustainability issues and based on the positive results from the testing of possible real-life solutions. Instead of the mainstream land-value capture framework that favours land exploitation and monetary value extraction, the One-Minute City adopts a wider notion of value creation and value capture which encompasses ecological and societal outcomes (Livingstone et al, p204). Figure 7 shows its attempt to strike a balance between use value and exchange value by adding the soft approach, along with the hard one, to densify the built environment and to increase land value beyond the narrow economic term. Specifically, the One-Minute City introduces soft densification that values the contribution of active citizens in co-producing and co-managing the commons--the street, the city and the planet. It also incorporates certain sustainability requirements (see Figure 7) that have been proven effective and feasible in addressing the unsustainability features in urban development such as unbridled property prices, congested cityscapes, a lack of green space and vulnerable lives and livelihoods that are at stake during pandemic conditions and global warming.

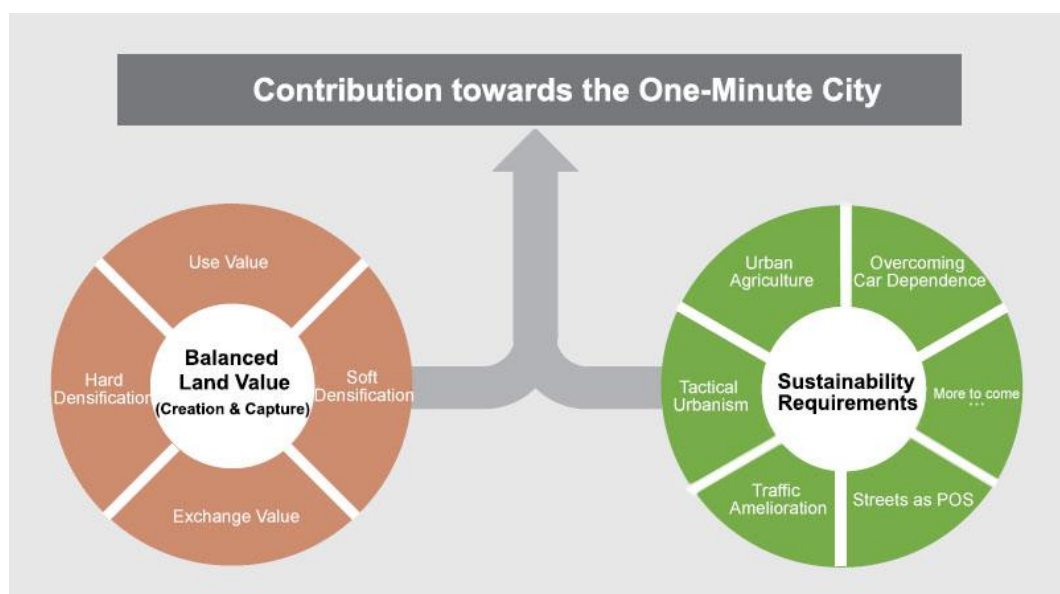
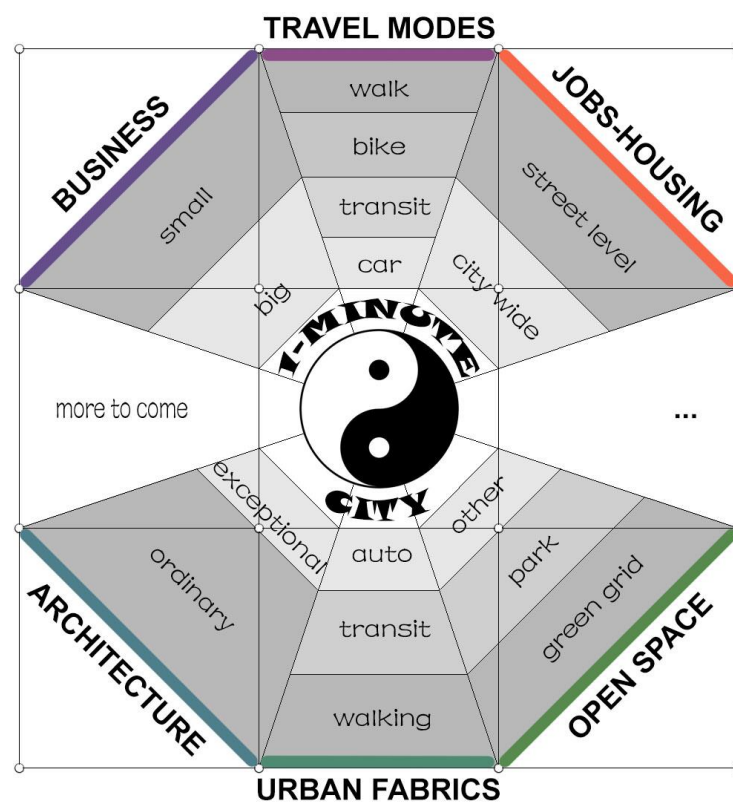


Figure 7: Basis for the One-Minute City (Source: Author)

5.2 The One-Minute City

Drawing on the knowledge of Feng Shui, the essence of the One-Minute City (see Figure 8) lies in multiple dynamic equilibriums. It includes balancing walking, transit and automobile--three of the urban fabrics, different travel modes such as walk, bike, public transit and private car, and retail formats such as small family-owned stores and “big box” malls. This ideology also extends to the jobs-housing balance both at street and city level, the right mixture of ordinary housing and exceptional public or corporate buildings, and the appropriate combination of the green grid of city streets, urban parks and other open spaces.



Balances--the Essence of the One-Minute City

Figure 8: The One-Minute City (Source: Author)

According to the mechanism of Yin-Yang theory that “the universe is composed of Yin and Yang that are in opposition and keep changing” (Wen et al, 2021, p18), it is impossible to eliminate the opposite forces but possible to transform them in one’s favour (Wang, 1994; Wen et al, 2021). While the One-Minute City primarily builds on the walking fabric, it never attempts to eliminate the automobile fabric and car use but keep them at bay as a supplement to active travel options (see the recommended proportion illustrated in Figure 8). Likewise, slow community life and fast urban life can coexist. Underpinned by the diversity

of business formats, local employment opportunities, housing and open space provisions etc., in the vicinity, residents of the One-Minute City are enabled to enjoy the slow village life on a more regular basis. Meanwhile, linked by speedy modern transport, and information and communication technology (ICT), the community does not have to be isolated from the rest of the city and lives in autarky. Rather, the residents still have the freedom to choose the jobs they desire and to visit the grand theme parks, mega shopping malls and exceptional public museums that the fast tempo of metropolitan life can offer.

Additionally, all these balances cannot be achieved without a proper street setting that has a variety of infrastructures in place to make the One-Minute City a thriving, resilient and protective place. Table 13, drawn from the case study of Royal Street, lists the physical, informal, digital, and social infrastructures which can be used for street recovery, business prosperity, individual health, and the well-being of urban dwellers from the threats of heavy vehicular traffic and deadly infectious diseases.

Table 13. Connecting traffic, location and disease control with required infrastructure. (Source: Wen et al, 2022, p16)

	Physical	Informal	Digital	Social
	<ul style="list-style-type: none"> • Well-connected street network • Traffic calming and pedestrianisation • Streets as Public Open Spaces with various anchors 	<ul style="list-style-type: none"> • Widened pavement; • Prolonged business hours for street vending and night-time markets 	<ul style="list-style-type: none"> • Internet and broadband service • E-commerce stores • Streamlined online transactions and delivery/pickup 	<ul style="list-style-type: none"> • Traffic calming and self-governance • Self-building and adaptation; • Small business and self-organisation
Traffic amelioration	Generate and better engage more foot traffic	Split and spread traffic flow, spatially and temporally	Increase internet traffic and reduce motor traffic	Reduce cross-city car travel and increase local active travel
Improvement of retail location	Increase foot traffic and time spent shopping; overcome indoor capacity restrictions	Expand free traffic for the benefits of informal business, night economy and tourism	Boost online and offline visits to combine physical and virtual economy	Increase local economic turnover and customer base with more localized business opportunity and community support

Containment of diseases	Ease indoor crowding	Ease crowding at major retail premises	Reduce unnecessary direct contact	Prevent cross-community spread
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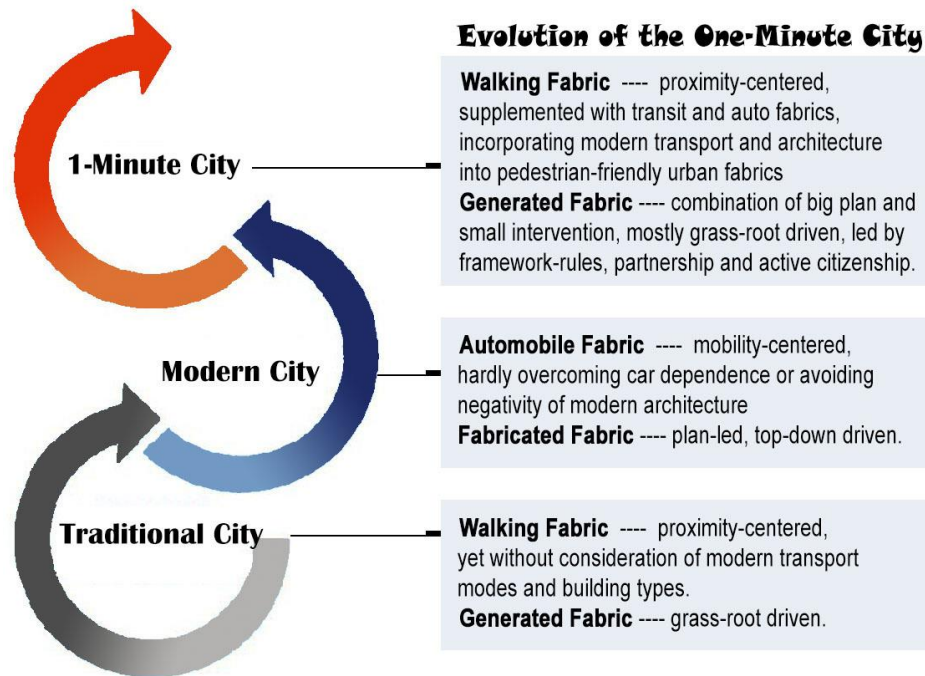


Figure 9: Evolution of the One-Minute City (Source: Author)

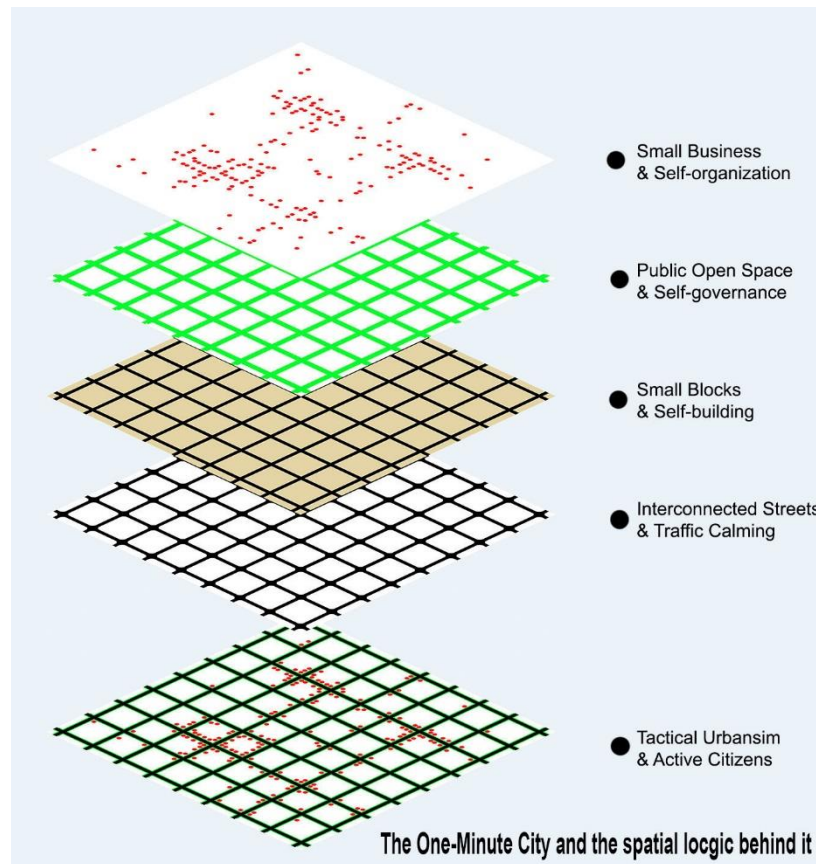
Figure 9 shows the One-Minute City, a new city form that evolves from the traditional city and modern city. In the case of the traditional city, it is characterized by walking fabric that is generated by the residents yet without taking into account the modern transport modes and building types. Modern cities, on the contrary, are mobility-centred and their prevalent automobile fabric has been fabricated by the professionals who generally have marginalized non-motorized and informal transport (Townsend, 2017). This not only has resulted in the separation of work, life and travel, but also has rendered a segregated city in which inhabitants are only geography-tied without much initiative in building place identity and authentic community.

Learning from the traditional and modern cities, the One-Minute City puts premium on nearness and walkability rather than on speed and mobility and sees the neighbourhood street as public open space rather than just a movement corridor. This opens up opportunities for local business and employment, and also makes the

journey for shopping on foot and unstructured free play for children possible. In time, the mono-functional street evolves into a multiple-purpose destination, thereby breaking the spatial separation between the journey and the destination that is commonplace in the automobile urban fabric. Not only does such a real proximity-oriented spatial pattern uplift the location and value of the neighbourhood, it also makes the community more self-sustained and safer particularly in times of crisis such as the COVID pandemic.

Meanwhile, the One-Minute City advocates grass-root initiatives rather than top-down blueprints (see paper 5 for details). It adopts a distinct spatial logic that “effective functioning of urban areas should embrace uncertainties, multiple possible alternative futures and flexible decisions and further allow for self-organisation and self-governance (Nunbogu et al, 2018, p32)”. Unlike a moderate improvement represented through the 15-minute city, which relies on professionals with their “rational” transport and physical plans (see more details in Paper 5), the One-Minute City sees the street space and the neighbourhood as commons that are co-produced and co-managed by the residents in collaboration with the municipality. Having active citizens and tactical urbanism in its core, this spatial structure incorporates traffic calming on interconnected local streets, self-building on small blocks, self-governance over the street as public open space and self-organization of small businesses (see Figure 10).

Figure 10: The One-Minute City and its spatial logic
(Source: Wen et al, 2022, p18)



In comparison to the narrow disciplinary knowledge which is “unable and unwilling to cope with the increasingly complex spatial problems that pose recurring crises for regions and localities” (Papamichail and Perić, 2018, p335), the One-Minute City is more likely to integrate various de-growth movements and shared lifestyles into collective governance of the neighbourhood street use in forms of Community Supported Agriculture (CSA), shared mobility, collaborative housing and business cooperatives etc., This is because it builds on the belief that “[a]chieving greater sustainability will inherently involve people and governance” which “will require decision-making in the interests of the ecosystem, the public good and future generations (Hartz-Karp & Weymouth, 2017, p113)”. In this respect, the spatial pattern and logic of the One-Minute City can create the right condition to facilitate a structural change from below--an alternative of downshifting lifestyle, non-market economy and grassroots politics to rise out of the shell of a decaying capitalist society.

In brief, the One-Minute City is about a sustainable spatial pattern that values proximity, walkability and utility, which is fundamentally generated by small everyday changes via “just do it” rather than fabricated by time-consuming big plans/projects through “have your say” which, more than often, involve deals and corruptions in the dark and render the community divided. It is also about co-production, sharing and living rich and harmonious collectively with less and small private possession rather than the contrary. Virtually, the One-Minute City is more about how the spatial re-organization facilitates the re-organization of civil society and how the latter reshapes the urban space, service and governance in the hope for a meaningful co-living of humankind rather than the bloody survival competition which is increasingly spinning out of control just as we watch live gun violence in the United States as well as bombing in other places such as Ukraine. In essence, the solution to current unsustainable development lies in a restructure of modern political systems, which, in the words of Fournier (2002, p202), “allows decision-making power to remain as close to the grassroots as possible...” and “bring the consequences of our action closer to our face.”

5.3 Implications

This research has made two major contributions to practical knowledge and provided potential to address the unsustainability issues of land value, urban development and climate change through reduced travel and associated carbon emissions. In the first place, it provides feasible solutions to a number of wicked problems in modern cities. These include the maintenance burden on green space, traffic congestion, overcrowding and housing and open space provision, and the predicament of small businesses. In addition, the contribution of the One-Minute City to the overall sustainability agenda is hopefully expected. This proximity-centered urban pattern imbedded with tactical urbanism has the potential to trigger strong intervention to current unsustainable urban development from changes of both spatial organization and citizens’ behaviour (see Figure 11).

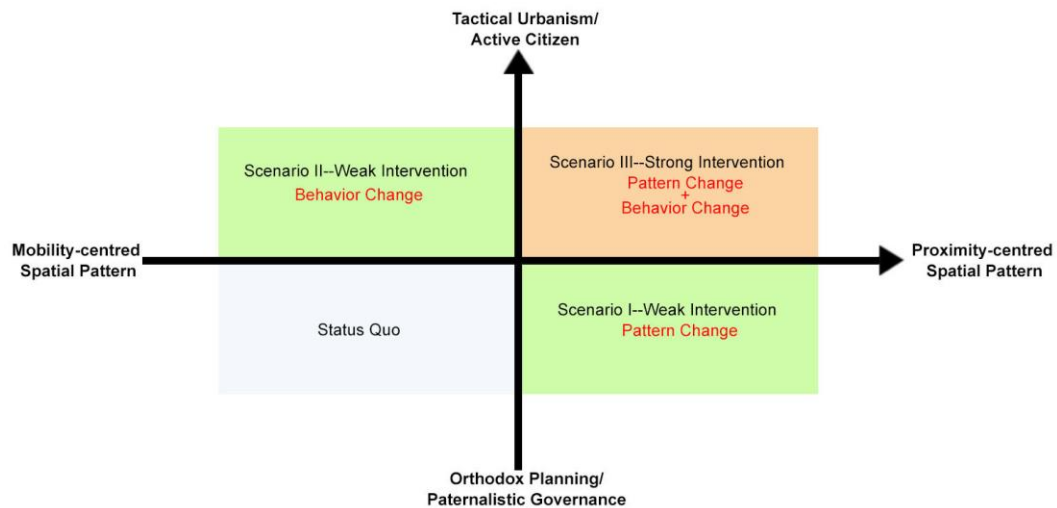


Figure 11: Contribution of the One-Minute City to the overall sustainability agenda

(Source: Author)

Academically, added significance of this study can also be found in the development of the concept of the One-Minute City. Firstly, the One-Minute City graphically describes a potential image for sustainable cities and communities that SDG11 has been trying to convey. It depicts multiple balances of key urban elements in a concrete and detailed way which provides a visual platform that can assist in achieving optimal land use and value in a balanced way. Secondly, this research explores the active and critical role of people and city streets and incorporates them into the unified frame of the One-Minute City. By doing so, it not only takes the 15-minute city/community concept one significant step further with a completely distinct logic behind the spatial structure but makes the One-Minute City more open for broader theoretical additions.

The contribution to new knowledge is the detailed integration of a large number of ideas in critical disciplines into a coherent whole which gives decision-makers unique new policy insights into how cities could be built and rebuilt better now and in the future. This interdisciplinary nature is a key strength which lends practical value for people in cities grappling with issues related to density, liveability, the role of streets, greening of cities, sustainable mobility and more. With integrated knowledge and unique contribution of the research in policy terms, it is expected to influence real-world decision-making.

5.4 Limitations and Future Research Suggestions

Because of the limitations related to time and human resources, the number of sustainability requirements and urban problems that have been chosen and put to test is limited. The concept of the One-Minute City needs more research and experimentations to understand how it could work. As such, the first suggestion for future research is to conduct additional tests of urban issues such as inequality and crime with more potential sustainability requirements including community land value capture for school funding and neighbourhood watch.

This research has so far not touched its application aspects and needs to consider the well-established political economy which is built upon the automobile culture. Extra effort is required to overcome the barriers that exist in orthodox planning systems, for instance, to accept and incorporate tactical interventions. So, the second research suggestion would be to study established or ongoing urban transition movements and find out “how urban mobilisations can dialectically move from the streets to the governmental corridors of power...” (Alexander & Gleeson, 2020, p369).

A further limitation is that there has been not much effort to quantify the expected land value improvement. This is because quantitative evidence at this early stage is beyond the scope of the thesis, and it is also difficult to quantify the ecological and social value such as a sense of place and social cohesion brought by specific and collective sustainability changes. In addition, by mimicking the Complex Adaptive System (CAS), the growth of the One-Minute City is non-linear, contingent and thus inherently unpredictable because it hinges on the shared visions of human agents and on the degree of numerous interactions among them and with non-human agents in a local context. Plus, the focus of the One-Minute City is on the typical spatial and social pattern rather than on a specific new town or urban project that normally has a physical boundary and detailed development targets often seen in conventional physical planning.

In this respect, another suggestion would be, if it is not too late, well ahead of doomsday, to conduct empirical research at regular intervals on the land value change of the communities that experiment with the One-Minute City and of those that do not. The type of land value assessment can include the market price or

exchange rates of the property, the level of car use/active travel and the noise or pollution in the local street, the growth of small business/local employment in the neighbourhood, the degree of residents' involvement in community events/activities or the extent of life satisfaction of local inhabitants. The list can go on as it is expected that fundamental changes can happen in this grass-root driven, street based hyperlocal city where everything tangible and intangible including amenities, sharing and mutual help can be a minute away. This is a comeback of the acquaintance society which is co-produced and co-managed by like-minded neighbours in collaboration with enlightened local councils and professionals who seek to live closely and differently upon a sustainable path that is economically viable, ecologically sound and socially just.

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PUBLISHED PAPERS

PAPER 1:

Exploring Chinese Feng Shui Culture for Achieving Sustainability

Statement of Contributions of Authorship

To whom it may concern,

I, Liang Wen, contributed 80% to the paper entitled above and cited as below:

Wen, L.; Li, Z and Guo, X (2021). Exploring Chinese Feng Shui culture for achieving sustainability. *International Journal of Information Systems and Social Change (IJSSC)*, 2021, 12(3), 15-26; doi: 10.4018/IJSSC.2021070102

Signature of Candidate:

Date: July 2022

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This Chapter is an exact copy of the journal paper referred to above

Exploring Chinese Feng Shui Culture for Achieving Sustainability

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ABSTRACT

This paper explores the origin, concept, and basic content of Chinese Feng Shui (geomancy) and makes a comparison with sustainable development principles to explore similarities and differences in philosophic thinking from environmental, social, and economic perspectives. It also attempts to acquire inspiration from Feng Shui for achieving ecological balance and harmony between humans and nature. The long history of the Chinese Feng Shui culture has important implications for extending the contemporary sustainable development theory, and this study argues that it can inform policy aimed at achieving sustainability in a more harmonious way.

KEYWORDS

Difference, East, Feng Shui, Philosophy, Principles, Recommendation, Relation, Sustainability, West

INTRODUCTION

Throughout history the cultural phenomenon of Feng Shui has intense traditional characteristics (Wang, 1994; Chen & Nakama, 2004; Cheng, 2011; Deng, 2013) and has firmly taken its place in the daily life of Chinese people (Cheng, 2011). Site selection of cities, villages, houses and graves – all follow the rules of Feng Shui. It has also influence upon the interior layout of dwellings and the proper location of the furniture (Emmons, 1992; Cheng, 2011). As a system for placement, the application of Feng Shui has been extended to national and land use planning, water projects, landscape, finding natural resources as well as the military waylay besides judging the Yin and Yang house (Shang, 2002). Feng Shui is not only widespread in rural areas but also has gained a sound place in the development of modern and westernized cities like Hong Kong, and even in other countries of Asia, Europe and America (Emmons, 1992; Shang, 2002).

DOI: 10.4018/IJISSC.2021070102

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The Feng Shui philosophy has made numerous contributions to ancient scientific technology and different fields of knowledge and practice. From a natural and philosophic perspective, Feng Shui has developed a holistic and organic view of naturalism and ideas about the harmony between humans and nature; it shares common roots with Taoism which evolves from nature (Shang, 2002; Yoon, 2003). From an environmental science aspect, Feng Shui focuses on various fields such as astronomy, geography, meteorology, biology and anthropology, and has analysed and contributed towards understanding the natural environment in which people live. In the aspect of architecture, Feng Shui has left the world a unique Chinese architectural system, including its own construction theory, method and style. Furthermore, in the realm of science and technology, the discovery of the water vapor cycle theory, the extraction and characteristics of Oxygen, and the invention and application of the compass and graphics are also attributed to Feng Shui (Shang, 2002).

However, Feng Shui is still mysterious and cannot be thoroughly understood by the masses (Wang, 1994). Labelled as superstition, Feng Shui was once prohibited in communist China in 1949, but was then revived in the 1950s first in the field of archaeology and then history of ancient geography, physics and architecture (Cheng, 2011). As a kind of folk culture, Feng Shui has become the topic of conversation and continuously attracted significant attention of the general public (Cheng, 2011). In the 1970s, an upsurge in Feng Shui studies appears outside the Chinese mainland focusing on three main aspects: the relationship between Feng Shui and aesthetics; the relationship between Feng Shui and site-selection, environment and landscape of cities; and the relationship between Feng Shui and the home environment (Bruun, 1996; Cheng, 2011).

One of the reasons behind this upsurge is to discover the environmental value of Feng Shui to deal with the crisis of population explosion, environmental pollution and resource depletion faced by humankind. Since the middle of the 20th century, the western industrial countries have achieved a lot in scientific technology and economic development, yet ignored the connection between humanity and nature which resulted in a series of environmental crises and psychological problems. Historically, China always valued nature and the Feng Shui theory won a lot of praise from present-age scholars for its important role in creating and preserving the living environment. Feng Shui confirms the naturalness of humans and encourages people to reconsider their appropriate place in nature rather than being the superior, dominant creatures in the world.

Another reason for the resurgence is that the development of the scientific thinking method gives priority to natural philosophy on which Feng Shui is based. Eitel and Mitchell (1993) point out that although Chinese natural science led by Feng Shui is a rough guess about nature, it is still full of wisdom of dialectical thinking and holistic ideas of how things develop and evolve, used to resolve real and practical problems. This is why such values are rediscovered even nowadays when science has reached much higher levels of development.

In fact, after the middle of the 20th century, the reappearance of Feng Shui theory research in the West is a return of natural philosophy of a higher level. Consistent with the development of contemporary science, the philosophy of the ancient Chinese organic view of nature and practice in dealing with the relationships with the natural world is the key to the door of science in the future (Wang & Qi, 1992). For example, the birth of ecological architecture (Arcology) in the field of building is an ideological trend that emphasizes that the organic connection between humans and nature is that of harmony rather than opposition (Wang & Qi, 1992).

Furthermore, Feng Shui can provide inspiration to the contemporary sustainable development concepts. Stepping into the 21st century, significant progress was made in natural and social sciences, but the solutions to population, environment and resource problems are still outstanding. The concept of sustainable development is gradually sinking into the heart of people and the global policy agenda, which makes the thought of harmonious coexistence between people and nature win greater attention in breadth and depth. As a return of traditional culture, Feng Shui is the deep dialectical quest of the human being, which can be traced back in history and projected into the future to re-establish the harmony that humans once lost but is now necessary for them to pursue: Heaven – Earth – Human

(Qi & Dan, 1992). Once named a promising learning by the American planning scholar Kevin Lynch (Wang & Qi, 1992), can Feng Shui provide some useful insights to the future of humankind?

This study first introduces Feng Shui as an ancient folk culture. Next, through comparison with the principles of sustainable development, the analysis aims to shed light on sustainability from environmental, social and economic perspectives as informed by Feng Shui. It concludes that Feng Shui's wisdom about existing in harmony with nature can inform a transition to more sustainable ways of living.

FENG SHUI

Whether described as a philosophy, art, geomancy – earth divination, communication with the earth at a deep level (Yoon, 1980; Geomancy Australia, 2017), or concept, Feng Shui brings its foundations from ancient times. Below is a brief history of Feng Shui followed with explanation of its main terminology.

History of Geomancy

Feng Shui is the product to meet the demand of human survival, security and spiritual needs in the ancient Chinese agricultural age (Yao & Wu, 1996). It originated from divination in the Zhou Dynasty (16th century BC to 7th century BC) (Wang, 1994; Deng, 2013). It takes Oneness (harmony between human and nature) and Qi theory as its theoretical purpose with Yin and Yang, Five Elements, Eight Diagrams, Heavenly Stems, and Earthly Branches as the application rules. The relationship between the various elements from the ecological view of Feng Shui pursues the harmonious coexistence of humans and nature, which is a symbiotic relationship between the natural and human environment that reflects people's systematic understanding of the biophysical world (Yao & Wu, 1996).

Chatley (1917, p. 175) gives definition of Feng Shui as “an art about the harmony between the place of the living and the dead and the Qi from the earth and the universe”. The core of Feng Shui is to realise the coordination with nature and get Qi as much as possible, through the sitting, orientation and layout of the building, so as to guarantee that the homeowner stays in the best position to take shelter and benefit from the natural environment (Yao & Wu, 1996). Feng Shui is trying to select the most pleasant site to incur fortune, safety, health, longevity and prosperity of any offspring (Wen, 1992). In this sense, Feng Shui shares with sustainable development the same goal – when pursuing a better living environment and a better quality of life, people should also pay attention to the benefits of the coming generations in the long run (Newman & Jennings, 2008).

The Feng Shui theory holds that the most fundamental idea of how to manage the housing environment is to conform to heaven and take the natural ecological system as the root to build the artificial ecosystem of the home (Qi & Dan, 1992). Whether the house can be in the hub of Yin and Yang—the ideal location for living in the natural ecological system, is the key to site selection. In Feng Shui, a specific and delicate method and process are required, which are part of the Four Geographic Division (Dili Sike). This method is employed to seek the main mountain (dragon), the surrounding hills (Sha or sand), the core area for building and living (Xue or hub) and water, and to check the Qi, distinguish the position and so on. In general, this involves observation of the sky and on-the-spot survey from a macro perspective; also, it is necessary to study the micro landform, micro climate, vegetative cover and so on. A final step is to decide and choose the position of the house according to the terrain of the mountains and rivers, and rules and relationships of Yin, Yang and sceneries, so as to make the home stay in the best relationship to the nature (Qi & Dan, 1992). Feng Shui practitioners must see buildings and surroundings as a whole and make observations and survey in a vast area (Wen, 1992). In order to choose the ideal place that is both appropriate in spatial and temporal sense, it is necessary to observe the topography of the area, the change of seasons, the running rules of the sun, moon and stars etc. (Shi, 1992). That is considered an indispensable and arduous field work for a proper evaluation of a site (March, 1968).

Feng Shui is a theory about environmental planning in ancient China. It has conducted deep observation and study of the natural geology, geomorphology, landscape characteristics, the shape of the wind, clouds, rain, the change of the four seasons, the water environment etc. These rigorous and meticulous site selection method and procedure in Feng Shui when compared with the principles of contemporary ecological architecture and landscape architecture show striking similarity. In fact, Feng Shui is a summary about the integrated operation mechanism of the wind and water which significantly affect the earth's biosphere and hydrosphere. As the essence of Feng Shui, Qi is synonymous with modern ecology which contains the critical elements of the environmental system that sustains life and determines its evolution (Qi & Dan, 1992). In fact, Feng Shui is an integrated natural science which includes geography, meteorology, ecology, landscape, town planning and architecture (Qin, 1992). In Eitel's opinion—the 1917 author of “Feng-Shui: The science of sacred Landscape in old China”, Feng Shui is another name for natural science (Wang & Qi, 1992).

However, Feng Shui not only deals with the physical environment, it also takes care of the behavioural and psychological needs of the dwellers (Qin, 1992). Without exception, the traditional Chinese housing invariably follows nature and seeks the best location—the hub of Yin-Yang which gathers water and Qi. This pattern features external envelopes with a closed block and internal space with an aerodynamic design (Qi & Dan, 1992). Its core is to respect and conform to nature and be harmonious with the natural surroundings; it pursues favourable climatic condition, geographical position and people's support, with physiological and mental needs being looked after carefully (Qi & Dan, 1992).

Geomancy Terminology and Its Philosophy

Ancient Chinese philosophy has given the main push and help to the formation and development of Feng Shui, which refers mainly to influence by Zhouyi, Laozi and Zhuangzi, Confucian and Taoist thought. Being the ideological basis for the development of Feng Shui, ancient philosophy is often used to predict the fate of people, to foresee urban planning and construction, and to drive people to explore and better understand Feng Shui. It believes the universe is composed of Yin and Yang that are in opposition and keep changing (Wang, 1994). People are regarded as one part of the world, and in line with the phenomenon, the rules of the five elements and Yin and Yang are applied, which have property, function and sequence relations analogous to natural things (Wang, 1992).

Tao is the rules and tracks that the whole universe and people must follow, which has been the core of the Chinese traditional philosophy. Definitions of Tao in Feng Shui are mainly derived from the Zhouyi system, which focuses on application rather than thinking and gives more emphasis on moral knowledge in the face of nature and society; it encourages people to know, grasp, comply with, and to create a good environment for the house in order to realise the ideal harmony between human and nature (Wang, 1992).

Qi is one of the most important categories in Chinese traditional philosophy and is regarded as the most basic composition unit of the universe. It is also called Primordial Qi-- the source of all things. Laozi says there are two kinds of Qi--Yin and Yang which become the things of universe through whippings (Wang, 1992). Qi can be real air and also can be a variety of terrain, ecological microclimate and landscape. The latter is seen as the condensation or movement of Qi from the ontology. Interaction and induction in the universe are also considered as a function of Qi. In human life, interactions exist with nature, architecture and life, which have different roles and will produce varying results for a person and any spiritual activities, including aesthetic feelings. So, Feng Shui argues that an ideal environment should be surrounded by proper Qi which acquires collaboration and coordination of nature and human society. Harmonious coexistence among people, architecture and nature forms the remarkable characteristic of traditional Chinese architecture. The Feng Shui theory is seen by contemporary scholars as the environmental architecture, landscape architecture and ecological architecture of ancient China (Wang, 1992).

The concept of Yin and Yang originated in the experience of ancient ancestors to observe astronomy and geography knowledge, they called things exposed to the sun as Yang, the reverse as Yin. Later, they realised that the heavens, the earth and everything in the world, all have the unity and opposites, like the Yin-Yang theory. Hence, Yin and Yang gradually developed into one of the core categories of the Chinese traditional philosophy and are used to explore the world and its changing mechanism. Zhuangzi sees Yin and Yang as the primeval of everything and all things are produced through interaction between them. Due to the effect of the unity and opposites of the Yin and Yang, the universe at every level is all in eternal change, which embodies the Chinese ancient simple dialectic materialism. As practical characteristics, this philosophical thinking is widely used in almost all China's ancient practiced academic disciplines, such as astronomy, geography, traditional Chinese medicine as well as Feng Shui (Wang, 1992).

Being one of the oldest and the most important categories in traditional philosophy, the Five Elements -- metal, wood, water, fire and earth, are the five most basic material elements comprising the world and the living need. They are regarded as the basic elements of all things. This is used as a proof that all things originate from the unity of the diversity. The Five Elements pay attention to the overall understanding of the relationships between things, which produced a profound impact on ancient Chinese scholars (Wang, 1992).

The Eight Diagrams is most distinctive and ingenious culture creation of the Chinese nation. It originated from natural primitive pictographic symbols derived from nature and shows mathematics through deduction. As a practical art, Feng Shui cares more about the relations between a phenomenon and a number and location; it judges whether things bring luck or misfortune through derivation of the number and location. This is always used along with a compass as symbols of azimuth calibration in time and space (Wang, 1992).

Such a Chinese traditional way of thinking has both intuitionistic sensibility and practical rationality and is also holistic and systematic, so it is closer to the holistic organic way of thinking of system theory today. Feng Shui's interpretation of natural existence and its effect on humans never claim the accurate basis of modern science, but are reasonable at every level from the whole to the detail (Wang, 1992, p. 101). Factors, such as the human and time, are always considered by Feng Shui in creating architectural space. Joseph Needham (1925) called it quasi-science, which includes the essence of science and blends with content from pseudoscience (Song & Yi, 1992).

Western traditional philosophy divides things into independent types or offers a one-sided segmentation way of thinking. On the contrary, Chinese traditional philosophy tries to grasp the overall from the point of view of Tao – Guanxi (relation). Consequently, a horizontal division is not obvious, but the vertical connection is very close and mutual infiltration coexists in a whole organic system (Wang, 1992).

The West formed its independent system of literature, history, science and various minor subject divisions during a long historical period. By comparison, the Chinese traditional philosophy fused different fields of ancient research and was not in a state of independent branches. Although there are many historical and cognitive defects in its development, the Chinese traditional philosophy, without precision in category, can still perceive and grasp the overall relations. This is because it focusses on the universal connections and the dialectical movement of things on the basis of rich experience. So, there exists an intrinsic mechanism that can allow for scientific achievements, which made China better than western civilization before modern times. More often than not, the Feng Shui theory led and continues to lead to reasonable results in practice.

IMPLICATIONS OF FENG SHUI FOR SUSTAINABILITY

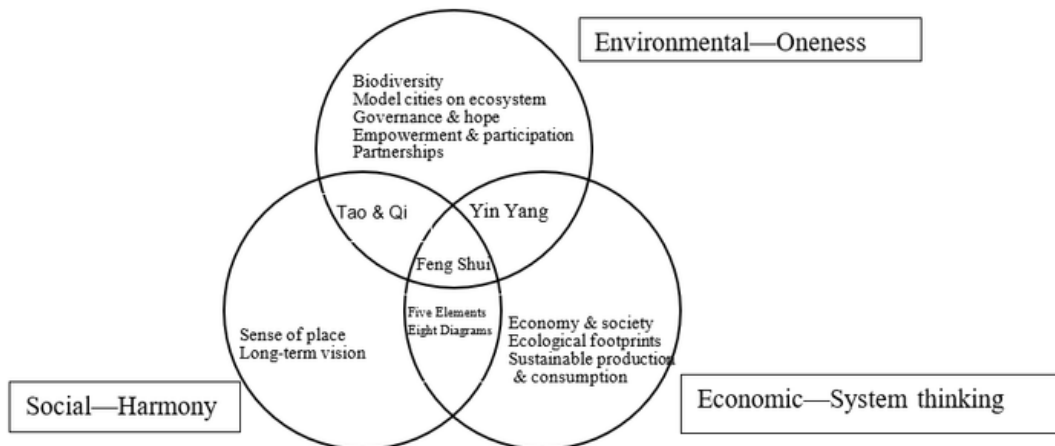
Contrary to agricultural society which featured self-sufficiency, harmonious coexistence of humans and nature, people's attachment to and fear of nature, the industrial society holds the belief that the human species is omnipotent and can conquer its natural environment by resource plundering (Yao

& Wu, 1996; Dong, 2012). After agricultural and industrial societies, sustainable development is the third period when a new relationship is required between humans and nature. How to set up a new sustainable development mode of heaven–earth–human has become a new topic that needs to be solved urgently (Yao & Wu, 1996).

In modern times, Chinese traditional culture has been under a large influence from western culture. The Chinese people had to be convinced by a scientific system established by the West. Furthermore, the whole Chinese society has to bear now increasingly serious environmental consequences while enjoying the abundant benefits of western type development. Gradually, it was realised that separating the economic, social and environment to seek development can ultimately bring devastating disasters to the earth and human society (Dong, 2012).

Feng Shui and the ancient philosophy it contains have three features: the overall concept of harmony between the heaven and human, the overall system mode of thinking and humanistic spirit that puts social harmony as the priority (Yao & Wu, 1996). This study attempts to interpret these three characteristics respectively from an environmental, social and economic perspective, and compare them to verify with them the ten Melbourne principles of sustainable development (Newman & Jennings, 2008). Figure 1 presents the ten Melbourne principles embedded within the sustainable development framework and combined with the Feng Shui elements. Thus, Feng Shui might be able to provide inspiration and shed light for sustainable development.

Figure 1. Sustainable development through the lenses of Feng Shui and the Melbourne principles



Environment

Feng Shui, a guidance to environmental planning, was mainly involved in and beneficial to construction activity in ancient China. It had large influence on the site choosing of cities, villages and housing. The planning and construction of ancient towns were unavoidably under the guidance of Feng Shui (Deng, 2013). That is to say, the popularity of Feng Shui was attributed to the guidance of governments at all levels, support of non-governmental organizations and participation of the general public. It is in line with three of the ten Melbourne principles which are governance and hope (Principle 10), empowerment and participation (Principle 7) and partnerships (Principle 8). Such an inspiration from Feng Shui might be helpful for the penetration and fulfilment of modern sustainable development. Feng Shui is a kind of environmental design theory and primary environmental science for ancient China (Shang, 1992). At the stage of site-selection, a geomancer needs to evaluate the site and make a selection, after considering a series of factors-- the geological, terrestrial, hydrology, sunshine, wind,

Table 1. Different attitudes towards nature from a western and eastern perspective

	Environmental Ideas	Relation between Humans and Nature
Western (environmental determinism)	Human, as God’s representative, has dominion over nature.	Unidirectional influence, a one-way influence from humans to the environment; dichotomy between human and nature
Eastern (geomancy)	Harmony between nature and humanity (oneness); Tao—relationship (guan xi); everything is equal.	Bidirectional influence, the influence from the environment to human is much greater than the reverse; unclear boundary between humans and nature

climate, meteorology, landscape characteristics and so on. Afterwards, the corresponding measures for planning and design will be advised so as to achieve the purpose of pursuing fortune and avoiding disasters, and to create a sound environmentally suitable location for long-term living.

Backing to Yin and embracing Yang, and facing to water and backing to mountain is the fundamental principle and layout of Feng Shui in site choosing for housing, villages and towns (Shang, 1992). Normally, an ideal layout of a village is as follows: it is better for the village to face the south to embrace the sun, with higher mountains in the back and lower hills on the right and left. The surrounding mountains abound with vegetation. Often, there is a pool or a winding stream in front of the village, with a mountain farther beyond the river. An axis is thus formed, linking the village and the pool to the mountains behind and affront. The village is sitting in a hub in the landscape, of which the terrain is flat and has a certain slope. Such a relatively enclosed space is beneficial to form a better local ecology and microclimate. With high mountains behind, the village can avoid the cold winter wind blowing directly from the north; facing the sun and water, the villagers can not only enjoy cool breeze from the south in summer, but also obtain enough sunshine in winter as well. Moreover, there are a number of benefits with the practice of encouraging the digging of pools and planting of fruit trees and flowers, which can not only keep water and soil, adjust temperature and humidity to form a good microclimate, but also form a beautiful natural environment (Shang, 1992). Such an environment complies with the description of biodiversity (Principle 3) and modelling cities on ecosystems (Principle 5) in the ten Melbourne principles.

On the other hand, contemporary planning theory originates from a western cultural system, the foundation of which is the logical way of thinking. It is good at analysing from the perspective of the individual. Due to neglecting the organic connection between humans and nature, believing in the human and mechanical strength, and persisting in conquering the biophysical world, eventually a series of environmental crisis happen. This shows the different attitudes towards nature (see Table 1) in eastern and western culture (Yoon, 1982, 2003).

The planning theory of the West (including contemporary China) can draw lessons from the typical layout in Feng Shui, and the environmental philosophy of harmony between nature and humans and all things being equal. First is the western view that humans dominate everything, people can conquer nature and that the natural needs changing. This needs to change and people should recognise that the relationship between humans and the environment is mutually influencing, and not the opposite. Second, it is advised to pay attention to the micro-topography and microclimate, especially in large-scale urban development, and not to easily change the landform without regard of the overall consequences. Last but not least, though there is no ideal place available, the imperfect land, under the guidance of Feng Shui, can still be corrected and improved by such means as planting trees, digging pools, constructing pagodas, changing entrances and so on. However, changing the environment must be appropriate, after receiving tips from Feng Shui on site-selection, architectural layout, the timing of construction and possible methods for land adjustment.

Social Aspects

Based on the accumulated experience during the agricultural civilization, the Feng Shui theory holds that nature has its universal laws, which is the way of heaven (Tao). People are an integral part of nature, and the way of the human--morality and ethical codes--should also be consistent with the way of heaven. People should neither violate the way of heaven, nor fight against nature. Moreover, the way of heaven must be understood, grasped and utilised to satisfy the needs of life, thus achieving the harmonious way of heaven and humans (Wang, 1992). In this respect, Feng Shui is not only about the physical environment, but also incorporates morality and ethics.

Different cultures have resulted in distinct relations between individuals and between the individual and society (see Table 2). In European and American societies where citizens are soaked in individualism, everyone acts by law and individual freedom and personal interests always come first. Things are not the same in China which features communitarianism and where individual behaviour is restrained both by the ritual system and legal system, with priority given to national and collective interests followed by personal ones (Wei, 2003).

Table 2. Cultural features of western and eastern societies

	Social Ideas	Relation between Humans and Nature
Western (individualist)	Freedom, independence and pursuit of maximum individual interests	Independent personality and personal behaviour is mainly bound by the legal system in a law-based society
Eastern (communitarianist)	selflessness, self-denial, in pursuit of social harmony and stability	Group personality and personal behaviour are restricted by the ritual system first, then by the legal system

Although shocked by individualism, the traditional communitarianist culture still has its vitality and significance in China. The traditional eastern society is more harmonious and has adopted a long-term vision for the future (Principle 1). It is more stable for two reasons. In the first place, the built environment, under the guidance of Feng Shui, features defensive layout embraced by the pleasant surroundings and microclimate which create a unique place full of desired Qi. Such a harmonious place, though seemingly hostile to the outsider, tends to set up a close relationship not just between humans and nature, but within the neighbourhood as well. It conforms to the description of sense of place (Principle 6) in sustainable development. Even in larger towns where there are more restraints coming from the land and economy, Feng Shui is flexible enough to take the local conditions into account in the creation of a better relation between buildings. Approaches, such as adjusting the building height, orientation, roads and entrances, among others are usually adopted. Sometimes, in order for a harmonious community to generate more auspicious Qi (fortune), certain ornaments or mirrors may be used, in the belief that such items can bring luck or escape from disaster (Qin, 1992). Despite the accusation of superstition, Feng Shui does help individuals alleviate tension and anxiety and sometimes is deemed medicinal (Emmons, 1992).

In addition, Chinese geomancy believes that the gradual, kind way is most likely to resolve conflicts with both sides being happy. Such a belief lies in the theory of Yin and Yang which postulates that there are contradiction or opposite forces in any system and the only way to maintain a stable system is to strike a balance between all parties (Yao & Wu, 1996). This is because the opposite forces cannot be eliminated, yet can be transformed just like the sun and moon, day and night, man and woman, or life and death. In the light of this theory, we may obtain inspiration about addressing various national, religion or domestic conflicts. In a world which is currently trapped in

the deep mire of anti-terrorism, conspiracies and hostility, winning the enemies might work better than eliminating them.

Economy

Although Feng Shui mainly focuses on building activities and has less involvement in the economic field, modern economy life still can get inspiration from the Yin and Yang theory in terms of circular economy and system thinking (see Table 3). Taking the classical layout of a village for example, being adjacent to water not only provides transport, drinking, sanitation and irrigation, but is also a place for raising poultry, fish and other aquarium plants which deal with domestic grey water and food residues. Thus, a circular economy is formed with no waste created and less emissions discharged. Further, a gentle slope can help avoid water logging, vegetation can conserve soil and water, adjust the microclimate, orchards or forests can also be cost-effective and a source of fuel. In brief, under this typical pattern of Feng Shui, it is easy to form a benign circulation of ecology and economy, and this organic theory is an inspiration for the green circular economy first. Second, Feng Shui theory advocates the development of the local economy, and pays attention to the capacity of land and resources to accommodate a certain population and realise self-sufficiency. What is worth mentioning is that materialism is discouraged in Feng Shui which advocates limiting of individual desire. At the same time, the local economy provides for long-term economic and social security (Principle 2). The outlook of economic development conforms to the description of sustainable production and consumption (Principle 9) as well as ecological footprints (Principle 4) in the ten Melbourne principles.

Table 3. Different ideas of economic development between the West and the East

	Economic Ideas	Characteristics
Western (globalisation)	The theory of globalization; division of labour	Global economy that encourages expansion and consumption is an unsustainable development mode.
Eastern (geomancy)	Organic holism, cycle theory (Yin and Yang)	Local self-sufficiency economy that discourages materialism is a sustainable development mode.

CONCLUSION

The origins of Feng Shui and sustainable development are conceptually, ideologically and historically very different (Li et al., 2015), however many of the ideas converge. Through the above analysis and comparison, it is found that Feng Shui and sustainability share most sustainable development principles in aspect related to the environment, society and economy. Also, Feng Shui has unique ideas about development which might give inspiration to today’s sustainability advocates led by the West. Like the ancient Chinese philosophers who kept searching for the laws of the universe and seeking the harmony between humans, nature and society, today we also need to remind ourselves constantly of the vision of sustainable development and the four key questions: Where are we now? Where are we going? Where do we want to be? How do we get there?

Confronted with most challenging crises, it is an option for the West to turn to Feng Shui and learn about the eastern view of harmony between nature and humans, the overall systematic mode of thinking, and humanism spirit that put social harmony as the standard. Maybe it is time for a change, from emphasising on survival competition to paying attention to the ecological balance and the harmony between humans and nature, from pursuit of individual freedom and interests to giving consideration to collective interests, from linear, unidirectional economy to circular, system economy (Liang, 1992).

ACKNOWLEDGMENT

Xiumei Guo is the corresponding author on this paper.

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PAPER 2:

Urban Agriculture—A Case Study of Ningbo Eastern New Town of China

Statement of Contributions of Authorship

To whom it may concern,

I, Liang Wen, contributed 80% to the paper entitled above and cited as below:

Wen, L.; Guo, X.; Kenworthy, J.; Marinova, D (2018). Urban Agriculture—A Case Study of Ningbo Eastern New Town of China. In Guo, X., Marinova, D. (eds) *Sustainability and Development in Asia and the Pacific*, pp. 85-102(2018); https://doi-org.dbgw.lis.curtin.edu.au/10.1142/9789813236004_0006

Signature of Candidate:

Date: July 2022

I, as a co-author, endorse that this level of contribution by the candidate indicate above is appropriate.

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Date: July 2022

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Date: July 2022

Dora Marinova Signature:

Date: July 2022

This Chapter is an exact copy of the journal paper referred to above

Chapter 5

Urban Agriculture — A Case Study of Ningbo Eastern New Town of China

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and Dora Marinova

1. Introduction

Food production within the built-up area of cities has long been regarded by urban planners and authorities as an important strategy of food security across the world. It was well illustrated in the case of medieval cities and towns in Europe where the gardens behind the houses were for growing food and for defensive purpose. This food function was further exploited at the national level in the United States, in the form of the War Gardens of World War I and the Victory Gardens in World War II. In 1944, 20 million Victory Gardens produced 40% of the nation's fresh vegetables (Mok *et al.*, 2014). Similarly, the UK launched the Dig for Victory campaign in 1939, with allotments providing half of the country's fruit and vegetables in 1944 (Mok *et al.*, 2014).

After this apogee in the importance of urban agriculture, it was not until the end of 20th century that it regained popularity, after being sidelined following World War II. Confronted with environmental issues and

embracing sustainability, people started to consider the environmental, social, and other economic benefits of urban agriculture, rather than just the sole function of food production and security (Zhou, 2015). Many forms of urban agriculture exist in the world, with allotment gardens in Europe and community gardens in the United States being two major representatives.

1.1. Community (allotment) gardens in Europe and North America

Germany is the only country in the world that supports allotment gardens on a national level by issuing a series of laws and regulations to govern their existence and use. Their major function has shifted more to recreation and away from pure food production and security issues (Qian, 2011). It is the legal duty of every German city to provide allotment gardens with the goal that one in 10 households has such access (Qian, 2011; Cai and Yang, 2008). These gardens, organized by local organizations, are often located in regions not suitable for development and congregated in areas called garden colonies (Zhang, 2007). Under supervision of the German Leisure Garden Federation, there are 15,000 such organizations in Germany, whose responsibilities involve sub-leasing individual land obtained from the governments, organizing tenants, and maintaining public areas (Qian, 2011; Zhang, 2007). Normally, there are two major funding sources — annual lease from the land and yearly management fees — that the organization can use for the construction and maintenance of public parts like roads and other facilities. Generally, citizens have to pay €100–300 each year for a 200–400 m² plot with a shed for storing tools (Zhang, 2007).

In London, there are 737 allotment sites (statutory, temporary and private) identified by a 2006 census. Statutory allotments, by far the most common, are on public land acquired or appropriated by a council for the specific intent of gardening. Temporary allotments are hosted on council land allocated for other uses and receive little protection from disposal. The length of waiting lists in Greater London has skyrocketed since 2006, with council surveys in 2010 and 2011 revealing that 16,517 and 16,655

people, respectively, were registered for plots. Plots are usually 253 m², and the average annual rent is around £50–60 (Mok *et al.*, 2014).

In North America, there are three scales of urban agriculture — small commercial farms and community-supported agriculture (CSA), community gardens, and backyard gardens. Small farms are mostly operated by urban farmers who sell their products directly through farm stands and farmers' markets. Both farmers' market and CSA programs, where members join and receive a share of the local harvest for an annual membership fee, have become increasingly popular. Today, there are over 18,000 community gardens in USA and Canada, which comprise large lots of land subdivided into plots for individual households and can be owned by a municipality, institution, community group, or land trust (Mok *et al.*, 2014).

1.2. Urban agriculture in China

Despite the growing interest, urban agriculture has been neglected by city planners, confined through restrictive zoning and inhibited by insufficient government support (Lovell, 2010; Cohen and Reynolds, 2014). It is indeed the case in China where policies and practices focus more on agriculture outside cities and less attention is paid to urban agriculture within cities' built-up areas. Most such activities are grass-roots driven, scattered and fragmented, without legal protection, planting knowledge, technical support, or organization (Wang and Zhu, 2013). By comparison, a growing number of North American cities are incorporating urban agriculture in municipal planning and policy making, and have amended zoning ordinances and building codes to legalize and support it (Hodgson *et al.*, 2011; Cohen and Reynolds, 2014). How to keep up with cities in developed countries in the field of urban agriculture, fulfilling its numerous benefits, is becoming a big and urgent challenge faced by urban planners and city officials in China. They must, like their counterparts in Western countries, come to realize its potential and contribution to a more livable and resilient city.

Introducing urban agriculture, in the first place, into public green space might be a feasible top-down approach, as it could bring some

economic incentives for the government as well as ecological and social benefits. First, lease income from community gardens could be an alternative funding resource to deal with the ever-rising maintenance cost of public green space as the number of parks and squares increases in cities, thus alleviating such financial burden on the government and taxpayers. Second, community gardens have been found to contribute to the value of neighboring real estate (Hodgson, *et al.*, 2011) and an effective promotion means of property sales (Qian, 2011). It could be a positive force in increasing land value for new town development since the revenue from land sales, as a sole source of income for the majority of new towns in China, is designated to be used by the government to cover the various costs incurred during their development. Third, urban agriculture could promote city tourism and create jobs, thus generating more direct income and tax in transport, accommodation, and shopping (Qian, 2011). A case in point is the allotment gardens in Germany which are an important cultural heritage and attract numerous international tourists (Zhang, 2007).

2. Case Study

The study area is the Eastern New Town (ENT), an emerging new city center of Ningbo municipality, with a land area of 15.85 km² and a projected population of 200,000 in 2025. Ningbo is one of the major cities in Eastern China, boasting the second largest port in the world and a history of 1,200 years. Now the city center will move to ENT, 4 km away from the old downtown, with CBD and civic, commercial and cultural functions. Having started in 2005, ENT is in the middle of its development stage, expected to be complete in 2025. As is normal planning practice in China, agricultural functions have been deliberately ignored (Wang and Zhu, 2013), and thus there is no farming land preserved or planned in ENT. The green system, along with waterways, however, has been well planned and is closely connected to the city's bioregion. This has laid a sound foundation for the development of urban agriculture in a dense, built-up context, with top-down efforts.

This research identifies the amount and distribution of public green space and predicts its total maintenance cost. Then it analyses the location and percentage of land area suitable for urban agriculture and creates a

land inventory for community gardens. The next stage is to estimate the lease income coming from those who are willing to pay for the lot for various purposes — profit, leisure, or others. Finally, by comparison with and without urban agriculture, it can be verified to what extent the leasing income can cover the maintenance cost.

2.1. Maintenance cost without urban agriculture (scenario 1)

According to the ENT 2015 plan, the public green area adds up at 291.82 ha, accounting for 18.4% of the total land area of ENT and the water area at 232.96 ha and 14.7%. It is of extremely positive environmental value for a city center with high-density and land value to set aside a very high percentage of land (about 33% for green space and water areas) for non-building purpose. This constitutes one of the 10 critical eco-city features that allows the permeation of the natural environment into a compact, mixed-use city form (Kenworthy, 2006). Moreover, the green space in ENT is often accompanied with river water and is evenly distributed in a systematic way. With easy access to farming land and irrigation water, there is great potential for urban agriculture.

By 2015, the total area of in-use public green space reached 36.54 ha, with an annual government budget for maintenance of RMB 3.3 million. That is equal to an average of 9.0 RMB/m² maintenance cost each year, and therefore the annual government budget in 2025 needed for the maintenance of the projected total public green areas of 291.82 ha is calculated to be RMB 26.2 million.

2.2. Maintenance cost with urban agriculture (scenario 2)

According to UNDP, producing, processing, and marketing food and other products on land and water in urban areas to yield diversity of crops and livestock animals can be defined as urban agriculture (UNDP, 1996). It includes husbandry, aquaculture, agro-forestry, and horticulture, and therefore there are a variety of forms and scales, such as large agriculture

parks in peri-urban areas and tiny private backyard gardens. However, in this analysis, we adopt community gardens (allotment gardens) in ENT on public green space, for three major considerations.

First, community gardens do not require large, consolidated areas of land which means great adaptability and proximity to population in high-density urban areas where there is sufficient green space available and adequate potential tenants and consumers in the vicinity. Second, because of their relatively small size and flexible form, community gardens could be well-integrated into part of the existing or planned green space with minor design adjustment and small-scale transformation. It means no additional land needed and less extra spending required, and it does not clash with the various functions of green space such as ecology and aesthetics. The last advantage is that there would be less complicated land rights issues and no arduous legal process for the revision of land use. As the public green space is owned by the government, there is no need to change the original land use designated for green space.

In this ENT study, the proposed community gardens are to be characterized by small plots targeting individuals, families, or institutions, mainly for leisure purpose. Such gardens can be distributed almost everywhere following the public green system. The urban neighborhoods could benefit from economic, social, and psychological perspectives through participation in planting activities. Seattle's P-Patch community gardening program in USA, which is city-run and now serving more than 2,000 households, is a good model. It is so popular that more than 1,200 people are on the wait list for a small 10-by-10 plot (Hodgson *et al.*, 2011). Community gardens can be further classified into those for households, children, or seniors, following practices in Japan (Tian *et al.*, 2014). Also, community gardens can provide alternative business modes to increase profit — produce distribution, business hosting services, and provision of training courses, tools, seeds, or organic fertilizer would be good options (Tian *et al.*, 2014).

Community gardens in the regional green belts or parks of ENT, where there is more land available for the potential of large-scale planting activities, will be allowed to be transformed partly or completely into other forms of urban agriculture, such as small city farms for products of high value and for agricultural tourism, in pursuit of higher profit.

Commercial farming with relatively large land areas can have good access to transport and infrastructure for food production, processing and distribution, and is less likely to pose direct noise or traffic disruption to neighboring residential areas. Further, large green belts and parks are the ideal places for the application of continuous productive urban landscapes (CPULs), an urban design strategy proposed by architect Andre Viljoen (Lovell, 2010). The benefits would be improving the overall urban environment by integrating multiple functions such as recreation and visual quality and by connecting the whole city to the rural area (Lovell, 2010).

In terms of the criteria for a land inventory of community gardens, two fundamental conditions need to be met. First, what is the main purpose of the public green space, whether it is for ecological and leisure purposes with sufficient green space, or activity-oriented with less planting area. In this respect, areas like the Central Park in the CBD and the Civic Square in front of the municipal government complex will be excluded, because they are mainly for assembly, exhibition, or sports, with potential security and aesthetic concerns. The next consideration will be pollution and human health risks (Lovell, 2010; Hodgson, 2011; Zhou, 2015). Small green spaces near roads with heavy traffic and pollution are considered unsuitable for urban agriculture, because there is not enough buffer space against traffic pollution.

For the remaining green area which has the potential for community gardens, the question then is: where and what is the exact amount of land area that can be used as or transformed into community gardens? A number of factors need to be taken into account. First, whether the green space is already in use/under construction or still in a planning stage, largely can influence or determine the location and the percentage of community garden in a certain public green area. For the former, it is critical to study each area on a case-by-case basis because there are multiple limitations such as the availability of suitable cultivatable land and the feasibility or cost to change the current layout for a community garden. By comparison, the latter is more flexible because the planting activity can be seamlessly integrated into the layout of the green space during the early stage of design. Second, demand for community gardens can have a big impact on the supply of urban agriculture land in the years to come. The more popular city farming, the more willing the authorities to provide a higher

proportion of green space to satisfy such enthusiasm. Last, ecological and aesthetic elements should not be ignored. It is highly recommended to strike a balance between urban agriculture and other land uses in public green space, for edible plants cannot replace those traditional landscape elements like lawns, bushes, and trees, which serve critical aesthetic and ecological functions.

It is difficult to allow for an exact percentage of cultivatable land area in green space, because this can vary under different circumstances. For green spaces in use and in plan, the percentage can be as little as 20% or less without altering the original layout of an existing public park, while in a planned green strip along the river, the proportion can be up to 50% or more with proper design. It is believed that a relatively lower percentage is less likely to change the existing landscape too much and the time and cost of modifying would be minimal. At the early stage of urban agriculture in particular, an overall 20% cultivatable land of the land inventory for community gardens is considered appropriate. This figure is expected to receive less complaints from those who favor large lawns, and it would also be less demanding for the government to carry out this project.

As for the plot size and price, relevant surveys and research conducted by others were analyzed and a recommended price is used for the calculation of lease income. In Beijing, a survey of 872 residents and 11 community gardens in the suburbs was conducted in 2012. One feedback from the residents shows that the willingness to pay (WTP) for community gardens is 1002.62 RMB per person and the desired plot area is 38.80 m². Another result from analyzing the 11 community gardens is that the average plot size provided is 38.64 m², and that the average annual rent charged is 40.21 RMB/m² (Tian *et al.*, 2014). The average plot size is smaller than that of allotment gardens in Germany (which are between 200 m² and 400 m²) or London (253 m²), yet the average rent in Beijing (equivalent to €210 and £182) is much higher than in Germany (between €100 and €300) or London (around £50–60) (Zhang, 2007; Cai and Yang, 2008; Mok *et al.*, 2014). This is probably due to the fact that the history of modern community gardens in China is relatively short and there is insufficient urban agriculture land which mainly targets high-to-medium-income households (Tian *et al.*, 2014). Domestically, the average

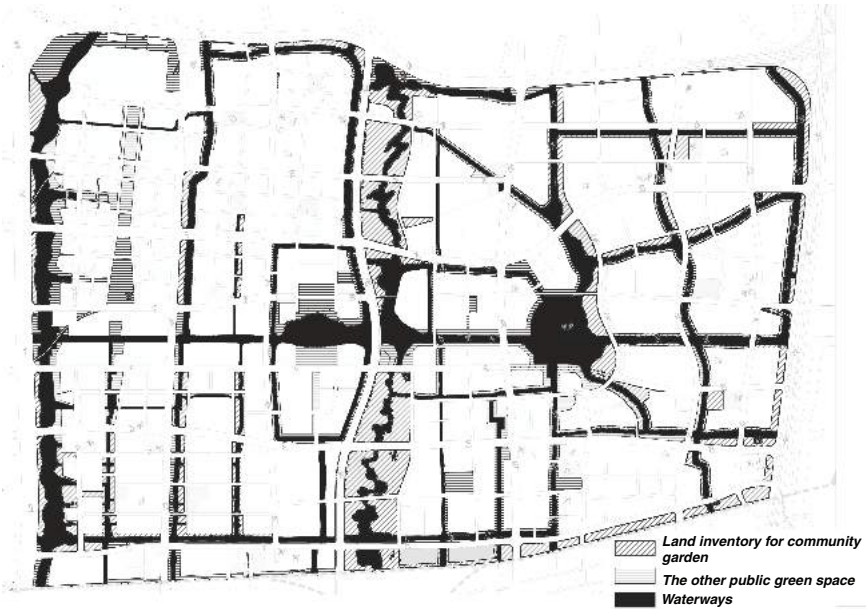


Figure 5.1 Land inventory for community gardens in ENT (scenario 2)

plot size and rent in Beijing are quite similar (according to online information) with those in Yulin, Shanxi Province (BenNongJia Farm: 15 m², RMB780), Changzhou, Jiangsu province (Big Buffalo Farm: 30 m², RMB2000), or Taipei, Taiwan (Taipei City Farm: 33 m², RMB1926–2880).

A minimum plot size of 15 m² (see Figure 5.1) and an average annual rent of RMB1200 would be appropriate for ENT for the following reasons. First, the rent is comparable and reasonable. It is close to the WTP obtained in Beijing and the average annual rent by the majority farms across the country. Second, the location and traffic system will be much better in ENT. Most community gardens surveyed above are far from the city and do not have good or direct access to public transport, which means higher time cost on the road and more fuel spending for private transport (Cai *et al.*, 2013). Conversely in ENT, the core area of the city is where most of the community gardens will be, that is within walking distance for local residents, meaning great convenience and better

affordability without the extra transport spending. Last, smaller minimum plot size can provide more flexibility and satisfy various needs of tenants, yet requires less strenuous work for households who seek recreation more than food production. It is in line with the survey conducted in Beijing (Tian *et al.*, 2014).

After assessment, there will be, in the land inventory, 141 sites suitable for community gardens, totaling 163.65 ha, 20% of which (32.73 ha) is cultivatable land for lease. The cultivatable land accounts for 11.22% of total public green area (291.82 ha) in ENT and the total lease income would be RMB 26.184 million.

2.3. Comparison between the two scenarios (2025)

In scenario 1, the total public green area is 291.82 ha and its maintenance cost is RMB 26.2 million, which would also be the government budget needed, as the government is traditionally the sole revenue resource (see Table 5.1). For scenario 2, the total public green area would be 259.09 ha, excluding 32.73 ha urban agriculture land area, as the tenants would take care of the areas for community gardens. Correspondingly, the total

Table 5.1 Comparison between scenarios, 2025

	Scenario 1 (without urban agriculture)	Scenario 2 (with urban agriculture)	Note
Public green area (ha)	291.82	259.09	Total public green area that needs maintenance
Total maintenance cost (million RMB)	26.21	23.32	Total cost for maintaining green space
Revenue resources			
Urban agriculture land lease income (million RMB)	None	26.184	
Government budget (million RMB)	26.21	None	

maintenance cost would be reduced at RMB 23.32 million. With the lease income of RMB 26.184 million from urban agriculture land, the government budget will no longer be needed.

In summary, the government budget for the maintenance of public green space in the ENT could be reduced dramatically — from RMB 26.21 million to zero, with the distribution from lease income generated from urban agriculture land and decreased maintenance cost resulting from the reduced public green area to maintain.

2.4. Total willingness to pay for community gardens in ENT

In order to find out the potential of urban agriculture in ENT, this study adopts the same equation and some of the parameters (average WTP and participation rate) for the estimation of the total WTP (TWTP) for community gardens, which were used for the same purpose in Beijing in 2012 (Tian *et al.*, 2014). The TWTP of ENT = Rent \times Population \times Share = 1002.62 RMB/person \times 200,000 planned population \times 59.29% = RMB 118.89 million. The current value of RMB 26.184 million from public green space represents only 22.02% of the TWTP, the rest of which could be provided by other forms of community gardens in a variety of locations. In the case of ENT, community gardens on neighborhood land, institutional land, or even rooftops will be more likely to have the spatial and market potential to fill the gap between availability of community gardens in public green space alone and the total likely demand for community gardens.

3. Discussion and Recommendations

In this study, a rough estimation of the potential economic value of urban agriculture on the public green space in Ningbo ENT was found to be up to 26.184 million RMB each year in the form of lease income coming from the land for community gardens. This is expected to expunge the financial burden on the government, with no annual budget needed for maintaining public green areas. This result is encouraging, yet it should be noted that there are some limitations and assumptions in the research method.

3.1. Method limitations

Firstly, this study does not include the many urban agriculture forms in existence across the world that can be also suitable on public green space. Among some of them are demonstration gardens and educational gardens, which can be integrated into community gardens if necessary. Other forms may not be very flexible and adaptable, such as market farms for pure commercial purposes, agricultural parks requiring large agricultural land, and hybrid urban agriculture that can produce ornamental plants, bees, fish, poultry, or animals (Hodgson *et al.*, 2011). Considering that relevant rules and regulations are not in place, and certain larger land is not available in ENT, such categories may carry risks or arouse dispute and are better left for a time when urban agriculture is more widely practiced and has developed more recognition and general support.

Criteria for the urban agriculture land inventory and the percentage of cultivatable land area are two other limitations, as these two items can be affected by a variety of factors, some of which can be, in reality, subjective and unpredictable. For the sake of a rough estimation in this study, 141 out of 363 public green sites have been selected and put into the land inventory and 20% of such chosen land will be cultivated as community gardens. In terms of implementation, it is highly recommended that the green sites be analyzed, designed, and decided on a case-by-case basis. Naturally, it is of priority to look first at spatial factors such as the main function of a certain green space, land size and form, topography, and surrounding land uses, and roads and traffic, because these factors are critical to any assessment. It is of equal importance to take into account other factors like economy, ecology, aesthetics, and psychology, which can have a huge impact on the criteria and percentage.

The average annual rent and minimum plot size are based on assumptions without specific surveys conducted in Ningbo City, for there are hardly any such community gardens known to exist in built-up areas of Chinese cities (Wang and Zhu, 2013). So, the annual rent and plot size adopted in this research do have some limitations, notwithstanding the survey in Beijing for reference and with other cities for comparison. Similarly, the TWTP of ENT is an approximation, because the key parameters of participation rate and average WTP are based on the survey conducted in Beijing.

Despite the limitations and resulting possible deviations, the results are encouraging and expected to give inspiration and incentive to the government which is under increasing financial pressure to provide public services (The World Bank and the DRC of the State Council of China, 2014).

3.2. *Economic benefits of urban agriculture*

However, the above are only some of the many economic benefits that this research tries to elucidate from the perspective of the government to better manage and increase revenue from public land. Economically, there are many other potential values that should not be omitted.

The fundamental one is the monetary value of vegetable, fruit, flower, and other kinds of plants that are harvested on the urban agriculture land. The yield potential of fruit and vegetable crops can be as high as 50 kg/m² each year, and the minimum land required ranges from 230 m² for the needs of one individual to as little as 18 m² for an average household in Brazil (Orsini *et al.*, 2013). With such huge amount of fresh produce to meet a daily intake of 500 g of vegetables and fruit recommended by UN and WHO (Haberman *et al.*, 2014), a local household, in the meantime, can also reduce its spending on expensive food with petrol costs and long miles embedded in its cost, and even increase household income as well as fresh produce consumption for poorer families in particular.

Moreover, urban agriculture has been proved to contribute to an increase in the value of neighboring land and property. A study in New York confirms a 9.4% increase in neighboring property values within 5 years of a community garden's opening (Hodgson *et al.*, 2011). Further quantitative research is needed to precisely measure such value increments, which would help consolidate the existence of urban agriculture in city contexts. Starting to realize such a benefit, developers and designers are increasingly encouraged to incorporate urban agriculture into new projects in Minneapolis and into design in Vancouver by special guidelines (Hodgson *et al.*, 2011).

In fact, urban agriculture in peri-urban areas has been gaining popularity, but more income has been earned from hotels, restaurants, and business conferences hosting. In the case of Heping Leisure Farm in

Hubei province, China, the profit from the above three sectors accounts for 60% of total revenue, much higher than the rest generated directly from farmland-based activities such as planting, fishing, fruit picking, and so on (Cai *et al.*, 2008). In this respect, a holistic perspective is required to assess the overall economic benefit in relevant sectors brought about by urban agriculture.

3.3. Planning and recommendations

As the TWTP indicates, community gardens or city farms, on public green space alone, are far from satisfying the huge potential demands for planting. *Other forms of urban agriculture* on various public or private space would need to be exploited. The typology of urban agriculture generally includes three categories — non-commercial, commercial, and hybrid (Hodgson *et al.*, 2011), which means great variety and potential in provision. In the case of ENT, apart from government-owned land, collective neighborhood green areas, institutional land, private backyards and balconies, roof tops, vacant land, and rivers or lakes are all potential places for urban agriculture.

Traffic pollution and its buffer distance can greatly influence the provision of land suitable for urban agriculture. So, both traffic calming and public transport are necessary to increase the land reserve for urban agriculture by reducing traffic-linked pollution. In the very long run, emissions-free transport can be expected as 13 governments, including Germany, have targeted zero emissions for passenger vehicles by 2050 (International ZEV Alliance Announcement, 2015). At the moment, encouraging cycleways to link communities with urban agriculture land is a feasible way, as there is already such a system planned or in place, connecting neighborhoods with green space in ENT. Little additional work is needed except for a minor adjustment of bicycle routes to be extended so they reach the community gardens.

The *infrastructure* for urban agriculture should not be neglected as it can greatly influence its performance. Normally this includes four major categories — accessory structures and materials, processing facilities, distribution, and retail destinations (Hodgson *et al.*, 2011). In the case of ENT, where there is a waterway network interlinked with urban

agriculture land, the rivers provide abundant water resources for agriculture, help save government expenditure on pipes, and reduce water usage cost for gardeners. Yet, some relevant facilities are still needed to be in place, which can be used for irrigation purpose. As for off-site categories, farmers' markets need to be well planned and set up as they collect and sell food locally, which can be an important link between producer and consumer and a great help towards optimal disposal of excess vegetables (Hodgson *et al.*, 2011).

To Chinese city dwellers, community gardens or city farms are a relatively new form of urban agriculture which can be hardly seen in built-up areas, and therefore it would be better to be prudent by choosing a number of community gardens as *demonstration projects* first. After the initial years of operation, surveys on annual rent, WTP, or participation rate can be conducted, since citizens are expected to have become acquainted and some rules and regulations will probably be available. Only then can urban agriculture be extensively implemented across ENT and beyond. Thereafter the *lease market* can start to be established where the price is decided by the demand. The revenue from urban agriculture could become a regular income for the local government when revenue from land sales is predicted to decline gradually (The World Bank and the DRC of the State Council of China, 2014).

There are several *operation modes* we can follow. First, there is the mode organized by the government, in which direct application for a piece of land is available for individuals, as is the practice in London (Mok *et al.*, 2014). This mode is probably suitable for the early years when the lease market is not set up and it is necessary to guarantee the right of the poor people to a plot of land at an affordable price. The second type can be widely seen in Germany where the local garden organizations obtain land from the government and then sublease to households (Qian, 2011; Zhang, 2007). The last one is fundraising by the public for various purposes. It is gaining growing popularity in London and also receiving support from the government (Cathcart-Keays, 2016). Fundraising can be used in ENT by groups of individuals to acquire a certain amount of urban agriculture land directly from the lease market at a lower price. The last two modes will greatly contribute to the emergence of urban agriculture-linked NGOs, and the cohesion and vitality of community, while the first

one will promote social equality as well as the start and spread of urban agriculture.

To support the movement of urban agriculture, a series of *rules and regulations* need to be drawn up as Germany has done for allotment gardens (Qian, 2011; Zhang, 2007) and a number of cities have started zoning revisions for community gardens (Jepson and Haines, 2014). In the case of ENT, it would be necessary to create an urban agriculture plan in the first place, which is an integral part of food planning. Then city planning could respect and absorb the ideas of urban agriculture and food plans during formulations of plans, as Chicago's regional GO TO 2014 plan does (Cohen and Reynolds, 2014). As a new land use in urban planning, practices like farmland preservation in green belts and top soil preservation and reuse in community gardens will not remain unfamiliar with planners anymore.

Another issue is how the afore-mentioned policies and programs get supported by municipal agencies. Germany again provides a good example in which various departments such as planning, property, and landscape get involved in and took responsibility for the supervision of allotment gardens (Qian, 2011). In North America, agencies like food councils and community garden federations have been set up for the development of urban agriculture. The Cleveland–Cuyahoga Food Policy Coalition is a good case. Among its five working groups is the Land Use Working Group (LUWG), which consists of city and county planners, architects, community development organizations, and a land trust. The group worked closely with city planning staff to review zoning codes and develop regulations for an urban-garden zoning district (Hodgson *et al.*, 2011).

4. Conclusions

By analysis and estimation, it appears feasible to generate sufficient revenue from public green space to cover its maintenance costs through the introduction of community gardens. Such an economic incentive will increase the acceptance and recognition by the government of the potential of urban agriculture and its contribution to a sustainable and livable city. Within the built-up area of cities across China, such top-down efforts are more likely to trigger the burgeoning of urban agriculture.

Although such an approach may be a breakthrough for urban agriculture, it serves only as a starting point. More efforts will be needed in terms of policy and organization, as well as knowledge generation and analysis to ensure that urban agriculture can grow as a viable part of urbanization in Chinese cities with multiple benefits accruing to both citizens and government.

Acknowledgments

The authors acknowledge the contribution of an Australian Government Research Training Program Scholarship in supporting this research.

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PAPER 3:

Solving Traffic Congestion through Street Renaissance: A Perspective from Dense Asian Cities

Statement of Contributions of Authorship

To whom it may concern,

I, Liang Wen, contributed 70% to the paper entitled above and cited as below:

Wen, L.; Kenworthy, J.; Guo, X.; Marinova, D (2019). Solving Traffic Congestion through Street Renaissance: A Perspective from Dense Asian Cities. *Urban Science* 2019, 3, 18; doi:10.3390/urbansci3010018

Signature of Candidate:

Date: July 2022

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This Chapter is an exact copy of the journal paper referred to above



Article

Solving Traffic Congestion through Street Renaissance: A Perspective from Dense Asian Cities

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Received: 30 December 2018; Accepted: 26 January 2019; Published: 29 January 2019



Abstract: Traffic congestion is one of the most vexing city problems and involves numerous factors which cannot be addressed without a holistic approach. Congestion cannot be narrowly tackled at the cost of a city's quality of life. Focusing on transport and land use planning, this paper examines transport policies and practices on both the supply and demand sides and finds that indirect travel demand management might be the most desirable solution to this chronic traffic ailment. The concept of absorption of traffic demand through the renaissance of streets as a way for traffic relief is introduced from two perspectives, with some examples from dense Asian urban contexts to demonstrate this. Firstly, jobs–housing balance suggests the return of production activities to residential areas and sufficient provision of diverse space/housing options to deal with work-related traffic. The second approach is to promote the street as a multi-activity destination rather than a thoroughfare to access dispersed daily needs, and to advocate more street life to diminish non-commuting traffic. Based on this, suggestions for better transport planning policies are put forward.

Keywords: travel demand management; land use pattern; low-mobility; active transport; street space; multi-activity destination; balance and adaptability; urban fabrics; Asian cities.

1. Introduction

With the increasing concentration of population and activities in cities, particularly in the automobile age, traffic congestion has become a major problem in most cities [1]. Given the negative impacts on individuals and the big economic, environmental and societal costs [2–4], major capital expenditures and countless other efforts have been put in place for tackling traffic problems [5], particularly in Chinese cities; yet little progress has been reported [6]. What is worse, the happiness of citizens and the liveability of cities have been found to be negatively associated with growing commuting time [7]. As long as the city and its population are expanding, new congestion invariably follows despite the advancement of technology or the provision of infrastructure [8]. It is logical to question then whether this vicious cycle can be broken and to ask whether there is a way out of traffic problems.

Traffic arises out of land use, a fact that has been formally acknowledged since 1954 by Mitchell and Rapkin in their publication “Urban traffic—a function of land use” [9]. Both transport and land use planning can make essential contributions to traffic relief, while at the same time improving the quality of city life. This paper focusses on the street as the dominant public space in place making—a place for consumption, production and living—and stresses its importance as a multi-activity destination, a role which is critical in traffic relief. Traffic congestion on the other hand can negatively impact the use of the street and community formation. Residents and the city alike can benefit from close proximity

between origins and destinations through reduction in travel demand and associated costs as well as changes to more sustainable modes, such as walking, biking and using public transport, which can also yield a healthier lifestyle.

This study examines the literature relating to the progress of traffic relief and investigates the root cause of congestion. It then explores the need to revive the streets as an important way to alleviate traffic congestion. The main objectives are to:

- Overview the traffic alleviation approaches within cities experiencing traffic congestion;
- Reposition the debate about traffic alleviation around the main cause of traffic congestion entrenched in inefficient land use patterns;
- Identify the role of neighbourhood streets in traffic relief through analysing the jobs-housing balance and opportunities for reviving street life using examples from Asia;
- Provide policy recommendations for linking transport and planning in order to alleviate traffic congestion, particularly in Asian cities whose dense land use patterns and limited road infrastructure are particularly vulnerable to congestion, even at low levels of car ownership.

1.1. Traffic Relief

Cities experiencing traffic congestion tend to go through four stages of alleviation efforts, each with a different focus and approach. Firstly, the attention is on the supply side with a distinct focus on capacity increases for private vehicles and less focus on expanding public transport. At stage one, the priority is primarily given to private transport infrastructure provision (especially freeways or toll-ways) and management improvement for mobility and speed, as opposed to improving accessibility. New road construction, however, only induces more car use and congestion still exists due to considerable 'latent demand' or induced traffic [10]. This is particularly true in larger, denser cities with necessarily limited road infrastructure, whose travel demands are too large and cannot be met solely with road transport focussed on private automobiles [11]. As said by many over the years, "you cannot build your way out of congestion" [5].

The recognition of the impossibility of solving congestion through expansion of road supply leads to stage two, which aims to transfer travel demand to rail or bus through heavy investment in public transport systems. This works temporarily in transferring traffic from private to public transport modes, but soon road congestion comes back as more cars are attracted to the less congested, free-flowing road conditions. Moreover, rail or bus riders often find themselves crammed in like sardines in public transport vehicles due to the expansion of travel demand on services ill-equipped to cater for such increased usage [11–13]. For example, this is the case of London's rail network where the problem of overcrowding is acknowledged and unlikely to be relieved before 2041 [14]. With growing population and per capita travel distance, the overall daily travelled distance increases dramatically, as does commuting time [15].

Since transport infrastructure supply increases alone cannot solve the traffic problem, authorities then begin to consider the demand side [16]. Stage three involves direct travel demand control with the introduction of congestion fees, car license plate auctions for the right to buy a car, as in Singapore and Shanghai (or lottery system in Beijing) or car use restrictions based on the last digit of number plates [6]. This is further aided in China with the strict Hukou (household registration) policy, soaring housing prices and the campaign of "sealing the wall and closing the street side shops" designed to remove illegal street-side shops that have sprung up in residential buildings and which create traffic. On the other hand, the policy of forcing such enterprises into shopping centres on the grounds of security, fire regulations, streetscape impacts, noise and traffic, may actually hurt the city economy due to removal of essential low-skilled labour enterprises [17]. Alone, this kind of demand suppression through car and population control does work effectively but cannot last long [5]. Additionally, it increases inequality and works against agglomeration economies [12].

Finally, stage four of traffic relief is the indirect control over travel demand through land use and transport integration (LUTI). This approach is not so commonly acknowledged, possibly because

it requires enduring efforts and authorities generally cannot wait for decades to see its effect upon traffic. Nevertheless, it is found that urban form and the built environment have substantial impacts on commuting distance and time, and that the change of land use patterns is essential to shorten the distance between origins and destinations, thereby reducing overall travel demand, particularly motorised traffic [18]. In view of “this functional isolation that denies cities as organic, living entities and sees transport as isolated patterns of origins and destinations” [8], there are now increasing efforts such as transit-oriented development (TOD), which are trying to better integrate transport and land use planning. This shifts the focus away from seeing the transport system in isolation from land use. Still, this alone is also not enough to tackle the already serious congestion problems in cities, especially considering the limited transit catchment areas in many places (particularly rail catchment areas around which most TOD is focussed) and the vast, sprawling metropolises, with their ever-growing population and soaring daily travel distances (from 1 km per person in 1900, up to 10 km per person per day by 1960 and 50 km per person per day by 2000) [15]. The root of congestion needs to be understood in order to find lasting traffic alleviation solutions.

1.2. Root Cause of Congestion and the Real Aim of Traffic Alleviation

On the surface, congestion is the problem of too many cars with insufficient roads or fast-growing numbers of commuters outpacing the provision of competitive public transport. Deep down, it is the problem of inefficient land use patterns that segregate the used-to-be close relationship between living, consumption and production space. Such spatial segregation and zoning combined with decreasing densities create huge travel demand for carrying out simple daily activities that were once achievable by short non-motorised trips on foot or bike. “Trip chaining” by public transport users whereby multiple trip purposes are achieved during a single journey (work, shopping etc.), is also more limited [19,20]. It is indeed the case that city dwellers are increasingly finding it hard to combine errands with the convenience of a single walking trip due to scattered destinations and stretched travel distances that are beyond the capability of walking or cycling [21]. Chinese cities are an example of more traffic problems arising with the increased spread of the automobile urban fabric. Such fabrics are increasing private motorised travel demand to get to and from destinations, such as shopping centres, CBD, employment areas and industrial parks, which are bigger in size, yet increasingly scattered in location.

The development of an increasing number of mega cities in China brings into sharp focus the dire consequences of disconnection between land use and transport that generates huge motorised travel demand, and which results in congestion, not just on the road, but also in the public transport systems [12,22]. Such traffic ailments may be manageable in the early stages of a city’s rapid growth with simple provision of infrastructure or improvement in traffic management. In time, however, traffic increasingly gets out of control, even with the aid of congestion fee policies as well as public transport investment, simply because motorised travel demand exceeds the ability of such responses to cope with it. Sadly, it is the city’s population, instead of the flawed land use pattern, that is frequently targeted as the culprit of the congestion in cities like Beijing where vehicular travel is rarely projected to stop growing and “the possibility of a lower-mobility future is not even considered” [23] (p. 866).

Generally speaking, the aim of travel is to get to some place to fulfil certain activities or more particularly, “the demand for transport is derived from the need to access employment, food and other essentials, health and education, visiting friends and family, and leisure activities and so on” [24] (p. 52). That is to say, getting somewhere is not the aim per se, but a kind of cost to overcome the spatial distance between the origin and the destination. As Lyons notes: “physical mobility concerns transcending distance” [25] (p. 6). The costs can take on many forms such as fuel, tickets or time for the individuals, infrastructure and services the government must provide, or other intangible costs which the whole society has to pay environmentally, socially as well as economically.

Given the above realities, the following questions arise. What if the distances between origins and destinations were to be greatly shortened? Can we slash or even eliminate the cost? Will there be any

traffic congestion when a considerable proportion of the motorised travel demand is dissolved and can be undertaken by foot or bike? The answer lies in physical proximity aided by virtual connectivity, with distances reduced or even eliminated. This results in less reliance on motorised transport and leads to active travel alternatives [25]. In this regard, it should be noted that without efforts in physical mobility, digital solutions alone are unlikely to produce the needed reduction in motorised transport. An additional point of relevance here is that in Singapore, Hong Kong and other Asian cities, with their preponderance of high rise residential buildings and intensively mixed land uses underneath, a significant proportion of travel is vertical in an elevator or on foot in staircases, followed by short walking trips in the vicinity of home.

Mired and unsettled in traffic congestion, we are getting distracted and gradually forgetting the real aim of urban travel—helping to live a high quality and happy life—something which was recognised as far back as Aristotle in ancient Greece [26]. Put simply, and at the risk of stating the obvious, people travel to their workplace not for the sake of the travel, whether it is slow or fast, but to get their work done and to make a living. Similarly, people driving to shopping centres or parks do so not for the journey. The real purpose is for survival and enjoyment. Hence, the ultimate target of traffic relief is not really for the faster, free-flowing movement of cars, goods or people, but for a better quality of city life. In other words, there would be no point to alleviating congestion if city dwellers are deprived of their street life through giving way to more and more cars, not to mention the alarming road traffic fatalities caused by high-mobility vehicular transport—1.25 million deaths globally with another 50 million injured annually [27].

Nevertheless, this point of creating a high quality of city life for people has been side-lined in misguided traffic policies which “... treat only the symptoms of an ailing transport system” [19] and are confined mostly to visible improvements in infrastructure and traffic management for the smooth flow of vehicles. This represents a car-oriented policy for the mere efficiency of vehicle movement or economic development, yet insidiously at the expense of individual health and happiness [28,29]. To put it another way, creating cities is not for cars but for people [30], as Lewis Mumford argued as far back as 1960 and as it is stated more recently in The Mayor’s Transport Strategy for London, namely that it is necessary “to put people’s health and quality of life at the very heart of planning the city’s transport” [14]. So instead of keeping people away from the street on the basis of the safety of pedestrians or fast and efficient vehicular mobility, it is time to give back the streets to people [31]. For this reason, a street renaissance is needed to help revive civil society in which the grassroots and middle class resist the encroachment of this space from the kind of capital investment and political power which has “a large vested interest in road-based solutions to the transport problem” [19].

2. Street Renaissance and Traffic Relief

Streets have served different functions throughout the time. The revival of their role in the cities of today requires striking the right balance between jobs and housing needs, as well as seeing the street as a place of multitude of activities which build communities and a sense of place. These issues are discussed below.

2.1. Streets of Yesterday, Today and Tomorrow

Historically, human settlements invariably grow along the road or waterway where people, goods and information flow and concentrate. It is believed that the very need for saving on transaction costs generates the natural impetus of agglomeration on the road first [32]. This means that roads are not just for traffic but have become part of the economic order, being “markets” where many economic, social and political transactions take place. The further clustering of industry and population along such streets produces another order—spatial order, namely a city [32]. In essence, the multiple layers of functions on the street contribute to cost reduction in transactions by saving time, land and transport costs. The street blocks are the foundation of a city, aggregating production, consumption and living

space on top of transport functions [33], and in urban design terms, the ideal street block size for permeability by pedestrians, is 100 metres square to maximise choice of routes and ease of access.

With the advent of the car, this traditional street organisation began to vanish, giving way to automobile-based modern transportation systems, often with huge block sizes, curvilinear streets and many culs-de-sac which are antithetical to non-motorised transport. The streets revert solely to motorised movement space and with that, the withering of the street economy and street life [34,35]. Residents become increasingly car-dependent to get to work in the CBD, suburban office, business areas or industrial parks, and even shopping and leisure are increasingly out of reach by walking. A case in point is that “a 200 metre walk at 5 km/h to a corner shop for a litre of milk becomes a 5 km drive at 50 km/h to a ‘big box’ shopping centre” [19] (p. 8). Consequently, the bond between transport and land uses was broken and the quality of street life collapsed in many parts of cities, giving rise to traffic and that traffic then making congestion a fact of life. It is not the problem of the car itself but the low-density land use patterns, single-use zoning and hierarchical road layouts, which result in the overuse of and dependence on the car [8], or in certain instances public transport, which replaced walking and cycling at a local level to meet daily needs [1].

A street renaissance is urgently needed to bring consumption and production closely back to the living space to reduce long-distance travel demand and to increase the share of non-motorised transport modes for daily trips [36]. As such, people need safe, diverse and vibrant streets which accommodate various functions and activities. In such streets, life and work are so closely knitted, that local residents find it more efficient and convenient to walk than drive, thereby overcoming car dependence. An appropriate city fabric and streets as public space are required to provide multiple functions for consumption and production, as well as for leisure purposes so that an increasing proportion of residents neither must commute to a crammed CBD or peripheral suburban, business and industrial zones, nor be obliged to drive to shopping centres or city parks on a daily basis [37].

The following sections discuss what street renaissance is about and how it is linked to congestion alleviation. Specifically, jobs–housing balance from the street economy perspective and streets as walkable destinations are put forward to explain how these two approaches can deal with work-related and non-commuting traffic respectively.

2.2. *Jobs–Housing Balance and Work-Related Commuting Traffic*

As an urban planning principle, jobs–housing balance has long been adopted to tackle population and traffic congestion, dating as far back as Ebenezer Howard and the Garden City movement [38–40], yet little has been achieved so far [41]. The work of Jane Jacobs [42] on American cities also emphasised the need for urban vitality and diversity in activities, not only downtown, but also in the city districts and neighbourhoods, which can attract a wide range of jobs, services, schools, shops, restaurants, entertainment and recreation, as well as provide decent housing. One of the difficulties in achieving job–housing balance is the complexity of the co-location of work and workers. For example, Curtis and Olaru [43] find that commute time to work, and closeness to rail and facilities are considered to be factors of less importance in residents’ housing choice. This is contrary to the common assumption in planning for self-sufficiency, that travel minimisation would be one of the major considerations for workers in deciding where to live. On the employment side, overly-simplifying the complex realities of firm location further makes jobs–housing balance an insufficient mechanism on its own to resolve traffic congestion, as it does not consider skills–job matching [41] or journey-to-work realities [44]. Evenly distributed employment would be at the cost of proximity to resources, such as specialised labour, complimentary firms etc. [22,41].

Despite such limitations, the balance of jobs and housing indicates the potential for traffic congestion relief, as ultimately the transport problem is related to land use [19,45]. The European case study by Hamiduddin [46] shows that the co-location of employment space and housing in a compact city model reduces work travel and encourages sustainable transport modes, such as walking and cycling. Furthermore, commuting time has been found to be influenced more by the jobs–housing

balance than socio-economic characteristics, such as income, age, gender and education [7]. It partially fulfils the policy target of self-sufficiency and provides the market with the spatial option for co-locating living and production spaces at a time when demand for proximity between home and work still exists in modern cities [47]. Although self-sufficiency may not be completely achieved, the jobs–housing balance is an important way that land-use planning can contribute towards traffic congestion relief, particularly in relation to work travel [48]. This is confirmed by Cervero and Duncan [49] who show that vehicle miles or hours travelled for work trips can be considerably reduced with abundance of jobs within four miles from home.

It is time to turn the attention to the local community and the street where jobs–housing balance, if jobs and homes are well mixed, can result in reduction in commuting distance [50] and more efficient commuting behaviour [51]. Achieving jobs–housing balance in a broader area, the whole city for instance, is naturally easier, but it does not necessarily mean reduction in commuting distance. There is, however, limited research on jobs–housing balance at the micro level, such as the neighbourhoods, while central and regional centres, industrial parks and traffic corridors have received more attention, despite being limited in numbers and offering relatively large scale, high-end or specialised employment. By comparison, the jobs–housing balance in the vast street network connected to the large number of neighbourhoods supports small-scale local employment opportunities and grassroots start-ups. The revival of the street economy with local opportunities can significantly reduce work-related commuting traffic. The major aspects of the jobs–housing balance, namely job creating and space/housing provision are presented in Table 1 and discussed below.

Table 1. Street-level jobs–housing balance.

Street-level jobs–housing balance (commuting traffic absorption and reduction)	Job creation	Creative industry/Industry 4.0 Urban agriculture Production-related services	Street economy
	Space/housing provision	Shops with upper-level office or housing East-west facing housing Community gardens and fresh produce sale space	

2.2.1. Job Creation

Employment has always been one of the top government priorities and society at large is believed to be quite inventive in creating jobs. In addition to services, such as retail and finance, street revival can bring to residential areas advanced manufacturing, urban agriculture and other production-related amenities, which have been largely excluded from areas where people reside.

It may be that we are used to the absence of production in residential areas and take it for granted that living and working should be naturally separated. Yet this is not the case. Historically, production activities have been an integral part of daily life in the city with artisanal manufacturing being held in individual households [52]. Alley factories in Shanghai were a typical street industry in the early 20th century, within a closely integrated residential and commercial space [53]. It was not until the 1970s that industry was segregated from residential areas because of environmental concern [52]. In this day and age with more stringent environmental regulations and the advent of smart manufacturing, Internet of Things, computerisation and digitalisation, it seems that the decentralised, computerised and interconnected industry 4.0 fits nicer within the urban fabric [54]. However, the interrelations between urban development and advanced manufacturing are yet to be properly explored and used [55]. This advanced manufacturing features small-scale distributed systems with quick-response, make-to-order modes, requiring less storage space with high dependence on modern logistics system. It demands a more educated and specialised workforce, yet without noise or pollution, which makes it possible and convenient to return to the city core and be mixed with housing [56]. An example is the high percentage (42.1%) of manufacturing departments in the core area of Tokyo [57], which indicates the competitiveness of urban-based industry against services or housing in the land or labour markets. Preserving the few industrial sites scattered in the built

areas and reintroducing clean manufacturing together with service departments and headquarters of manufacturing enterprises in the street blocks appear to be a smart strategy in creating jobs [58].

Similar to industry, agriculture is also making a comeback to the built-up area in the form of, for instance, allotment gardens in Europe and community gardens in the United States. Confronted with environmental issues and embracing sustainability, people started to consider the environmental, social and other economic benefits of urban agriculture, rather than just the sole function of food production and food security [59]. However, in China urban agriculture has been vastly neglected with most such activities being grassroots driven, scattered and fragmented, without legal protection or organisation [60]. There is an evident mismatch between enthusiasm for planting and growing on the one hand, and the space provided for urban agriculture on the other, which indicates a big demand for community gardens. Public or private open space such as parks, collective neighbourhood green areas, private backyards and balconies can be transformed into community gardens. This also means opportunities for employment in gardening and farmers' markets or stores where the local produce is sold.

The huge potential of the service sector also needs to be exploited further, as it has always been a vital part of the city, starting from traditional retail to specialised industry services. These days, the border between manufacturing and services is blurring, being reshaped by new technologies which facilitate the flow of ideas, goods and services, breeding thousands of new start-ups in fields such as social media and mobile apps, rather than the few big companies, such as Microsoft and hardware products, decades ago [56]. The innovation-driven or knowledge economy is typically occurring in crowded central cities and inner suburbs where exchanges of ideas are facilitated by closeness to other companies and surrounding supporting activities and amenities, such as cafés, restaurants and bars. This shift to dense, multi-use central urban locations is in contrast to the patterns of the past 50 years, characterised by isolated corporate campuses and research parks accessible only by cars. There is potential for local communities to attract technology companies by creating a physical environment that facilitates the growth of technology start-ups and entrepreneurial businesses within the street fabrics. These tech companies in turn not only provide technical support to traditional manufacturing and retail, but also reshape them into advanced manufacturing and commerce with technologies like the Internet of Things, Big Data and Cloud Computing.

2.2.2. Space/Housing Provision

The creation of new jobs requires the provision of various spaces for consumption, production and living. The affordability of space and the proximity between housing and shops, offices or production premises not only mean cost reduction in rent and fuel, but also less time and stamina spent on the increasingly congested roads or crowded transit by avoiding long commuting to and from work. Quite a few cities have realised the importance of affordable housing or offices and their link to boosting technological innovation. New York is a good example in transforming from a capital-driven to an innovation-driven city since the 2008 global financial crisis by launching programs, such as Incubators & Workspaces Program and Promoting Infrastructure Program [61].

It is time to reintroduce shops with upper-level office or housing space in dense streets/street blocks as they can serve as incubator place for start-up firms and businesses while contributing to traffic reduction. Traditionally, such hybrid buildings—both for work and living—have long existed not only for the benefit of lower overall rent, but also for the convenience of being able to juggle business and home duties with flexibility, including less or no commuting-related costs, time and efforts. A recent example is the scheme of AIR—Artist in Residence, in New York which encourages creative industry by allowing the artists or musicians to live in the loft [62]. Demand for mix-use buildings widely exists, which is illustrated by shops emerging from garages or housing, with living space on the top or at the back of the store. Design approaches that increase the height or width of shops will not only improve the working and living conditions but also offer more flexibility for advanced manufacturing, which may require higher ceilings for storage or operation. The return of

multifunctional buildings, together with associated regulations and designs, is essential for attracting start-ups, revitalising the street economy and reducing traffic pressure.

To improve the jobs-housing balance and reduce traffic, residential buildings should be built east-west facing on small blocks making them more affordable for housing and shops, with facades towards the street and easily seen by people passing by. Abundant provision of shops and the resulting lower rent or cost for business, help foster a vibrant street economy with less obstructive street interface, such as walls and fences. Such an improved streetscape and street vitality with an increased number of businesses encourages walking. In fact, employment density is considered a determinant of transport mode use [15].

Another merit of the east-west facing smaller affordable housing is that it can push down the house prices or rents with more stock available in the market. This is particularly relevant to slum dwellers worldwide, estimated to represent 1 billion people and 30% of the world urban population [63]. In Beijing, there is an estimated 100,000 “ant tribe” or “rat people” living in informal settlements, most of whom are low-income new migrants or underemployed college graduates, who live in windowless underground basements, buses, containers or have to share a bedroom with up to six strangers to be able to pay the rent [64]. The most important thing for them is not residing in a place with spacious rooms and ample sunshine all day long, but an affordable basic living space, particularly at night. China’s current sunlight regulation which is believed to help guarantee a basic standard of living environment [65], may be a double-edged sword increasing the price of housing and requiring more space. Moreover, mixing different income households within the same residential area would benefit both the wealthy and the poor from the proximity of demand for services and labour provision, which results in a better jobs-housing balance with minimal travel demand.

As a production space for gardening enthusiasts, community gardens can also contribute to traffic reduction. They are within walking distance for local residents who do not have to rely on cars or public transport for access. As a matter of fact, on weekends an increasing number of Beijing citizens go to farms which are located far from the city and do not have good or direct access by public transport, which means a longer time spent on the road and more fuel costs for private transport [66]. An average household can also reduce its spending on food, which embeds petrol costs and long miles, while diminishing vehicular traffic linked to transport. The presence of indoor farmers’ markets, street-side weekend fresh produce markets or stores catering for gardening needs is equally essential for attracting potential tenants and consumers within a short walking distance.

2.3. Multi-Activity Destination and Street Life (Life-Related Non-Commuting Traffic)

In addition to commuting, non-work related travel further worsens the traffic problem and extends peak hours. Longer travel to amenities can be more acceptable to the public in real life than that predicted by standard planning models [67]. Factors, such as public services and facilities as well as street fabric and accessibility, impact on real-life traffic, which includes travel to a wide range of destinations. The New Urbanism agenda aims to create a compact and diverse city and pedestrian-friendly streets to encourage walking and reduce car use through the development of traditional neighbourhoods and TODs [68]. Such an approach is working to some extent, resulting in increased walking trips for the purpose of leisure as in the case of Perth’s Liveable Neighbourhood practice adopted as part of the New Urbanism [69]. Notwithstanding this, the daily vehicle miles travelled (VMT) by residents barely change due to the lack of walkable destinations, such as corner shops, delis or other services, despite the better network connectivity [69].

To address the traffic issue, we need to rethink the street as a destination where most daily requirements could be satisfied on foot without the need to drive around. Historically, the walking cities—5 to 8 km across, dense and compact with highly mixed land use—first emerged [70]. All destinations are available within about half an hour, by walking at 5 km/h. In transit (public transport) cities, which have grown along rail corridors and stations, most of daily needs can still be satisfied within walking distance or by rail and walking combined. Most destinations in these two

kinds of cities are within the 60–70 min of a daily travel budget [71]. However, this travel-time budget is out of control in an automobile city that is sparse and sprawling with segregated land uses [72]. The destinations are scattered in a bigger city—50 km across, where residents have to rely on private cars or public transport to achieve high enough speeds to maintain any semblance or a normal travel time budget.

In fact, the street is becoming less attractive for pedestrians, mostly due to the lack of walkable destinations, which leads to car dependence for daily needs to and from big box shopping centres or parks, often scattered outside of neighbourhoods and out of reach by walking. The street, with its declining streetscape, is increasingly regarded as an unsafe boring passage filled with fast-moving vehicles, toxic fumes and noise, connecting home to various destinations for specific and separate purposes, such as working, shopping or leisure. We are gradually forgetting that the street used to be the dominant form of public space in daily life [33] where the locals satisfy their necessities, go for business, meet people and participate in activities and events. The street was also an extension of the private family space for raising children, spending time and getting old. Essentially, the limited number of destinations along the now less attractive streets results in inactive street life that highly promotes and depends on motorised transport modes. A way to revert back to making streets alive, safe and attractive is to create destinations where people want to be. This needs to be done within a supportive environment that encourages the street economy and street life by balancing the urban fabrics and the travel time. These are discussed below.

2.3.1. Destination Creation

There are different ways to make the street an attractive walkable destination where everyone can find something that appeals to them. Three of them are presented here, namely making the street a place for shopping and recreation, a place where one can find public services and facilities, and finally, offering space for business incubators and work.

Shopping and recreation: Amenities are an important factor in creating excess traffic [48] and contributing to congestion. Shopping centres, superstores and hypermarkets separate the customers and producers; they are unsustainable not only in promoting car dependence but are also hurting the local economy. Bringing consumption and production close together can help restore feedback loops [36] through components, such as the neighbourhood centre. In addition to a few local shops, such as a grocery store, supermarket, deli or local general store, there is also need for ‘click-and-mortar’ stores that have both a local presence and online shopping capability. Farmers’ markets or mum-and-baby shops, for example, which target specific circles and have online shopping as well as physical retail outlets, are gaining popularity as attractors for both shopping and recreation. Additionally, small restaurants and food stalls help foster a vibrant street environment and create a sense of community by providing meal options throughout the day and midnight snacks—something quite common in China.

The linear street is supposed to be the fundamental public space, connecting dotted parks, plazas and squares and featuring slow movement with shops or parks adjacent. Living close to a green space is more important than its size for the people who use it [3]. Such leisure space allows for acquaintances and friendships to develop, attracting a variety of people for varied reasons at various times. It is the foundation for civil society. Thanks to traffic calming, visibility from the street and proximity to housing, pedestrians do not have to be constantly vigilant about fast-moving vehicles, be worried about personal safety or be anxious about catching the last bus at night.

Public services and facilities: In addition to shopping and leisure, there is a multitude of other amenities that also attract the locals. Their size can be adjusted to the local neighbourhood. Schools in Beijing, for example, not only disproportionately cluster in the inner city [22], but are also bigger in size with larger catchment areas than their counterparts in Tokyo (see Table 2) [6]. They attract around 10% of the weekday traffic volume created by private cars which pick up or set down primary school children. The same goes for other public facilities in Beijing, including hospitals, libraries

and governmental services, which are so scarcely distributed in the newly developed areas that residents have to flock to downtown to use such amenities [73]. This again generates additional traffic and congestion.

Table 2. Comparison of school catchment areas in Beijing and Tokyo.

City	Catchment Area (Year 2011)		
	Primary School	Senior High School	College
Beijing	14.86 km ²	56.78 km ²	184.39 km ²
Tokyo	1.67 km ²	5.03 km ²	11.70 km ²

Source: [6].

Incubators and workspaces: In an age of mass innovation, it is time for a street renaissance to motivate individual innovators to actively participate in the burgeoning new economy that values face-to-face interaction, supporting activities and amenities. If we rely only on a few and isolated spots such as universities or technology parks, which have limited numbers of research and support staff, it would be difficult for many cities to embrace the innovation-driven growth model. Perth, Western Australia is a typical example—the city experiences the pain to transform its mining mono-economy and one-dimensional service-based economy, partly due to the limited walkable street space. In other words, Perth needs to change its current land use pattern that features car-dependence, mono use and lack of activities. Instead, it needs a people-oriented street network which accommodates various functions rather than transport only, to provide space for technology and advanced manufacturing sectors to flourish. Given the burgeoning of the sharing economy, the street, with its low business cost, has become the ideal place for trial and error. Apart from numerous makerspaces, micro social space or even lab space can thrive on the street. Other options include co-working spaces and low rent apartments as in place in New York to attract tech start-ups by bringing down the rent for offices and housing, as well as the fuel costs and time through a better jobs–housing balance which reduces the need to drive [61].

2.3.2. Balancing

Creating street destinations requires support from all stakeholders, particularly from transport and planning in the first place to change the existing travel patterns. Table 3 describes the land use factors which can affect travel behaviours.

Table 3. Land use impacts on travel.

Factor	Definition	Travel Impacts
Density	People or jobs per unit of land area (acre or hectare)	Reduces vehicle ownership and travel, and increases use of alternative modes. A 10% increase typically reduces vehicle miles travelled (VMT) 0.5–1% as an isolated factor, and 1–4% including associated factors (regional accessibility, mix use, etc.).
Mix	Proximity between different land uses (housing, commercial, institutional)	Tends to reduce vehicle travel and increase use of alternative modes, particularly walking. Mixed-use areas typically have 5–15% less vehicle travel.
Network connectivity	Degree that walkways and roads are connected	Increased roadway connectivity can reduce vehicle travel and improved walkway connectivity increases non-motorised travel.
Roadway design	Scale, design and management of streets	Multi-modal streets increase the use of alternative modes. Traffic calming reduces VMT and increases non-motorised travel.
Active transport (walking and cycling) conditions	Quantity, quality and security of sidewalks, crosswalks, paths and bike lanes	Improved walking and cycling conditions tend to increase non-motorised travel and reduce automobile travel. Residents of more walkable communities typically walk 2–4 times more and drive 5–15% less than those in more automobile-dependent areas.
Transit quality and accessibility	Quality of transit service and access from transit to destinations	Increases ridership and reduces automobile trips. Residents of transit-oriented neighbourhoods tend to own 10–30% fewer vehicles, drive 10–30% fewer miles, and use alternative modes 2–10 times more than in automobile-oriented areas.

Source: [74].

The impact of each land use factor on travel is limited and varies; there may even be conflict between different factors. It is the cumulative and synergistic effect that matters for traffic reduction [74]. As with the theory of yin and yang, there are contradicting or opposite forces in any system which cannot be eliminated, yet can be transformed [75] in order to strike the jobs–housing balance. In the light of this ancient Chinese philosophy, it can be interpreted that the traffic ailment stems from losing balances in the city system, such as the balance between different urban fabrics and the corresponding travel-time budget. Therefore, the idea of a balanced and adaptive street is indispensable in the revival of the street as a walkable destination offering a wide range of attractions.

Balance of urban fabrics: According to the theory of urban fabrics [35] (p. 445), “cities should be identified as a combination of three overlapping fabrics” based on their transport systems and the universal travel-time budget. These three fabrics are walking, transit and automobile-based [70]. Historically, there are widespread urban fabrics that value accessibility in both walking and transit cities, linking homes, jobs and key facilities within acceptable distance on foot, by bike or public transport [69,70]. However, with the advent of cars, it is mobility not accessibility that is playing a more important role in the organisation of economic activity and social life in the city. This freedom of movement not only spurs suburban sprawl but also reshapes the traditional walking and transit fabrics with automobile fabrics. The motorised high mobility, combined with less constraints on the closer spatial distances, comes at the cost of traffic congestion, time lost in travel, fuel related costs and deeply affects the intimate relations between where people live, work, shop and entertain. Reviving the walking and transit city fabrics is suggested by Newman et al. [35] for their great value in facilitating the knowledge economy as well as easing the traffic. This is supported by the growing trend of big tech companies setting up branches in city centres to follow the new creative class of employees who are attracted by the quality of life offered there. Although the extensive car-based urban fabric is unlikely to disappear, it needs to be reshaped for the growing demand for walking and transit fabrics [35].

The balance of the urban fabrics involves keeping various equilibriums, and balancing block sizes or the road network is an integral part of it. Dense streets and small blocks have been widely considered as a typical feature of the walking and transit fabrics. The small-block network has a better traffic efficiency than the supper-blocks based urban grid [76]. In Beijing, the streets are characterised by a “half street economy” as they are segregated by wide roads, traffic fences and heavy traffic flow. This is in contrast to the dense and narrow street network in Tokyo where both the local shops and residents benefit from traffic calming and easy pedestrian crossings (see Table 4). In response to the negative aspects of the wide and sparse streets, a national policy of transitioning from big gated communities towards small open blocks was issued in China [77]. The comeback of fabrics with dense streets and small blocks can be seen in the planning of the Nanjing Honghua airport area redevelopment, not just for traffic relief but for other benefits as well [34]. Evidence from Ningbo city also supports this evolving trend of block size—from traditional small blocks (2 hectares average) in the old city centre to large surrounding communities (of 15 hectares) built around the year 2000, to again the current small sizes (of 2 hectares) under construction in the core area of the Eastern New Town [78].

Table 4. Comparison of road network between Beijing and Tokyo.

City	Road Area Ratio	Density of Road Network	Curb to Curb Width
Beijing	7.11%	4.85 km/km ²	14.64 m
Tokyo	18.75%	19.04 km/km ²	4.2 m (national)

Source: [6].

Balancing the urban fabrics is also associated with a balance of street uses to deal with tensions arising from demand for the finite street space [79,80]. The urban street should first be a public domain a meeting, liveable and lively place, and then a space for commerce, with mobility to support it. After all, “it is accessibility not mobility that is at the heart of economic and social welfare” [81] (p. 105). Furthermore, the balance of the formal and informal should not be neglected, as these two aspects

not only compete but also complement each other in the street space, both spatially and temporally. The informalities involve informal transport that can be used for daily travel purposes, informal housing to accommodate the vast number of slum dwellers, “ant tribe,” “rat people” and opportunity youths, as well as the informal economy to create jobs [82]. Cervero [83] points out that the integration of transport and land use should be pro-poor, which means inclusive use of the street for all people. It also means an adaptive and flexible street that can be used for a variety of purposes at different times.

Balance of travel time: According to Marchetti [71], the mean travel time per resident in the city is around one hour per day (60–70 min). This universal travel-time budget further explains that the number of out-of-home trips within the one hour travel time is generally fixed on a daily basis [84,85]. Given that every car passenger presently spends as high as 50 min daily in the car [25], which not only results in traffic congestion, but also poses health and social problems with less time budget and stamina left to support an active lifestyle, it is justifiable to turn this around with more time spent in active transportation, outdoor physical or social activities. Though the overall travel time budget cannot possibly be changed, it is better to optimise its composition through a rebalance of the three urban fabrics. The walking and transit fabrics are associated with a more active lifestyle and help reduce traffic congestion as well as improve public health and quality of life [86]. Similarly, Frank et al. [87] find a positive association between walkability and time spent in active transport with a corresponding reduction in VMT. What is also worth mentioning is that slower travel speeds do not necessarily mean more time used for travelling due to the shorter trip distances required within a concentration of destinations [88], which also justifies the efficiency and value of living a slow and simple life in terms of wise spending of the travel budget.

In essence, balancing travel time is more about the balance of passive and active transport modes or lifestyles. It results from the need to maximise people’s free time through creating efficient spatial-functional structures around the street [30]. With the phenomenon of peak car use, Newman et al. [35] advocate for a new town planning that is no longer car-dependent and can be extended to car-based suburbs. According to The Mayor’s Transport Strategy for London, by 2041 all Londoners will be doing at least 20 min of active travel a day and walking will be prioritised, particularly around schools [14]. The concept of 20-min neighbourhoods is also introduced in the Plan Melbourne 2017–2050, which is about living locally with the support of active transport options [89,90]. Table 5 summarises the opportunities for making streets walkable destinations.

Table 5. Streets as walkable destinations.

Streets as walkable destinations	Destination creation	Shopping and recreation Public services and facilities Incubator and workspace	Street life
	Balancing	Balance of urban fabrics Balance of travel time budget	

3. Policy Recommendations

In order to reduce traffic congestion, further efforts which link together transport policy and land use planning are required. Many developers are reluctant to engage in mixed-use schemes, which include provision of commercial and housing space, because of a perception of risk and complexity, especially within the same building complex. These two areas of transport and land use planning need to come together in an innovative way that allows for the street to re-emerge as the main public space and a focus of the new economy. It builds on a new holistic approach combined with planning flexibility, which are discussed below. This will reduce the perception of risk, making mixed use and co-location of jobs and housing the standard within the new revived street economy and diminishing the need to travel. With the emphasis on mixed land uses since the 1990s as a way of managing travel demand and making neighbourhoods livelier, there are now architectural approaches to buildings that minimise any conflict between residential and other functions [91] and also planning solutions that

achieve efficient mixing of uses by the placement of different use buildings within a diverse urban milieu [92].

3.1. Holistic Approach and Multiple Lasting Efforts

A holistic approach is needed to deal with traffic congestion as it involves numerous factors and complexities [72]. First of all, continuous efforts are required in providing accessibility to deal with the expanding city population and per capita travel distance. Though we have experienced peak car use and are seeing its decoupling from GDP growth [72], the aim is to overcome automobile dependence rather than eliminate car use. With its comparative advantages over other transport modes, the car will still hold its niche and play a specific role in supporting economic growth and facilitating quality of life [6]. This is in line with the fourth era of travel [11] in which road, rail, slow modes and air will continue to satisfy our transport needs. What should be avoided is the practice of transit adjacent development (TAD) which further contributes to the overuse of vehicles [93].

Secondly, there is still opportunity to use congestion pricing to construct mass transit, particularly in Asian cities with high-density urban form and low per capita road availability [10]. In addition, car restriction policies can positively impact people's choices between public and private transport modes. For example, Pan et al. [94] found that TOD alone does not effectively contribute to reduction in car ownership and travel unless vehicle use restriction is in place. Further, we should avoid the failure for land use to leverage the benefits of proximity to fixed-line transit by only targeting the performance of the transport network [95]. This is the case in Perth where the primary objective of the railway is to compete with the car for patronage, which results in many railway stations surrounded by large park-and-ride sites with little consideration of walkability, health, environmental benefits, employment and economic development [93–95]. Instead, the overall benefits from integration between land use and different transport modes needs to be maximised [96,97].

Thirdly, more attention to long-term solutions related to indirect travel demand management is needed to reduce VMT by encouraging active transport, such as walking and cycling, as road and public transport provision or restraint of private vehicles are not enough to solve the traffic problems [6]. Travel demand management can be tackled through measures which encourage voluntary reduction but also through pricing, including fees and fines, and better technological solutions. Voluntary demand reduction through changes in land use and transport patterns would be far more effective than treating an ailing transport system, as an ounce of prevention is worth a pound of cure. The demolition of the Chenoggye freeway in Seoul, South Korea is an excellent case that demonstrates the fact that traffic can dissolve or disappear by simply taking roads away. Therefore, the renaissance of the street with a better jobs–housing balance and revitalisation of the street life, though time-consuming, could be a lasting cure to the current traffic problems. They can bring the travel origins and destinations closer, thus reducing motorised travel demand and encourage walking and cycling for utilitarian purposes [29].

In residential neighbourhoods in the Asian dense cities, as in most other parts of the world, streets are owned by the public [98]. They are part of the commons and with traffic congestion, particularly at peak hours, become the equivalent to a scarce commodity because of too much demand. The introduction of a congestion fee could be seen as a fine for the use of the publicly owned space in a way that denies others access to it. This can financially control travel demand, especially by private cars.

Intelligent transport systems (ITS) and particularly, cooperative ITS which combine “interactions between vehicles, roadside infrastructure, mobile devices and back-office systems” [99] (p. 18), are rapidly being developed and implemented. They are an area of application of artificial intelligence based on real-time data integrated with machine learning [100]. Such systems are helping with raising safety, reducing waiting and travel time for vehicles as well as any associated emissions and pollution. Similar expectations are accompanying the development of autonomous vehicles [101]. However, ultimately the goal of such technological traffic/engineering solutions is to facilitate mechanised

movement rather than contribute to place making and improved sense of community. Although initially these technological solutions may help in managing travel demand, the more successful they become, the more likely they are to maintain or increase rather than diminish the need for travel. It is hence important to look for and implement policies which have lasting effects in reducing traffic congestion. Jacobs [42] emphasised this need in her seminal work when she pre-figured the development of traffic calming approaches and street renaissance to solving the problems of cars in cities. She stated [42] (p. 363):

“Attrition of automobiles operates by making conditions *less* convenient for cars. Attrition as a steady, gradual process would steadily decrease the numbers of persons using private automobiles in a city . . . attrition of automobiles by cities is probably the only means by which absolute numbers of vehicles can be cut down . . . Tactics are suitable which give room to other necessary and desired city uses that happen to be in competition with automobile traffic needs.”

Fourthly, traffic policy and land use planning are “rarely simply technocratic exercises” [10] (p. 1). They are linked to market mechanisms and technology development. With distribution of housing and jobs decided by the market [48], it is wise to create more choice for citizens and firms in deciding about location and transport mode selection. An example is the China-Singapore Economic Corporation Zone in Suzhou Industrial Park which, although planned with jobs-housing balance from the start, still has a serious home–work separation due to the mismatch between housing and job markets during the development and construction stages [38]. Various barriers or incentives can be removed or created for the market to play its role in alleviating traffic congestion. For instance, availability of affordable housing adjacent to the workplace together with a tax reform on property stamp duty might facilitate better movement of residents following ever-changing employment opportunities by providing options and reducing costs in moving house, which is likely to reduce the need to drive.

Technical progress is always a major driving force behind city growth, but technology alone can neither resolve the traffic congestion nor replace people’s need for interaction. For example, the lower-cost, on-demand transport-as-a-service (TaaS) is expected to significantly improve the mobility and efficiency of the physical transport system [102]. However, the savings in road capacity and parking space resulting from abandoning car ownership are likely to be compromised by the projected increase in demand for motorised travel. Similarly, telecommuting also has impact on traffic, but its effectiveness in shaping the type and level of traffic in the cities is not clear because of the two opposing trends—centralising and decentralising—it produces [103]. Technology can bring hope, yet can also create dilemmas as is the case of automobile technology which provides high mobility but also congestion. So, instead of hoping that technologies such as autonomous electric vehicles (A-EVs) will ease traffic, non-technological approaches which improve land use patterns can reduce the negative externalities of car use.

Last and not least, as an approach to traffic alleviation, the renaissance of street hinges on reforming a series of laws and regulations in a number of fields, such as housing, transport and environmental protection, in order to provide living, production and consumption space that is nearby, diverse and affordable. Such amendments are invariably associated with political, cultural and psychological elements as is the case with advanced manufacturing which is cleaner and quieter, yet still not acceptable enough for the general public to allow it to return in the residential neighbourhoods [104]. Another barrier that needs to be overcome in the case of China relates to sunlight and fire regulations because of concerns for safety and fairness in respect to east-west facing housing and hybrid buildings.

3.2. Transport and Planning—a Visionary Debate and Flexible Decision Process

It is increasingly realised that a flexible, experimental approach is necessary in modern planning practice to deal with complexity and uncertainty [79]. Cities are a complex chaotic system and understanding and predicting traffic may be well beyond our grasp [105–107]. Hence “planning has to move from a prescriptive activity to a process of learning and adaption” [108] (pp. 29–30).

First of all, people need to rethink modern transport and planning which are largely based on functionalism or rationality. They regard cities as a living machine that can be simplified as an assembly of parts or a series of orders [106]. A lesson that people have learned is the unexpected large amount of traffic volume derived from an “orderly” city form created by segregating land uses for specific purposes—residence, transport, employment and leisure, the four fundamental city functions [107]. Modern people need to learn from ancient towns which were modelled as complex adaptive systems where the various components, particularly human inhabitants, constantly interacted, learned and adapted [106,109]. These naturally grown towns or cities evolved through actions by individuals and local communities rather than via step-by-step implementation of blueprints and top-down planning by a few representatives of the elite [110]. In other words, noisy and untidy cities may not be as dysfunctional as often assumed and some diversity in land use and transport can make them more resilient with more capacity and options to cope with unexpected natural or human-made disasters [111].

Secondly, a new combined transport and planning strategy is needed which should be incremental and locally based. As in a chaotic system, though long-term prediction is logically impossible, it is predictable for short periods because of sensitivity to the initial conditions [105]. That means that people should shift their attention to the neighbourhood and at the street level with the participation and support of the local community. Different functions and activities will be mixed well and constantly adapted within a certain degree of spatial entropy or chaos, yet still featuring self-similarity and scale invariance—fractal structures commonly seen in nature and ancient towns [110,112]. In other words, due to the inherent complexity and adaptability of humans and their varied perception about congestion and happiness [113,114], it is time to think of travel demand management under the shared vision of local residents to incorporate assumptions and weighted values that favour active and healthy living [115] and sustainable transport modes and match transport demand to the supply of infrastructure [116]. The impacts of vertical mobility also need to be considered, particularly for the dense Asian cities [117].

Lastly, a commitment to travel demand management is required to remove many built-in incentives for car use as noted by Cervero [83], and this cannot be done without political and community engagement to disrupt existing practices, policies and trends [116,118]. Without an overthrow of the conventional traffic regulations, it is unlikely we will see approvals for reduced number of lanes and vehicle speed in neighbourhoods, simply because of expected changes in travel behaviour resulting from improved land use associated with increase in active transport and decrease in the demand for cars and road space. Thus, a new approach to transport planning based on a visionary “debate and decide” is suggested by Kenworthy [19,119] to replace the “predict and provide”, computer-driven process employed in the conventional transport-land use planning models. It is increasingly realised that these models are unable to simulate latent or induced demand and undercount shorter trips [74], which are mostly non-motorised, almost with no consideration of complex factors, such as a place’s history, heritage, tradition, culture, economy and political conditions, and using simply distance or proximity to work [7,44].

4. Conclusions

This study outlines the different approaches used to alleviate traffic congestion in cities ranging from increased traffic capacity through provision of extra roads and public transport, to control of traffic demand through congestion fees and restrictions on vehicle licence plates, and to indirect control through integration of land use and transport. It finds that alleviating congestion requires reducing demand for vehicular transport and encouraging active transport modes by bringing the travel origin and destination closer to each other through integrating land use and transport planning. The root cause of congestion lies in the inability of the transport system to handle the ever-increasing motorised travel demand derived from inefficient land use patterns that segregate uses and lengthen travel distances.

Physical proximity together with virtual connectivity is believed to be able to overcome the high cost of spatial distance resulting from such dispersed destinations. Thus, the street can play a significant role in reducing vehicle use by becoming a place for living, work and leisure. This can help revive street life and make residential neighbourhood streets attractive multi-activities places which strike the right balance between offering local jobs and diverse space/housing options. Production activities can return to residential areas and streets will no longer be seen just as a thoroughfare to somewhere else. More street life will diminish the need for non-commuting traffic to dispersed daily needs. Instead streets and neighbourhoods will provide opportunities for sustainable living and place making.

Achieving congestion alleviation through linking land use and transport is a complex task given the history of urban development in auto-dependent countries such as Australia and the USA. However, it is less of an issue in dense Asian urban contexts, which have a long history of very compact, mixed land uses, though these have been under increasing threat in recent years from auto-based planning. Traffic reduction requires a holistic approach and consistent efforts within transport policy and beyond, not only because of the complexity of the city system but also because of the unpredictability and uncertainty of its inhabitants. This means establishing a balance between the three city fabrics—walking, transit and automobile-dependent—and a redistribution of the travel time budget with the preferred vision of low-mobility and active lifestyle. That is to say, instead of simply pursuing efficiency in the transport system, traffic amelioration ought to be by the people, for the people, for the people taking into account the place's history, cultural, economic and political circumstances and using new visionary methods that allow for deliberative, productive debates and flexible decision making. Such a new holistic approach to solving traffic congestion through the revival of the streets should be underpinned by localised democratic principles, promoting the well-being of the city inhabitants.

Author Contributions: Conceptualisation, L.W., J.K., X.G. and D.M.; Methodology, L.W., J.K., X.G. and D.M.; Formal Analysis, L.W., J.K., X.G. and D.M.; Investigation, L.W., J.K., X.G. and D.M.; Resources, L.W., J.K., X.G. and D.M.; Writing—Original Draft Preparation, L.W., J.K., X.G. and D.M.; Writing—Review & Editing, L.W., J.K., X.G. and D.M.

Funding: This research received no external funding.

Acknowledgments: The authors acknowledge the contribution of an Australian Government Research Training Program Scholarship in supporting this research.

Conflicts of Interest: The authors declare no conflict of interest.

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PAPER 4:

Higher Density Environments and the Critical Role of City Streets as Public Open Spaces

Statement of Contributions of Authorship

To whom it may concern,

I, Liang Wen, contributed 70% to the paper entitled above and cited as below:

Wen, L.; Kenworthy, J and Marinova, D (2020). Higher Density Environments and the Critical Role of City Streets as Public Open Spaces. *Sustainability* 2020, 12, 8896; doi:10.3390/su12218896

Signature of Candidate:

Date: July 2022

I, as a co-author, endorse that this level of contribution by the candidate indicate above is appropriate.

Jeffrey Kenworthy Signature:

Date: July 2022

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Date: July 2022

This Chapter is an exact copy of the journal paper referred to above

Article

Higher Density Environments and the Critical Role of City Streets as Public Open Spaces

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Received: 24 September 2020; Accepted: 19 October 2020; Published: 27 October 2020



Abstract: This paper explores the relationship between crowding and streets as public open spaces in high-density urban environments from the perspectives of perceived density and human needs, two antecedents to crowdedness. City streets are the places through which various forms of crowding are perceived and experienced. Hence, they can play a role in easing this sense of crowding if corresponding strategies are put in place. The paper argues that practices, such as traffic calming and self-building, can transform the streets to serve as public open space, which increases spaciousness and eases crowding. It also puts forward tactical urbanism as a strategy for city governance to create the right conditions encouraging flourishing civil society initiatives in a dense primary environment that is invigorating and at the same time has a level of crowding perceived as both comfortable and liveable.

Keywords: streets; perceived density; human needs; dense sprawl; compactness; primary environment; traffic calming; self-building; tactical urbanism; sustainability; autophotography

1. Introduction

Due to the global population increase and unprecedented rates of urbanisation, a growing number of people are experiencing or going to experience overcrowded urban environments, which in the context of this paper can be described as having more people in a space than is considered safe, comfortable, or allowable, according to specific cultural contexts or other standards. This paper attempts to show how cities can have substantially higher density environments, with a sense of crowding that is comfortable, invigorating, and enhancing of the liveability of urban environments by utilising streets as public open space.

Although there are some housing standards for what is considered a crowded or overcrowded habitable room (e.g., respectively more than 1.5 and 3 inhabitants in USA according to the US Census Bureau [1]), the application of this concept to cities is much more fluid and left to people's perceptions. In fact, the terms crowding and overcrowding are used synonymously to indicate a level of discomfort and potential hazards because of inadequate space availability. So obvious is crowding in urban areas today that it can be spotted virtually everywhere in cities and in various forms, from clogged road networks to jam-packed public transport systems and skies crowded out by towering buildings. It can also be sensed from annoying noise, stuffy air, unpleasant odour, and heat from cramped spaces such as rooms, lifts, and buses. Most city dwellers have experienced other forms of crowding that derive from the frustration of waiting in long lines for a place in quality facilities and services, e.g., hospitals, popular restaurants, theatres, shopping areas, or recreational places. Even worse, the threat of frequent

outbreaks of contagious diseases, including pandemics such as COVID-19, further aggravates the public's fear of crowded urban spaces.

Despite the longstanding and inconclusive debate about the complicated relationship between crowding and health, it is found that individuals do have undesirable biological and social responses to crowding [2], and that at the community level, it is associated with "... a cultural lifestyle of impatience, aloofness, and social isolation..." [3] (p. 51). Further, the general public sees crowding more as a threat to mental health than to physical wellbeing, particularly in larger settlements where people are more likely to become mentally ill. This could probably be explained with the theory that human brains are not perfectly shaped for living in overly rich urban environments in which "a person's dopamine production starts to go wrong in the first place" [4]. Except a few crowded situations like sporting events or live concerts that are in the category of "the more the merrier," generally, "everybody hates overcrowding and those who must endure it hate it worst" [5] (p. 208).

Crowding is not just affecting the health and wellbeing of urban inhabitants, but undermining the liveability of the city as well (in fact, the level of crowding can be an important indicator of liveability). In contrast to the fact that cities have historically been perceived as places of overcrowding and pollution, "an increasing concern for the environment, a burgeoning world population and the emergence of the economic benefits of agglomeration all provide impetus for the case in favour of higher density" [6] (p. 3). Sustainability transitions also see cities as environments where the ecological, social, and economic agenda can be integrated [7]. Under such circumstances, it is predictable that people would keep flocking from far and wide to already dense cities for the so-called urban advantage—better healthcare, better education, and better standards of living. It is no doubt now an unprecedented challenge for many city residents to try to find a way to live in relative comfort with adequate personal space and privacy. Does this necessarily mean that in seeking higher densities, crowding is unavoidable and that we are doomed to fall victim to more city congestion?

It can be argued that crowding has never been tamed regardless of a significant improvement in housing conditions such as light, air, and space since early planning responses to the poor sanitary and living conditions during western industrialisation. Instead, crowding materialises in ways that go beyond the census definition of overcrowding and its simple standard of one person per room [8]. A prevalent and insidious form of crowding is what can be termed "dense sprawl", a phenomenon whose problems are not commonly given the attention they need. It combines the development of automobile city fabric [9] and vertical growth, as for example in Dubai and many Asian cities, and is increasingly linked to perceptions of crowding. Featuring heavy traffic and often increasingly taller buildings, this type of sprawl looms across the globe from the dense, low-to-medium rise sprawl in Los Angeles, to skyscraper suburbia in Beijing, and gives the impression of rising densities. This is contrary to the very fact that in the last thirty years, urban densities around the world have consistently been declining across all countries and income levels [10]. In some places, this decline picked up its pace in the new millennium [11,12], particularly evident in China, where the urban density of major cities has been steadily diminishing in recent years. Taipei declined from 230 persons per ha in 1996 to 170 per ha in 2006, Shanghai from 196 persons per ha to 170 per ha from 1995 to 2009, Beijing from 123 per ha to 102 per ha from 1995 to 2012, and Guangzhou from 119 per ha to 100 per ha between 1995 and 2014 [13]. Loose sprawl or loss of compactness resulting from inadequate planning and poor organisation of the urban fabric could probably explain the significant mismatch between the perceived high density and declining physical density.

Systematic incorporation of crowding considerations with planning responses to increase density for sustainability reasons (e.g., for reducing car use and the environmental impacts which flow from this—Newman and Kenworthy [7,14,15]; Schiller and Kenworthy, [16]) is urgently needed. Bringing crowding and sustainability concerns together can help to change the way urban planning shapes the city, since the quality of city environments powerfully determines the perception of crowding and the acceptance or rejection of higher densities. In a study of pedestrian perceptions of density along paths,

Fisher-Gewirtzman [17] (p. 676) points out that “the challenge was how to maintain quality dense urban environments whilst avoiding perceptions of overcrowding”.

Because the street is a predominant element of urban form in a person’s image of the city—that is a cognitive map of the city [18], along with how various urban elements, such as buildings, pavements, cars, and pedestrians are arranged and presented, it represents a key element, if not the key element, in tackling the crowding vs. density issue. It is through streets that we travel and start to know a city [19]. The performance of the street can be a barometer of the city, be it tidy or messy, spacious or crammed, attractive or ugly.

2. Materials and Methods

Two main methods are combined to analyse the street’s place in reducing the sense of crowding and improving liveability—literature review and autophotography. The paper first draws on the literature to show the relationship between density, open space, and crowding. It then explains the role of city streets as public open space in creating spaciousness via such practices as traffic calming and quality self-building (as opposed to commercial or industrial development).

Autophotography is a participant-driven research method, which generates a combination of visual and descriptive data [20]. In this case, we apply a variation of autophotography as photographs taken by the research team, which are used to present details and aspects of the streets more convincingly expressed with pictures [21]. Such photographs also serve as means for stimulated recall [22] about the street features encountered in different parts of the world. Autophotography is increasingly being applied in qualitative research [23]. Such visual methodology and materials have the ability to generate new knowledge by allowing the researchers to discover “additional layers of meaning, adding validity and depth . . . and increased trustworthiness” [24] (p. 1). Consequently, the reader, urban planner, or policy maker can further interpret the visual evidence presented in the paper. This is particularly relevant as city crowding is an issue of perception much more than something that can be objectively measured or captured through verbal or written skills. Hence, we have used autophotography to enhance the themes highlighted from the literature.

The present-day photographs that we employ are taken in various parts of the world and they also allow us to transcend cultural, language, and historical barriers in comparing the place of streets in different cities. They can trigger feelings and intuitive responses with the information contained in them offering unique experiences for the viewer [25]. Street photography is regarded as a special class of photography and autophotography, where the photographer captures elements, activities, and functioning of the streets. Some consider it to be a very challenging genre, as it needs to tell a story [26]. In the visual materials we use, the story we try to present is the overall place of the street within the urban environment, rather than any specific details.

In this way, the visual methodological approach adopted in this study helps to convey the interpretation of density in the city in association with the themes distilled from the literature review, including in exploring the mechanisms behind crowding. Following the analysis, recommendations are put forward explaining how planning interventions and city governance can reduce the negative perception of crowding.

3. The Relationship between Density, Open Space, and Crowding

In discussing crowdedness, it is first critical to provide some clarification from the literature about crowding’s close relationship with density and open space, especially city streets. We argue that streets need to be perceived as public open space instead of traffic corridors to improve people’s perceptions about crowding.

3.1. Density and Crowding

For many people, it is not easy to distinguish density and crowding because both are associated with the quantity of people or objects in a certain area. Even worse, “ . . . density becomes tarnished in

the public mind with images of crowding, overshadowing and overlooking” [27] (p. 44). Density in many cultures, particularly in the new world, comes with significant negative connotations.

For example, “[f]or many Australians, density appears to be associated with ‘ugliness’, ‘crowding’, ‘congestion’, ‘parking problems’ and ‘irresponsible residents’ ... ” [28] (p. 474). Such negative associations about density in people’s minds, while being emotionally understandable, are not factually supported, since there is no direct causal relationship found between the objective physical properties of density and the subjective psychological experience of crowding, even in the typical high-density living of Hong Kong [29,30]. Following from this, it is easy to understand that “it is perceived density which, judged by some criteria, results in affective density (the experience of being crowded or isolated as defined by the individual or group)” [31] (p. 149).

Perceived density is an essential aspect of any discussion of crowding, and can be defined as “... an individual’s perception and estimate of the number of people present in a given area, the space available and the organization of that space” [32] (p. 390). Hence, perceived density involves “people interpreting their experience of an environment, including physical, social and cultural factors, and associating this with a density” [33] (p. 337). With this in mind, perceived density is believed to be more important than actual densities, particularly in explaining the perception of crowding. A case in point is misperception about built form and density. Low-rise, detached buildings are often assumed to be of low density and attached, high-rise apartments represent high density, simply because of the very different ways these two types of buildings can be arranged and regardless of whether they have similar floor area ratios (FAR) [28]. The concept of perceived density has therefore been introduced to facilitate manipulation via planning tools in dealing with crowding. A case in point is demonstrated by Tokyo where Sand [34] explains the extreme density of an old low-rise Tokyo neighbourhood in which he lived:

“At its peak in the late 1960s, population density there was 40,000 people per square kilometer. That is close to double the density of Manhattan as a whole today and a third higher than the density of Greenwich Village. Yet the houses remained a uniformly diminutive two stories tall. The great majority were single-family homes ... ”

High density is necessary, yet, not enough by itself to forecast the feeling of crowding [31], because “the same density can be perceived and evaluated in very different ways, by different people, under different circumstances, in different cultures and countries” [32] (p. 390). Reynolds [35] explains that people experience crowding at high density only when they feel stress from a disruption of their needs. Less crowding and higher levels of liveability are likely to occur when specific human needs such as noise control, privacy, and open space/sunlight are satisfactorily maintained in high-density living environments. Put simply, to prevent crowding, Figure 1 shows that we must intervene in two conditions—perceived density and human needs, either by finding ways to lower the perceived density, by trying to satisfy human requirements, or by doing both simultaneously. The streets are an important way to achieve this.

3.2. Streets as Open Space and Crowding

Urban open spaces, ranging from highly maintained gathering places to relatively natural landscapes, provide relief from noisy, busy, or overcrowded places and are closely associated with both perceived density and human needs. On the one hand, the human race has its origins in certain savannah landscapes that feature spreading trees, low ground cover, and water. “Nature then becomes a source of spiritual inspiration” as “viewing natural-looking settings can reduce stress and promote healing” [36] (p. 273). In comparison with the asphalt and concrete of built environments, people lean towards natural things because contact with nature is consistently found in association with positive psychological well-being, including attention restoration and stress reduction [37]. Additionally, it has been shown that “open space provides opportunities for specific kinds of behaviour and recreation, for privacy, for reducing perceived density ... ” [32] (p. 404). It is also found that increased visibility

needs such as noise control, privacy, and open space/sunlight are satisfactorily maintained in high-

and a preferred view created by urban green/open space help to lower the perceived density and that a canopy of leaves and branches of street trees contributes to a moderation in the scale of wide streets and tall buildings [17].

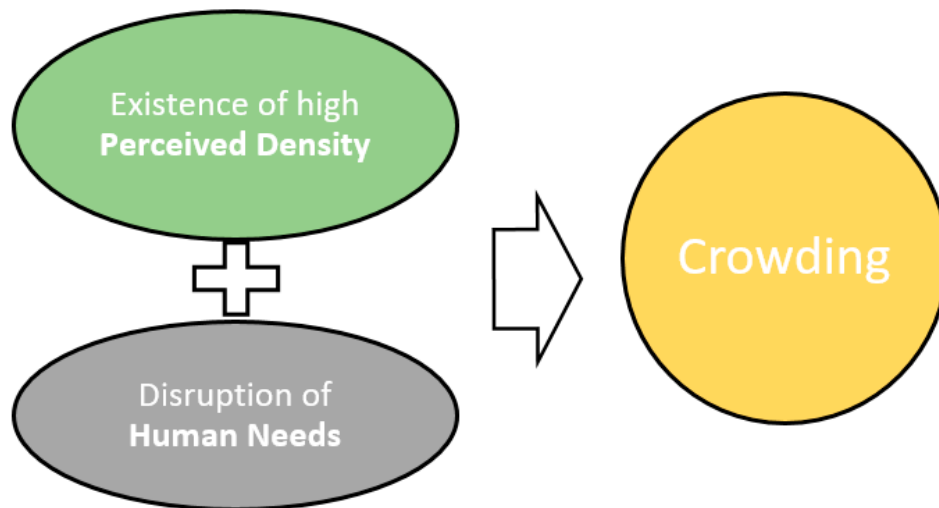


Figure 1. Two conditions contributing to a sense of crowding. Source: Authors.

Amelioration of perceived density with an increasingly urbanised and stressed population is, however, difficult. The growing demands for more housing and more open/green spaces result in a conflict between ‘denseness’ and ‘spaciousness’ because densification generally reduces spaciousness as floor area is added and open space is erased [38]. Furthermore, “designating land for park development often represents an unacceptable trade-off between scarce housing and park provision” [39] (p. 368). This conflict is evidenced by the fight between ‘dense’ and ‘green’ since the birth of modern town planning and its response to the ills of the 19th century industrial cities, where inner-city residents lived in crowded conditions without any access to natural environments. The obsessive pursuit of park-like built environments in Ebenezer Howard’s Garden City could also be seen in Le Corbusier’s Radiant City, which turned out to be “a park, skyscraper and automobile freeway version of Howard’s small-town Garden City” [5] (p. 342). Both efforts can be understood as trying to merge density and greenness with the concern that nothing is gained by overcrowding.

The key to creating a dense yet spacious city probably therefore lies in compactness, the quality of using very little space, and for that, the street has already proven its capability in keeping human settlements compact and spacious with a lively sense of community and interaction. For Jacobs [5], the streets of earlier eras were the major public open space (POS) of a city, with “its uses manifold and varied, far more than its modern analogue . . . ” [40] (p. 1). Viewing streets as POS is very important in the development of compact cities, where an accepted balance and fine integration between built and open space is needed to create a dense but still spacious environment.

How does this work? In compact, dense environments, streets, by their very quantity, are simultaneously the major POS system and means of accessibility for connecting city inhabitants to both open spaces and other human needs within the built-up area and beyond. The sense of spaciousness in cities tends to increase along with the improvement of POS (quantity and quality) and through the enhancement of accessibility to places with higher spaciousness [41].

Therefore, streets have an important dual role of providing accessibility to properties and more distant POS and enhancing people’s immediate sense of spaciousness in their urban environments. However, this latter function can only be achieved if streets are designed in ways that allow them to serve other needs than just movement space and, therefore, to become a genuine part of the open space system in cities. For example, it is found that people in Spain preferred pathways to “stay places”

indicating the need for a complex and diverse open space system to meet the demands of various population groups [42].

3.3. Examples of Streets as Open Space

The perception about a city is generally formed by its public open spaces, particularly its streets [43]. They give life to the city, creating its unique identity and providing space for human interactions to occur through a diversity of uses [44]. In this respect, Figure 2 depicts La Rambla in Barcelona, Spain, which beautifully serves the multiple roles of movement space for pedestrians, access to properties that front the street, a place to spend time and enjoy the colourful, green, and vibrant activities that line the street (Figure 3), and an unbroken pathway to the more distant spacious open spaces of the city's waterfront (Figure 4). This multiple function of streets in serving open space, accessibility, and movement functions is further depicted in Barcelona through the integration of quality public transport and walking facilities and open space functions in a dense urban setting, even along a major arterial road (Figure 5).



Figure 2. La Rambla in Barcelona, serving accessibility, movement, meeting, and open space functions. Source: Jeffrey Kenworthy.

Looking at the city core of Barcelona (as shown in Figures 2–5), New York, or Paris, green space is usually embedded within the street fabric, together creating an attractive, continuous spatial system for pedestrians to both move through and spend time in sedentary activities. This explains why dense European and American city centres that have relatively little POS (5–15%) but sufficient land allocated for streets (above 30%), are still well-liked by residents [45]. As Stähle [41] (p. 233) puts it: “It all has to do with how public open spaces are designed and located within the street-pathway system in relation to where people live”. Using London as an example, Rogers [46] argues that for streets to function as POS they need to provide a diversity of uses stimulating the local economy, active facades allowing connections between the ground levels of the buildings and the pedestrians, human-scale constructions, green areas, shared space and safe circulation for all users, including public transport, and a specific identity that encourages social interactions.

There are many good examples of streets that reduce the negative perception about crowding in the city [47]; in fact, the opposite is true, since streets that are active and buzzing with activities make the city attractive. The section to follow examines traffic calming and self-building practices as preconditions for streets to act as POS and attract human interactions and social exchanges that make a vibrant city.



Figure 3. Part of La Rambla showing the space provided for people to stay and enjoy. Source: Jeffrey Kenworthy.



Figure 4. Part of the Barcelona waterfront open space, accessible directly via a long walk down La Rambla. Source: Jeffrey Kenworthy.



Figure 5. A Barcelona street serving as a major pedestrian, public transport, and traffic thoroughfare and urban open space. Source: Jeffrey Kenworthy.

4. Preconditions for Streets to Be POS

Byrne and Sipe [48] (p. 17) explain that while “... most cities have a hierarchy of street types ranging from small alleys to large expressways ...”, many of these “... could not be considered as green or open spaces as they are major traffic arteries” with few human activities at ground level. Indeed, most streets, which are so important in our daily life, have been reduced to ‘passages’ as opposed to ‘places’ [49,50]. The result has been a decline in the provision of quality outdoor public space and a reduced compactness, as witnessed in two major models of present urban expansion. The first is the horizontal suburban sprawl typical of auto-dependent cities, especially in North America and Australia, with densities that are too low and green areas that are dominated by the front and back yards of suburban homes. In such cities, there is much less in the way of public green open space and relatively few active and inviting other public environments (Figure 6). The other model is the high-density vertical ‘sprawl’ that is commonly seen in many Eastern and Middle Eastern cities and which is too often devoid of genuinely attractive and useable public open spaces with inviting human qualities (Figure 7). Both these models leave growing demands for high quality public open/green space unsatisfied. While moving along the streets, city dwellers consequently start perceiving more crowding than ever, such as jam-packed roads with cars bumper-to-bumper or city skies increasingly obscured by towering skyscrapers. Figures 8 and 9 depict these issues in Dubai.

It is argued that a combination of traffic and building practices can greatly influence the way people perceive the street—be it crammed and polluted as a mere conduit for cars to drive through, or be it spacious and inviting as a POS for people to stay and enjoy. Initiatives such as traffic calming and tactical urbanism are thus gaining momentum for the revival of the street—the most common public space and the most readily available resource for relieving a sense of crowdedness in high-density environments.



Figure 6. Aerial view of Adelaide suburban areas showing the dominance of low-density sprawl with little public green or other public space and streets designed as movement space. Source: Jeffrey Kenworthy.



Figure 7. High-density, auto-orientated vertical sprawl in Sharjah, UAE, devoid of quality public open space. Source: Jeffrey Kenworthy.



Figure 8. Hostile, high-density, traffic-dominated public spaces in Dubai, UAE. Source: Jeffrey Kenworthy.



Figure 9. Vertical density in Dubai, which increasingly creates a sense of crowding and limits visibility without any relief at ground level. Source: Jeffrey Kenworthy.

4.1. Traffic Calming and Pedestrianisation

Traffic calming is a physical attempt to reduce traffic speeds to at least 30 km/h or less [51–53] along both arterial roads and on smaller streets in housing areas. Thereby, traffic is not eliminated as in the most extreme and most effective form of traffic calming, which is pedestrianisation. Traffic calming public space and the most readily available resource for relieving a sense of crowdedness in high-

is achieved through changes in street design, which involve many different physical transformations. These include chicanes, mid-block neck-downs, altered horizontal and vertical geometry of the street, 45-degree or 90-degree angle parking, widened footpaths, and provision of cycle lanes and lane reduction (e.g., 6-lane to 4-lane, or 4-lane to 2-lane roads). Green entry statements into the street are also included, such as arches, changes in street surface and colour, signage to indicate pedestrian priority, planting of trees and introduction of gardens, and provision of street furniture or even spaces for games, to turn the street at least partly into a place, not just a passage. It can also include simple changes such as the provision of pocket parks within a grid-street structure where just one short block is turned into a small park for local use, which has the effect of slowing down cars along long stretches of straight streets. Newman and Kenworthy [15] provide a fuller picture of traffic calming. Figure 10 shows an example of effective traffic calming in Frankfurt am Main, Germany along Leipzigerstrasse.



Figure 10. Traffic calming along Leipzigerstrasse in Frankfurt am Main, Germany. Source: Jeffrey Kenworthy.

Pedestrianisation, which is increasingly practiced in the centres and sub-centres of cities today and sometimes across extensive street networks (e.g., Munich, Germany), as opposed to the single traditional “pedestrian mall”, is the most effective way of asserting the liveability needs of people in cities, especially in high-density areas. Figures 11 and 12 show part of the pedestrian network in Munich and a green, pedestrianised sub-centre in Munich on the U-Bahn (metro) line 4 (Arabella Park). Pedestrianisation can also be practiced in more suburban areas, for example in small neighbourhood centres, by simply removing traffic for a block or two. This creates an enhanced sense of liveability, reducing the feeling of being crowded, and offers the opportunity to mingle in public space. The inner city of Montreal provides examples of this approach (Figure 13).

In the absence of pedestrianisation, traffic calming is deemed as the first step for pedestrians to reclaim the right to the street—the right to host open-air markets, political rallies, and the ability to play games, stroll, busk, sit, read, and dine in an attractive street environment [54]. These activities and behaviours are most vulnerable to motor vehicles because “[o]nce traffic speeds exceed approximately 15 mph (24 km/h), roads become the monopoly of motorized traffic, effectively excluding other users such as pedestrians and cyclists” [55] (p. 709). There is a safety issue too, in that the faster the speed of cars, the higher the risk of pedestrian death in crashes, which rises from 5% at 20 mph (32 km/h) to 45% at 30 mph (48 km/h), and 85% at 40 mph (64 km/h) [56]. The general rule that the faster we travel,

the greater the cost of this travel, also applies to other externalities such as air pollution, noise, and neighbourhood severance.



Figure 11. Pedestrianisation in the city centre of Munich, Germany. Source: Jeffrey Kenworthy.



Figure 12. The high-density Arabella Park subcentre in Munich built around traffic-free and greened urban space. Source: Jeffrey Kenworthy.



Figure 13. Pedestrianisation in the high-density inner suburbs of Montreal. Source: Jeffrey Kenworthy.

Moreover, the car is known for its insatiable appetite for space as well as for speed. As Gehl [57] (p. 9) explains: “A typical scene in many Asian cities is that all available city space is simply filled with moving and parked vehicles and every city got precisely as much traffic as space would allow”. Jane Jacobs recognised these problems 60 years ago when she said: “Traffic arteries, along with parking lots, gas stations and drive-ins, are powerful and insistent instruments of city destruction. To accommodate them, city streets are broken down into loose sprawls, incoherent and vacuous for anyone afoot” [5] (p. 338). Consequently, pedestrians, victims of the car, now find few other places except parks to go for a relatively carefree outdoor stroll. However, Jacobs [5] also saw a solution to these problems when she prefigured the invention of traffic calming, which gives back street space for uses other than accommodating cars. She prophetically said:

“Attrition of automobiles operates by making conditions less convenient for cars. Attrition as a steady, gradual process (something that does not now exist) would steadily decrease the numbers of persons using private automobiles in a city ... What sort of tactics are suitable to a strategy of attrition of automobiles by cities? ... Tactics are suitable which give room to other necessary and desired city uses that happen to be in competition with automobile traffic needs”. [5] (p. 363)

Smyth [58] estimates that “40 percent of the initial cost of development in conventional land use planning is automobile related” (in [32] p. 401), not to mention external costs caused by traffic pollution, injuries, and deaths. Considering the high cost mentioned above and the major safety issues in cities from speeding cars through residential streets, early traffic calming schemes such as the woonerf (“living yard”) in the Netherlands or more recently “home zones” in the UK, were introduced to slow down vehicle speeds in residential streets to walking pace in which pedestrians, bicyclists, and motorists coexist harmoniously by eliminating the division between pedestrian and auto space. In addition, these schemes frequently claim space from the vehicular domain for public use, such as parklets and small pedestrian plazas [59]. It has been estimated in the Netherlands that as of 2001, more than 7000 streets in residential areas had applied the woonerf concept, with pedestrians permitted to

use the whole width of the street while having legal priority over cars [60]. Higher property values (10–15%) have also been witnessed in woonerf neighbourhoods, which suggest the popularity of traffic calming that reduces the negative impacts of cars on street environments [60]. Traffic calming schemes that reduce vehicular speeds have also made a difference in creating safer streets for vulnerable users and providing children with outdoor play areas close to the home.

Minimisation of the car's negative effects, however, does not automatically lead to the maximisation of people's enjoyment of street space. For example, traffic calming practices alone are not always sufficient for neighbours to get to know each other better because of the few meeting opportunities available in single-function residential streets [61]. Resulting from this lack of acquaintance in the neighbourhood, parents also cannot be absolutely assured that their children will be safeguarded through "eyes on the street". Lowering car speeds is necessary but not enough for the street to automatically become an inviting place that brings closeness and security. Human interaction is inherently limited if residents still drive in and drive out of their streets. To get people out of their cars and into the street, reasons to travel by foot or bicycle are needed, and for that, urban planning policies and building practices play a pivotal role in providing for many daily needs at a local level. Higher densities and mixed land uses become critical, but how to achieve them often remains elusive.

4.2. Self-Building Practice

Coupled with traffic calming, appropriate building practices are potentially capable of transforming streets into vibrant public open spaces filled with various human activities. This is due to the contribution of buildings, which make life between them possible via the mixture of living, consumption, and production space along streets. While "streets are defined as roads with buildings on both sides" [62] (p. 1), it is the intimate relationship between housing and path that distinguishes a street from a road. Sadly, this close bond is now too frequently broken. Streets have too often become roads, or mere thoroughfares, and the housing, which frames wide streets, is for the first time divorced from the street with its ground floor and windows often insulated against road noise, air pollution, or burglary [63]. This is often attempted through the construction of high walls, which makes a walk down the street very unattractive and ensures no interaction between residents and passers-by.

Such a disconnect occurs partly because our road networks, as well as cities and neighbourhoods, are now designed for the car to comfortably travel through them with minimum interruptions. The loss of a wide variety of street front stores and other smaller local facilities means that instead of a short walk or bike ride along "slow streets" with a variety of activities lining them, many trips are now performed by car to big-box shopping centres or grand city parks. This perverse situation, where we find ourselves driving to a park for a walk and to a supermarket for groceries, leads to increasingly crowded roads, and impersonal recreational and shopping areas. In effect, our traffic problems derive from land use and building practices that separate different activities into single-use zones and degrade the traditional role of streets from places to passages to access dispersed daily needs [64].

As important as buildings are for the activities they accommodate, it is equally essential to consider how they are combined with the street. Being the most critical urban tissue or interstitial space in metropolitan areas, the street epitomises and shares with the city itself the same problems; both are now a collection of giant fragments rather than a unified whole, as they used to be. Due to single-use zoning policy and the massive scale of building projects, modern cities are suffering from giantism, a symptom featuring huge transportation systems that are segregated for single travel modes, sprawled residential or industrial districts that are monotonous and dull, and immense commercial complexes that are scattered and out of reach on foot [65]. Jane Jacobs expressed it this way in *The Death and Life of Great American Cities*:

"... the problem is size of use rather than kind of use. On certain streets, any disproportionately large occupant of street front is visually a street disintegrator and desolator, although exactly the same kinds of uses, at small scale, do no harm and are indeed an asset". [5] (p. 234)

In comparison, organically grown cities are built upon the basis of daily activities over time and on a scale that is adapted to the senses and potential of human beings [57]. The antidote to this symptom probably lies in self-building practices that are embedded with traditional knowledge about scale and proportions and an understanding of the public culture of streets. Defined as building of a house by its owners [66], self-building can combine the work of amateurs as well as highly skilled professionals with the ideas and passion of those who will be the users. According to Brown [67], self-building is a creative process that results in architectural solutions that are unique and authentic and generates material (e.g., homes) as well as non-material (such as well-being and self-identity) outcomes.

After being abandoned in favour of big developers and large transformations instead of small ones, self-building practices that were very common before the twentieth century are now regaining popularity. Lloyd et al. [68] found that in the Netherlands and the UK, the share of self-built buildings in new housing areas, amounted to between 10–15% in 2015 (in [69]). The return of self-building practices not only provides a variety of lot sizes and housing types to cater for diverse housing needs [70], it also tends to create a walking fabric that accommodates more diversified functions and activities than does an automobile fabric [9]. This small-scale, fine-grain development creates a vibrant, human-scale street environment in which life, work, and leisure are so closely knitted that residents and tourists alike find it more convenient and efficient to walk than to drive.

Such a natural urban morphology can often be seen in many traditional towns and cities that grow upon “private ownership, incremental development, and organic adjustments among different households” [69] (p. 8). Figures 14 and 15 demonstrate this in some of the chaotic, intensively mixed yet attractive and understandable streetscapes of Seoul, South Korea, while Figure 16 depicts this in Freiburg im Breisgau, Germany.



Figure 14. Colourful, walkable, mixed use streetscape in Seoul involving self-building practices. Source: Jeffrey Kenworthy.

In order to understand how streets as POS make cities more liveable, it is important to also recognise the factors that contribute towards the perception of crowding. Being a subjective feeling and experience, the presence or absence of crowding can be influenced by the way the streets are designed. We refer to this as tactical urbanism and the section to follow elaborates on these concepts.



Figure 15. Intensely mixed, pedestrian-accessible uses spilling out onto the footpath making the street both lively and legible. Source: Jeffrey Kenworthy.



Figure 16. Freiburg im Breisgau, Germany, as an organically evolved, old urban landscape. Source: Jeffrey Kenworthy.

5. Mechanisms behind Crowding

The two main aspects of crowding are how urban density is perceived and what human needs are (see Figure 1). It is important to understand both in order to make a judgement about city density.

dings, indicating that the high-

5.1. Perceived Density

For crowding to occur, a high perceived density must be present, either out of sheer lack of space or because of excessive social interactions or stimulus overload. For example, crowded indoor living conditions that arise from the perception of high dwelling densities, are often characterised by a shortage of space/rooms, an excess of human interactions/stimulation, and a resultant decreased control of privacy, rather than dwelling density per se. Like cramped interior environments, messy built forms can also generate feelings of crowding.

Owing to unbridled horizontal and vertical expansion, some modern cities are often compared to concrete jungles, featuring a clutter of tall buildings and structures, labyrinth-like circulation systems, and insufficient natural ventilation (Figure 17). This type of crowdedness comes from individuals' negative impressions of the built environment, since "tall buildings, limited spacing and complex layouts increase the perception of density significantly" [17]. Therefore, Churchman provided a list of design variables such as small neighbourhoods, greater spacing, and separated building entrances, in order to form a low-density impression [32]. Nevertheless, some caution is required, as wider spacing has been frequently seen between taller buildings, indicating that the high-rise apartment does not necessarily mean high building density because of extended spacing and lower site coverage. In this respect, advocating low- to medium-rise, high-density residential development is probably a suitable middle ground, as it has good privacy with individual entrances.



Figure 17. The City of São Paulo's concrete jungle-like urban landscape. Source: Jeffrey Kenworthy.

This lower-rise, high-density urban landscape requires less spacing between buildings, which helps to diminish perceived density. If streets are also functioning as public open space with a balance of pedestrian and traffic needs, then the sense of crowding is strongly ameliorated (Figures 18 and 19).

Gridlock is another typical example of crowding that is associated with the perception of high (vehicle) density and lack of space, both for vehicles and people. Considering that a root cause of a traffic jam lies in the separation of different land uses that requires cars to access dispersed daily needs, such as working and shopping, traffic alleviation cannot be achieved by mere increases in road supply [71] or by only reducing the number of cars via vehicle use restrictions. As Jacobs [5] (p. 348–349) puts it: "in the absence of city diversity, people in large settlements are probably better off in cars than on foot". To create diversity and overcome automobile dependence, local streets ought to be an inviting destination, having a better jobs-housing balance, and a vibrant street life to diminish both commuting and non-work motorised traffic. Moreover, according to the theory of stimulus overload, a surfeit of stimulation such as petrol fumes or vehicle noise arising from road congestion

leads to a perception of high density and such high concentrations of pollution are most likely to be evaluated as uncontrollable and unwanted, which results in negative perceptions of crowding [3].



Figure 18. A medium rise, dense urban landscape in Budapest ameliorated by generous pedestrian and cycling space and good landscaping. Source: Jeffrey Kenworthy.



Figure 19. A traffic calmed, medium-rise dense neighbourhood in Budapest where the street serves to reduce a sense of crowding and adds liveability, as well as a tram service in the middle of the road. Source: Jeffrey Kenworthy.

Considering the unpopularity of automobile traffic, the Great Streets Initiative in Los Angeles set up the “People St” website allowing local communities and residents to apply for parklets, pedestrian plazas, and bicycle corrals [72]. Churchman [32] (p. 407) concludes that “converting a significant proportion of the spatial resources consumed by the car to other land uses may increase the positive effects of high density and reduce the negative effects”.

In brief, problems of perceived density lie in a combination of planning rules that leave self-building practice endangered, large-scale projects spinning out of control, modern transport codes that claim streets primarily for the car and practices that render the street a place that is noisy, polluted, and dangerous. The street as a special POS aided by traffic calming, quality public transport, and self-building practice constitutes a unique mechanism in dealing with the sense of crowding that is caused by perceived high densities. Undoubtedly, to achieve such qualities there must be an overhaul of current urban policies favouring vehicular traffic, single-use zoning, and large land holdings, all of which inevitably push up perceived physical densities and render cities more congested. Land-use zoning that strips the street of mixed uses, making daily needs for basic services and amenities out of reach on foot must be changed. These sought-after qualities can be aptly summarised by three images from Portland, Oregon’s downtown, where over many years, the city centre and surrounding neighbourhoods have transformed themselves into an area that is simultaneously dense, has quality public transport, attractive streetscapes designed for people, a strong residential population, green spaces, and streets that still carry a traffic function (Figures 20–22).



Figure 20. A downtown Portland street showing a mixture of the Light Rail System (LRT) line, traffic lane, pedestrians, and greening of the environment. Source: Jeffrey Kenworthy.



Figure 21. Portland’s Light Rail System (LRT) system (MAX) on a street in a market area in downtown Portland that was to be for a freeway, but was transformed into a major public area. Source: Jeffrey Kenworthy.

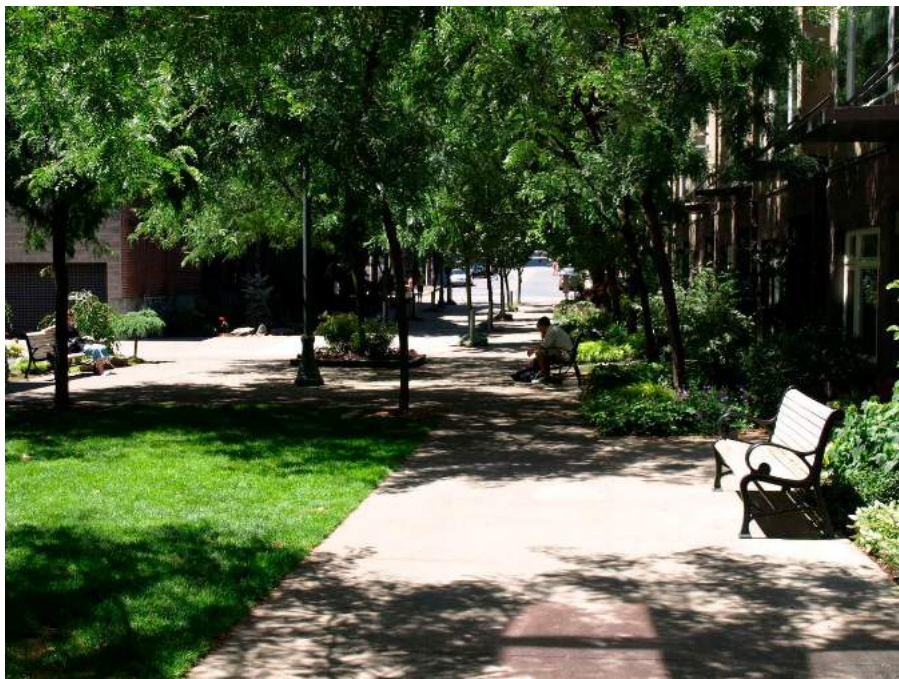


Figure 22. A dense residential street in Portland’s Pearl District transformed into a green pocket park. Source: Jeffrey Kenworthy.

5.2. Human Needs and Tactical Urbanism

The existence of a high-density environment seems to be a necessary antecedent to the perception of crowding, but it does not necessarily and automatically produce a sense of crowding [73]. Only when individuals feel that their needs are disrupted by high densities, will they feel more stressed, attributing

it to a negative experience of crowding [35]. Indisputably, basic physiological and social needs such as fresh air and personal safety are increasingly under threat, particularly in the outdoor street environment of cities. This is possibly linked with our overreactions to crowded conditions and an excessive quest for a “liveable” enclosed environment. Jacobs and Appleyard [65] (p. 117) state that:

“Too often, for example, the requirement of adequate sunlight has resulted in buildings and people inordinately far from each other, beyond what demonstrable need for light would dictate. Safety concerns have been the justifications for ever-wider streets and wide, sweeping curves rather than narrow ways and sharp corners. Buildings are removed from streets because of noise considerations when there might be other ways to deal with this concern”.

In time, modernist superblocks emerged “with garden and park-like settings giving the impression and benefits of lower densities” [33] (p. 342), trading off the access to jobs and services with the insatiable demand for sunlight and green space. By attempting to physically design out pollution and crime, this mono-functional planning resulted in a sense of private splendour and affluence in cities, but also a growing feeling of public squalor, reducing the street to a lifeless wasteland filled with petrol fumes and “ideally suited to rape, muggings, beatings, hold-ups and the like” [5] (p. 33). This can happen in what globally would be considered relatively low-density settings, such as Los Angeles (notwithstanding that the Los Angeles Urbanized Area is the densest in the USA—Newman and Kenworthy [7]). Mike Davis [74] in his book *City of Quartz*, talks graphically about Los Angeles, where the quality of public environments has been totally sacrificed in pursuit of a privatised, secure world through an almost complete capitulation to the automobile, and where streets are merely passages and a genuine civic life is almost non-existent. He refers to Los Angeles as displaying a “militarization of city life” resulting in an “ecology of fear” and ultimately, depicts the city as “Fortress LA” [74]. In addition to these matters concerning the public realm and how people are catered or not catered for, deeper psychological needs such as self-esteem and self-actualisation through personalisation and control of one’s dwelling are often ignored in many building activities.

Cities today, therefore, instead of being the cumulative expression of countless varied and conscious actions by many individuals, are too often the direct outcome of a single plan or design from a handful of professionals [75]. This is witnessed in the increasingly identical land-use patterns and built form across the world, whether that be unrelenting, monolithic high-rise urban fabric, or endless low-density sprawl as the two extremes. Moreover, the “control-density model” [32] (p. 404), suggests that densities that lead to less control over a situation may also be judged by those who experience them, as crowding. For example, while modern gated apartment compounds generally have an abundance of green space and good spacing of buildings, residents still can feel crowded because they are often not allowed to tinker with their dwelling, while also having little to do with, for example, the frequently rundown community facilities and broken elevators or the underutilised and boring collective green space. These factors are generally in the hands of property management which can often be found unforthcoming and unwilling to address the issues. Even when the community facilities are well maintained, residents rarely participate in the process and see it as an extra financial imposition rather than an opportunity to engage in communal activities.

Contrary to such “dead” anti-adaptive neighbourhoods (AANs), the residents of the now demolished notorious Walled City in Hong Kong showed a high degree of tolerance towards the extremely high density because the community was alive and was satisfying the changing needs of the residents during decades of building and rebuilding. It was the inhabitants who decided the community’s continuous development without any intervention from higher authorities or professionals, and “everything was agreed on an ad-hoc basis by those residents directly affected” [76] (p. 129). A similar situation can still be found in the Kampung Improvement Programme (KIP) in Surabaya, Indonesia, which has been very successful at regenerating what were once highly dilapidated, very dense physical living environments through an intense and largely self-funded process facilitated by participation between the local university of technology, the City of Surabaya, and the kampung communities

themselves. The resulting dense but low-rise physical environment is very diverse, lively, green, and productive and functions within solely on non-motorised modes of transport [77]. Figures 23 and 24 show the self-build nature of the urban environment and the absolute focus on living, green, lively, and walkable streets.



Figure 23. A green, people-oriented street in a Kampung Improvement Programme (KIP) community in Surabaya, Indonesia. Source: Jeffrey Kenworthy.



Figure 24. Self-build houses in Surabaya, Indonesia with local cottage industries and streets that are both movement space and places. Source: Jeffrey Kenworthy.

Mono-functional, top-down, and hierarchical thinking of much city planning often ignores human needs and turns its back on the street. This results in the public being increasingly detached from the

street, their own neighbours, and the community at large, leaving people little option other than to try to enjoy their own private, and from a wider city perspective, limited worlds [65,78]. Deprived of the right to self-building and the right to the street, an individual generally does not anymore see the primary environment as something to reshape according to their own wishes [79]. This is because building practices and streets have become a collection of fragments that fall largely in the hands of public agencies and licensed professionals. Instead of a place “where different, sometimes conflicting, lifestyles, interests and values are intermingled” [75] (p. 43), the primary environment has become a meaningless place, absent of diversity, spontaneity and surprise, and beyond the residents’ grasp. Sanford Ikeda [80] explains that: “substituting the genius of the planner for the collective genius of ordinary people diminishes the intricacy, complexity, of the social order” (in [69] p. 12). As a result, it appears that “the more a city promises for the individual, the less it seems to have a public life” [65] (p. 116).

The awareness of this problem has grown and has given rise to what is now termed tactical urbanism. According to the activist website ParCitypatory [81]:

“Tactical urbanism can be defined as ‘a city and citizen-led approach to neighbourhood building using short-term, low-cost, and scalable interventions intended to create long-term change’. Actions can be classified as tactical when they have a vision, a local context, a short-term commitment, a low-risk and high-reward value and the support of a community. Ideally, they even develop social capital by bringing neighbours together. In the long term, pop-up interventions are intended to get an official sanctioning or create change”.

This small-scale, quick fix generally targets undesirable physical conditions that fail the expectations of individual residents or community groups in two major respects—public spaces and housing. The most visible testing ground that showcases this bottom-up grassroots spirit is probably the street, a city’s largest reservoir of public space, and the land uses along it. Lydon and Garcia [82] (p. 6) summarise the opportunities as “empty storefronts, overly wide streets, highway underpasses, surface parking lots, and other underused public spaces”. Naturally, citizen-led interventions frequently take place in this immense laboratory in real time from “the rise of food trucks, pop-up stores, better block initiatives, chair bombing, parklets, shipping container markets, do-it-yourself (DIY) bike lanes, guerrilla gardens” [82] (p. 6). Figure 25 shows, for example, a recent example of a parklet in the East Perth Redevelopment in Perth, Western Australia.



Figure 25. Example of a parklet in the East Perth Redevelopment area in Perth, Western Australia. Source: Dora Marinova.

another promising area that grows in popularity for tactical

The annual Park(ing) Day is one of the most popular tactics employed to turn metered municipal parking spaces into small temporary “park” spaces for perhaps only 2 hours [83,84]. Similarly, intersection repair involves citizens converting street intersections into gathering places, which usually includes “not only the pavement surface but also the physical geometry to favour safety for all” [82] (p. 103). The Better Block project is another case that “works with commercial property owners and neighborhoods to create temporary, low-cost traffic calming and streetscaping experiments” [84] (p. 393).

These interventions, as with do-it-yourself (DIY) bike lanes, DIY Wayfinding, or guerrilla gardening on street medians, could be seen more as attempts to “hack” into an entrenched urban system, resisting the likes of car-centric urban planning [79]. This is different to the civic improvement in the nineteenth century, when “city plans were a relative novelty” [85] (p. 138) and major concerns were “for civic spirit, beauty, artfulness, order, and cleanliness” [85] (p. 139).

Community-led housing seems to be another promising area that grows in popularity for tactical intervention. The surge of community initiatives such as self-build or co-housing is a response to capital-intense, modernist approaches to mass housing production that leads to a wide gap “between what planning delivers and people’s needs” [86] (p. 1048). For instance, small-scale interventions like self-build activities manifest “the freedom of countless numbers of people to make and carry out countless plans . . . ” [5] (p. 391). Rather than limited options to “choose between different types of lay-outs, kitchens, bathrooms etc.” in custom-build projects [87] (p. 32), the “many changes by many hands” approach [85] (p. 138) not only caters for diverse housing demands but also tries to address the issues of housing shortage and affordability. Wallace et al. (2013) made an estimation that 12,000 new self-build homes were produced in the UK annually (7.6% of new supply), “account[ing] for larger numbers of new homes than all of the large housebuilders produce together” [87] (p. 33). Meanwhile, the cost of owning a home could be substantially reduced not just by squeezing out the profit margin of big developers, but also by putting in cheap or free labour from locals or the homeowner, who may undertake all or part of the building works (in the USA, this is termed a “sweat equity” project).

Collectively built and self-managed, co-housing is another good example of the frustration with the current “alienated, isolated and disconnected social life in the city” [88] (p. 321–322). This small-scale style of housing cluster is for like-minded residents to seek neighbourliness that is not found in the mainstream housing market of multi-unit apartment buildings and gated communities in particular [89].

It could be said that either in the street space or housing sector, each and every tactical intervention mirrors an ignored human need to tinker with the built environment and walks around the barriers set up by the formal planning system, which often favours cars and large projects. For citizens, tactical urbanism, which “starts with something small and starts where it counts” [82] (p. 171) can be utilised to make some quick changes to the cracks of the increasingly faceless and characterless urban environment in an over-planned and over-regulated city.

The concern is the degree to which such small interventions of civil disobedience or informality will be tolerated by the authorities. In other words, is it possible to “set up formal planning provisions allowing residents to legally test tactical interventions . . . ” [90] (p. 486), “leveraging small-scale change to build toward a larger, government-backed approach to urban improvement” like the City Beautiful movement did? [85] (p. 144). The section to follow discusses the required policy changes to create vibrant high-density cities where the streets function as open public spaces.

6. Policy Recommendations

In a bid to reduce perceived physical densities, direct planning interventions are required to integrate land use, landscape, architecture, and transport, reviving the street as a comprehensive POS. However, as crowding is perceived based on human needs, it is also pivotal to create the right conditions to encourage active citizenship and improve people’s well-being. This study puts forward the argument that designing streets as POS can reduce the perceived feeling of crowdedness in the city.

As our examples show, some cities around the world are already adopting such an approach. However, many are not. It is difficult to make generalisations across countries and different geographical

and sociocultural settings. Even within the same city, appropriate planning interventions can help transform the streets from being traffic passages to places of activities. According to Whitelegg [91], where and when the economic paradigm dominates the way streets are viewed and used, traffic defined as movement of vehicles, is given priority. On the other hand, when public health, people's experiences, reduced traffic risk, sustainability concerns, such as lower air pollution and greenhouse gas emissions, are prioritised, the streets can become urban spaces [91]. This can reduce the sense of crowdedness replacing it with people-friendly enjoyable and desirable urban environments where the use of the streets as public open space takes over.

China presents some examples of such change occurring. After a period of strong emphasis on the economic paradigm for developers with big blocks and wide roads offering diminishing opportunities for street shops and active mobility, a renaissance of the traditional urban fabric and street life is taking place in selected redevelopments, such as around Nanjing Honghua airport [92]. Ningbo city has also witnessed increased density from an average block of 15 hectares—typical for the automobile fabric surrounding the old city, back to the traditional two hectares in the Eastern New Town [93], allowing for higher density and energised street life.

Hence, for any positive change to build momentum, new planning interventions need to be supported by good conditions in the primary environments where residents spend most of their time, including the streets. Such interventions need to be integrated in the planning process. Furthermore, planning regulations should allow for self-building and people's control over the environments where they live.

6.1. Integrated Planning Interventions

Firstly, city streets are better conceived as a green grid rather than mere black asphalt and modified accordingly. This would generate a higher green area/open space to floor area ratio and improve the accessibility of that open space. Such a green grid would not only offer some basic form of "nature" at people's doorsteps—trees, vines, green walls, large flower pots, both on the ground and hanging from light-posts, vertical-window boxes etc.—but such a network would also provide comfortable access to gardens, parks, squares, and perhaps natural areas that often surround cities (e.g., Frankfurt's Stadtwald—city forest, or its many community association gardens—Figure 26). Instead of constructing scattered parks to meet arbitrary standards such as 10% public open space in new subdivisions or 10 acres (4 ha) per 1000 residents [48], green streets effectively put the whole city in a "park"—an interconnected and evenly distributed new open/green system, which promises the public a more equal and immediate sense of contact with nature.

Singapore is attempting to follow such a green vision for its entire metropolis through different forms of biophilic architecture where as many human-made structures as possible are given a green face, including building walls, support columns for transport infrastructure, and a general greening of streets. The basis for biophilic architecture is provided by Totaforti [94] and its application in Singapore is explained in detail by Newman [95].

This vision of green streets is a timely response to the changing needs of city dwellers that prefer more amenities and opportunities in streets than in parks during utilitarian walking [96]. It also calls for urban green to be generated "only if strictly necessary, avoiding dullness and waste" [69] (p. 27), and to be created for all, preventing green gentrification. This is because it is problematic knowing with certainty how much green is enough to justifiably satisfy various and varied needs in different parts of the city [42]. In this regard, it is necessary to challenge "the understanding of 'green' as only that which looks pretty or is somehow 'natural'" [97] (p. 1039), because such an approach has been neglecting city streets as potential green networks often rendering present POS systems fragmented and underused. In other words, park systems in cities should be a perfect complement to, but not a replacement for the street system, in terms of the provision of POS and the creation of a sense of spaciousness. The UN Habitat [70] recommended standard is 30% of land and 18 km of street length per km² in cities. This is a significant use of land to maintain accessibility and mobility, which under the scheme posited here, would achieve the dual purpose of also greening the city and enhancing a sense of spaciousness.



Figure 26. Part of one of Frankfurt’s many local garden association areas in Sachsenhausen, 2 km from the Frankfurt Central Business District. The surrounding six and four-storey apartment buildings are arranged in a close-knit parkland setting. Source: Jeffrey Kenworthy.

Secondly, streets as viewing corridors, would be better off framed by low- to medium-rise housing, without high-rise apartments obstructing strategic views and landmarks. To reduce a sense of crowding, it is desirable to leave city skies as open as possible. Tall or large buildings should be limited to clusters in the most suitable sites such as the central business district (CBD) and major activity centres that have higher infrastructure capacity. Additionally, given that high-rise buildings are not the only means to achieve dense living, it is advisable to ensure an adequate provision of small parcels in the land market to encourage small-scale, self-build, or collaborative housing. Executed in the right way, small housing and tall buildings can be a good combination to make the skylines neither too flat and dull nor too vertical and messy, contributing to the vital mix of great cities [98].

It is also essential to curb the proliferation of superblocks and buildings that are merely architectural edifices, turning their backs on the street without ground floor activities. Breaking the labyrinth and closeness that cut off inhabitants from the everyday life of the streets is critical. The massing, scale, and layout of all buildings should help make public street spaces coherent and at a human scale [99], avoiding free-standing individual buildings that are isolated by either large parking lots or ambiguous green area, without a positive contribution to street life. An abundance of short blocks and small plots should be in place to help support a great mixture of ordinary housing, amidst prudent use of exceptional buildings/superblocks, which in turn then contribute to a more open sky view and to revitalising broken, derelict street space.

Last but not the least, the street, underpinned by traffic calming, can serve as a diverse, multipurpose destination to encourage pedestrian traffic and to disincentivise car use. This is very different to the strict zoning, which was extensively applied in many cities across the world, especially in the post-World War II period, resulting in mono-functional streets, often characterised by lifeless urban space devoid of people. It is, therefore, vital for streets or districts to have more than one primary use and to reintroduce production, consumption, and leisure back to the street, balancing the desire to pass through the street (making it merely a conduit or passage), with the desire to go to the street (a place to stay) [45].

The creation of sufficient diversity enables residents to enjoy themselves by spending hours doing necessary errands and meeting many practical and social needs along the way without the need to drive [100]. This can also help translate into a vision of low-mobility and active lifestyles with a balance of city fabrics in mind, transforming more of the auto-city fabric into walking and transit fabrics, which help to support street life and the local economy [9]. While mobility, rather than accessibility, is still upheld as the key objective of transport planning [71], equating it with economic and social progress, a growing number of cities have come to realise the “penny-wise, pound-foolish” nature of merely maximising travel speed and minimising physical effort [101]. Without traffic calming, the diversity of the street alone is found insufficient to sustain a healthy and vibrant street life. High traffic speed is a major threat, which makes motorised traffic socially destructive, a fact that is convincingly described and measured by Appleyard [102] in his classic study of liveable streets in San Francisco. The dramatic reduction in personal autonomy of children playing on the street also well illustrates this point [96,103]. That is partly why a default speed limit of 30 km/h in built-up areas has been widely adopted in countries like the Netherlands and Germany [104,105]. The success of Times Square, New York in transforming a traffic thoroughfare to a pedestrian plaza provides further proof of helping local areas grow and thrive by reinstating the place function of streets [106]. In sum, diversity must join hands with traffic calming to bring back the widely-enjoyed hustle and bustle of street life, rather than the vehicular congestion disliked by most.

6.2. Control of Primary Environments

According to Reynolds [35] (p. 120): “Planning intervention directed only at controlling the density level is inadequate. It is the disruption of human needs that ultimately determines if crowding will occur”. It is, therefore, crucial to create the right conditions to encourage active citizenship in satisfying the very need for taking charge of one’s primary environment. This is where people spend most of their time and where crowding is believed to be more intense and difficult to address.

Taking control of one’s primary environment must start with one’s dwelling, enabling individuals’ right to housing, and the ability “to own, use, manage, transform private places” [107] (p. 57). The prevalence of anti-adaptive neighbourhoods (AANs—see earlier) indicates that individuals are losing the power to maintain and adapt their living environments not only because of public rules that freeze the adaptations of AANs, but also due to the daunting challenge of too many communal facilities and shared spaces to manage collectively [69]. To curb this trend requires the comeback of traditional building codes to encourage self-building practices for the possibility of personalised houses, or temporary and local usages. With distributed ownership and design, more tailored and personalised forms of development can be expected, not only satisfying individual households’ demands, but also “bypassing intermediate steps of real-estate development, marketing, promotion, and sales in an aim to restore financial sustainability” [108] (p. 308). On top of the individual right, it requires the collective right of community to govern themselves and organise activities to fully take charge of the primary environment.

When community facilities are in need of fixing or improving, the neighbourhood will very often “choose to do it themselves without asking permission” [79] (p. 6). When in situations of disinvestment, public inaction, and uneven development, the enthusiastic residents/creative class are likely to step in, helping the community build new communal space, create new business facilities, or take over local services. In time, this community-driven development may lead to the rise of an innovative district, which is “crowd sourced rather than close sourced, entrepreneurial rather than bureaucratic, networked rather than hierarchical” [109] (p. 25). Allowing a certain degree of autonomy and a substantial proportion of grassroots initiatives makes a community more creative and quicker to adapt to changing circumstances as the ‘Friends of the High Line’ organisation in New York City does in transforming a defunct railroad line into a popular linear park “to spur economic growth and structure the leisure and consumption patterns of the new urban middle class . . . ” [110] (p. 9).

To be an alternative route to the top-down, plan-led development, a redistribution of power is unavoidable, as it does in the “Build your own home—the London way”, a UK programme that creates the conditions necessary for individual freedom and communal self-determination [99]. As Rosenfield [111] points out, “power shapes people’s perceptions of their ability to act on and influence the environment” (in [112] p. 255). The decentralisation of power firstly calls for a reduction of hierarchy in city governance to unlock significant untapped value in the wisdom of crowds. Underpinned by the Basic Autonomy Bylaw, the community bus initiative in Tokyo is a good case “whereby decision-making at the local government level is taken down the hierarchy to the lowest feasible level” [113] (p. 137). In addition, Berthelsen [114] discovered the existence of small places of anarchy, transforming the mega-size city of Tokyo into a human-scale one. Through human-scale action like DIY gardening, local residents feel rewarded with attachment to and care of their own environments, creating networks and bonds among those who care. Social bonds like this have been found to protect against stress and crowding in dense living environments [8], which further leads us to question whether we are building/planning for generations of living and collective memories or just for profit in anticipation of escalating property prices in the short term [63].

City governance further involves a clear demarcation between the public and private domain, with public planning focusing on delivering collectively significant public spaces and major infrastructure with public resources. On the other hand, a simplification of planning rules is desirable allowing DIY urbanism to take place in the private realm of the city. Admittedly, planning rules and procedures are increasingly complex and time-consuming, being dubbed as a brake on the economy [6] and being accused of either manipulation of powerless citizens, or alternatively, allowing citizen control of the planning process and its outcomes [115]. For both private investments and public participation, such “uncontrollable conditions weaken self-efficacy beliefs and undermine motivation resulting in learned helplessness” [116] (p. 390).

In comparison, principle-led planning that recognises self-organisation and encourages self-building, enables the expression of an uncountable number of life plans via daily building activities. Moroni and Cozzolino [75] (p. 44) point out that “[t]ypical examples are the common ‘organic’ morphological patterns that have emerged without rigid city plans, the hidden logic of the built environment or the different local building types”. In the case of Almere in the Netherlands, an innovative ‘organic area development’ is fundamentally led by a framework-rule that is simple and generic. It aims at “creating opportunities for incremental urban development that build upon a series of civic initiatives” [117] (p. 11), which avoid a paternalistic approach to city planning—“an end-state control device aiming at ordering the actions of private people ... ” [118] (p. 380–381).

Having the bottom-up autonomy and general framework-rules in place, local communities are enabled to transform the street, the backbone of the community, into a POS to experiment with new business ideas or life plans by adjusting building structure and function, streetscape or traffic conditions without top-down control. Such a POS may start to take form with civic initiatives like guerrilla and community gardening, street refurbishment or experimental traffic closures, through which residents become socially engaged to green and beautify the street and to calm the local traffic collectively. The “road-association” in the Netherlands is a good example where the many participants may share the costs, rights, and responsibilities of the road development, subsequent maintenance and spontaneous streetscaping. From traditional retail, to weekend open markets and to technology start-ups, this POS can be further diversified and vitalised through street users’ participation in localised business activities during which entrepreneurs and inhabitants become economically connected. For example, in Australia, in the Victoria Neighbourhood Renewal Programme, community-based enterprises were created via local networks “in horticulture, recycling, construction, hospitality, information technology and childcare” [119] (p. 116).

Additionally, seeing the streets as shared assets and as incubators of new ideas, the whole community may get fully motivated to brand the street/district, to upskill themselves, and to seek opportunities for local development, employment, and tax revenue. Given that these street experimentation spaces

and networks are unique and cannot be copied, “the detailed outcomes of such a system cannot be determined in advance but rather ‘emerge’ from practices of adaptation and self-organisation.” [120] (p. 355). It is expected that such a synergistic relationship between people, firms, and place that is generated via street-level interactions may substantially enhance residents’ own sense of identity and boost their control of the primary environment.

7. Conclusions

The city is neither a farm nor a tree. To wrestle with crowding, it is essential to always keep in mind the balance of nature and city, creating adequate spaciousness without losing the concept of the city as an inherent concentration of people and activity and the advantages of urban living. In response to current fragmented and inefficient urban space, the concept of the city in the “park” reimagines the potential of urban streets, encouraging more compact developments created at street level and more urban green embedded in daily walking trips for utilitarian purposes. Seeing streets as the fundamental POS derives from the fact that cities have limited land resources and cannot afford the cost of filling in streets to build more parks. It is, therefore, very difficult to satisfy the varied and changing demands for a complex POS system and the need to reduce a sense of crowding in denser environments, without the unique contribution of a green, street-based grid. To help lower perceived physical densities, direct planning interventions are indispensable for a return of people-centred street space that is of a mixed use, human scale and green enough to satisfy people’s need for a better sense of spaciousness and contact with nature.

It is essential to realise the limitation of planned actions to ease a sense of crowding without considering human needs. Being an integral part of the primary environment, it is argued here that the street is the right means to deliver spaciousness as a comprehensive POS that is also open to citizen action and entrepreneurship. For that to happen, creating the right conditions to unleash pent-up creative energy in DIY or tactical urbanism is of paramount importance. This inevitably requires a restructuring of the state–civil society relationship and an introduction of more general, simplified planning rules. Through a redistribution of rights and duties, local inhabitants should ideally be the ones who take full charge of their primary environment and who truly have their say in local development, offering local solutions to local problems without the undue interference of bureaucracy or planning regulations that are too prescriptive.

The argument presented in this paper is based on autophotography and visual analysis of the street features, as well as integration of knowledge from a very wide range of literature on the subject from different disciplines. A quantitative assessment of the contributions of streets to alleviating the perception of urban crowdedness can be a topic for future research. Previous studies have quantified the impact of features, such as traffic calming and pedestrianisation on retail activities (e.g., Hass-Klau [121]) or benefits from active streets, which allow for walking, cycling, and public transport (e.g., Kott [49]), but a quantitative assessment of the impacts of streets as POS on people’s perception about crowdedness is yet to be conducted (e.g., through perception surveys). Such a perspective can potentially add to the evidence used in our study and expand the understanding of the streets as POS.

Drawing on traditional urban codes, seen especially in traditional walking city urban fabrics, modern cities could have been built with a lower sense of crowdedness caused by oversized buildings, and with public spaces that are less burdened with vehicles and all the other paraphernalia that accompany overdependence on private motorised transport (large roads, parking, gas stations, auto sales and repair facilities, large roadside advertising etc.). Sadly, history shows that uncritically embracing skyscrapers and cars, and discarding old ways of city building tend to produce both caged children and adults who are increasingly stuck in congested, machine-like cities. If we are to pursue high-density urbanisation, a core principle of sustainable development, there needs to be systematic consideration of how to mitigate a sense of crowding and to deliver a greater sense of green and contact with nature within the city. We argue here that to do this, there must be a renaissance of

city streets, converting most of them into a comprehensive POS system and providing a framework for autonomous and spontaneous urban change, which avoids possible undesirable effects of high densities. Not until the orderliness and utility of big urban plans and the individuality and creativity of small interventions come together, can city residents begin to experience the fact that cities can be large, green, diverse, exciting, fulfilling, health-promoting, economically advantageous, and attractive places without a sense of crowding.

Author Contributions: Conceptualisation, L.W. and J.K.; formal analysis, L.W. and J.K.; investigation, L.W. and J.K.; methodology, L.W., J.K. and D.M.; project administration, J.K.; resources, L.W., J.K. and D.M.; supervision J.K. and D.M.; visualisation J.K. and D.M.; writing—original draft preparation, L.W., J.K. and D.M.; writing—review and editing, L.W., J.K. and D.M. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Acknowledgments: The authors acknowledge the contribution of an Australian Government Research Training Program Scholarship in supporting this research.

Conflicts of Interest: The authors declare no conflict of interest.

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PAPER 5:

Street Recovery in the Age of COVID-19: Simultaneous Design for Mobility, Customer Traffic and Physical Distancing

Statement of Contributions of Authorship

To whom it may concern,

I, Liang Wen, contributed 80% to the paper entitled above and cited as below:

Wen, L.; Marinova, D.; Kenworthy, J and Guo, X (2022). Street Recovery in the Age of COVID-19: Simultaneous Design for Mobility, Customer Traffic and Physical Distancing. Sustainability 2022, 14, 3653.

<https://doi.org/10.3390/su14063653>

Signature of Candidate:

Date: July 2022

I, as a co-author, endorse that this level of contribution by the candidate indicate above is appropriate.

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Date: July 2022

Jeffrey Kenworthy Signature:

Date: July 2022




Xiumei Guo Signature:

Date: July 2022

This Chapter is an exact copy of the journal paper referred to above

Article

Street Recovery in the Age of COVID-19: Simultaneous Design for Mobility, Customer Traffic and Physical Distancing

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Abstract: This paper explores the relationship between urban traffic, retail location and disease control during the COVID-19 pandemic crisis and tries to find a way to simultaneously address these issues for the purpose of street recovery. Drawing on the concept of the 15 min city, the study also aims at seeking COVID-19 exit paths and next-normal operating models to support long-term business prosperity using a case study of Royal Street, East Perth in Western Australia. Nearly half of the shops became vacant or closed at the end of 2020 along the east section of Royal Street, demonstrating the fragility of small business in a car-oriented street milieu that is inadequately supported by proper physical, digital and social infrastructure. A key finding from the analysis is the formulation of the concept of the Minute City. This describes a truly proximity-centred and socially driven hyper-local city, where residents and retailers work together on the local street as a walkable public open space (other than movement space), and benefit from ameliorated traffic flow, improved business location and a safer, connected community.

Keywords: traffic; business location; social distancing; city streets; free-riding benefits; traffic calming; Minute City; Perth; Australia; sustainability



Citation: Wen, L.; Marinova, D.; Kenworthy, J.; Guo, X. Street Recovery in the Age of COVID-19: Simultaneous Design for Mobility, Customer Traffic and Physical Distancing. *Sustainability* **2022**, *14*, 3653. <https://doi.org/10.3390/su14063653>

Academic Editors: Luca Bertolini and Marc A. Rosen

Received: 25 January 2022

Accepted: 17 March 2022

Published: 21 March 2022

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1. Introduction

Bidding farewell to 2020 and 2021 turns out to bring neither the end of the pandemic crisis nor the return of business-as-usual. As COVID-19 raged on, it left many cities with no other choice than to accept on-and-off lockdowns as the new normal. The persistence of the virus means prolonged financial pain for small retailers and restaurateurs faced with a substantial reduction in the overall traffic patronizing local businesses [1,2]. In Western Australia, for example, “36% of small business saw a decline in revenue due to COVID-19” and “half of businesses in accommodation and food services reported declines in revenue relative to 2019” [3] (p. 12). The fear of the spread of COVID-19 owing to customer crowding, the imposition of a 2- or 4-square-metre per person capacity rule on the operation of shops, restaurants or other enterprises, and further restrictions, have hampered the flow of people able to access such businesses. According to a national survey in the USA, “over half (55%) of small business owners are worried that continued social distancing measures that limit business capacity will harm their survival chances” [4] (n.p.). Customer traffic, the lifeblood of retail trade, can be a major deciding factor in determining whether a business sinks or floats.

The customer traffic issue is not new. A long-existing dilemma facing small business is dwindled foot traffic, due both to low residential densities and dependence on the car, and few retail locations near homes to start and support trade. Added to this, high rentals and long commutes create vulnerability in times of crisis, be this pandemic-related or, for instance, sudden and steep fuel price increases or shortages. Traffic congestion,

long queues and panic buying were a typical scene upon the start of snap COVID-19 lockdowns. This occurred at all major supermarkets in Perth, Western Australia, including Coles, Woolworths and IGA. It exposed a serious traffic and location problem. Unable to access essential amenities, such as grocers and restaurants, within a short walking distance, “residents are forced to venture outside of their immediate neighbourhood for basic necessities” [5] (p. 24). Favouring global capital, present municipal policies have created bland, identical suburban shopping-scapes, subsidizing malls and cars, at the cost of street-facing shopfronts and pedestrians. From the Arab Spring that started with the sacrificial death of a Tunisian street vendor [6] to Occupy Wall Street [7], a protest against economic inequality, mass social movements took to the streets long before the pandemic struck, demanding change and a new way to do business.

The COVID-19 crisis offers a rare opportunity for a city-wide reboot to embrace the new normal. Under social restrictions, new trends have been emerging in retailing and urban mobility. When COVID-19 hollows out city centres, malls and restaurants, there arises a demand to work, shop and do business locally, along with the need for more outdoor space in the neighbourhood to exercise and socialize. Braga, for instance, a northern Portuguese city, “has opened public squares, sidewalks, parks and more to restaurants and businesses seeking to cater to customers with social distancing” [8] (n.p.). Another example is Rotterdam, where “architect Harm Timmermans created a simple 16-square grid design for a tiny marketplace that can be quickly and cheaply assembled in public squares, allowing people to shop locally and at a safe distance” [8] (n.p.). Additionally, when city centres become deserted, the ridership of public transport shrinks dramatically. In comparison, more city residents are walking and cycling across the world. In metropolitan Perth, for example, cycling trips rose 45% in the June quarter of 2020 according to media statements from the Government of Western Australia [9].

There is a growing body of literature regarding urban planning and COVID-19, which shows a clear consensus about preparing the city to respond to present and future threats of infectious diseases [10]. The epidemic prevention area concept [11] is one way of responding to infectious diseases. This model is focused on the sanitary and life-supporting systems of the city which allow residents to gain access to medical services and daily essentials within an arm’s reach from home, thus preventing the cross-community spread of diseases [11]. Similarly, the concept of the 15 min city originally proposed by Moreno has been gaining traction across the world, instigated by COVID-19 [12]. It aims at designing urban environments in a way that allows residents’ daily needs to be met within a 15 min walk or bicycle ride from home [13–15]. Although representing an improvement on the automobile-dependent city, both models are confined to the task of responding to a health emergency within the available transport options, but do not simultaneously consider issues related to customer traffic, business viability and individual health. This study aims to address these three issues by answering the following research question: How can urban design cater simultaneously for individual health, business prosperity and customer mobility?

Royal Street in East Perth, Western Australia presents an interesting case study to address this research question. During 2020 and 2021, the COVID-19 pandemic was ravaging cities around the world. In Australia, the cities of Sydney and Melbourne were exposed to long lockdowns of 157 [16,17] and 262 days [18], respectively. Numerous restraints and rules that seriously affected people’s lifestyles, and consequently, the way businesses and streets operated in the city, were put in place. The situation in Perth, Western Australia, however, was very different. After a six-week lockdown in March–April 2020, the State was kept safe with no community transmissions of the coronavirus during 2020 and 2021. In May 2020, dine-in in restaurants, cafés and pubs was allowed, and by June 2020, all gathering restrictions were lifted. There were three subsequent snap short lockdowns, each lasting for four days, namely in February, April and June 2021 (in response to travellers returning from overseas to Western Australia who tested positively to COVID-19). Because of the short duration, they were much less disruptive. The isolation

of the capital city of Western Australia from any other large metropolises, combined with a firm border control, resulted in no other serious restrictions imposed on Perth residents. In fact, Western Australia was one of the few places around the world that in 2020–2021 managed to eliminate community transmission of the coronavirus. Although the risk of a lockdown was always present, street-life was expected to return to normal. The centrally located Royal Street represents a good case study of the effects of COVID-19 on the urban environment and local business as it had the opportunity to bounce back and recover from the strict restrictions put in place.

The remainder of the paper is structured as follows. We first explain the link between streets, traffic and business. This is followed by a methodology section which outlines the use of the case study approach and the collection of research data. Royal Street is then introduced as the actual case study and discussed with lessons drawn about designing the urban street environment in a way that is protective and supportive of active communities and flourishing businesses. The findings from the analysis generate the concept of the Minute City, a sustainable spatial pattern supported with appropriate infrastructure that can help with street recovery. Finally, the conclusion stresses the importance of simultaneously designing the urban fabric for sustainable mobility, customer traffic and physical distancing.

2. Streets, Traffic and Business

City streets are capable of providing free-riding benefits that retail business can utilize to survive and to prosper. These include availability of trading space for market entry or the existence of positive externalities for cost reduction which generate location-based benefits. However, the most important free-riding benefit is the flow of people, and it is not a secret that “retailers have always depended on the exposure of passing traffic for their livelihood” [19] (p. 43).

To have a sufficient flow of customers to sustain business, a street first must be well-connected, linking different places of interest such as the home, work, schools, libraries, train stations and bus stops. This not only reduces transport costs, but also creates adequate traffic for a business to be commercially viable. Trips between geographical points are affected by distance and demand some form of movement which involves a cost, “whether this is actual payment of money to travel by bus, train, or jet, or to transport materials or goods; wear and tear on the soles of the feet; or perhaps the time involved in moving between places” [20] (p. 20). People moving around also generates traffic, such as motor traffic that a suburban shopping centre is heavily dependent on for its revenue, or foot traffic on which a small family-owned store relies for its existence. A well-connected street network featuring “many short links, numerous intersections, and few cul-de-sacs”, makes “travel distances decrease, and route options and travel modes increase . . . ” [21] (p. 32). For example, a 5 km drive at 50 km/h to a “big box” shopping centre for a loaf of bread can become a 200-m walk at 5 km/h to a corner shop, if the concept of accessibility were used in preference to mobility [22]. Shorter, direct travel between destinations promotes more non-motorized traffic which benefits small business. It is also a social equalizer, as the trips are not dependent on being of driving age or having access to a car.

In China, where there has been a lot of new urban development, there is a trading proverb to explain the most desirable location with the highest retail value. It is the “golden corner”—a street intersection where the traffic is the highest and the visibility the best from all four directions. This “golden corner” is followed by the second best or “silver line/edge”—the adjacent storefronts. The least demanded location with a low commercial value is the “grass belly”, the middle section of a long street or a site nestled inside a big block. Figure 1 compares two street designs and the desirability of different locations within them. The design on the left is based on automobile traffic with business located in a walled community. It has four prime locations (the corners in red), several adjacent second-best positions (the green lines) and a lot of inferior space (marked in blue). Such a design of the retail layout often puts shops or restaurants tucked away in the middle of a large block, and even if aesthetically located near a park, playground or other facilities, they can struggle

for existence. By comparison, a better street connectivity with higher intersection density, shorter blocks (ideally 100 m-long or less) and walking traffic, as shown on the right of Figure 1, offers more prime locations. For their successful existence, restaurants and shops often need to go with the flow and capture the traffic from the public streets rather than rely mainly on advertising and reputation. A walking fabric design also offers many more prime locations for business and face-to-face access to more potential customers.

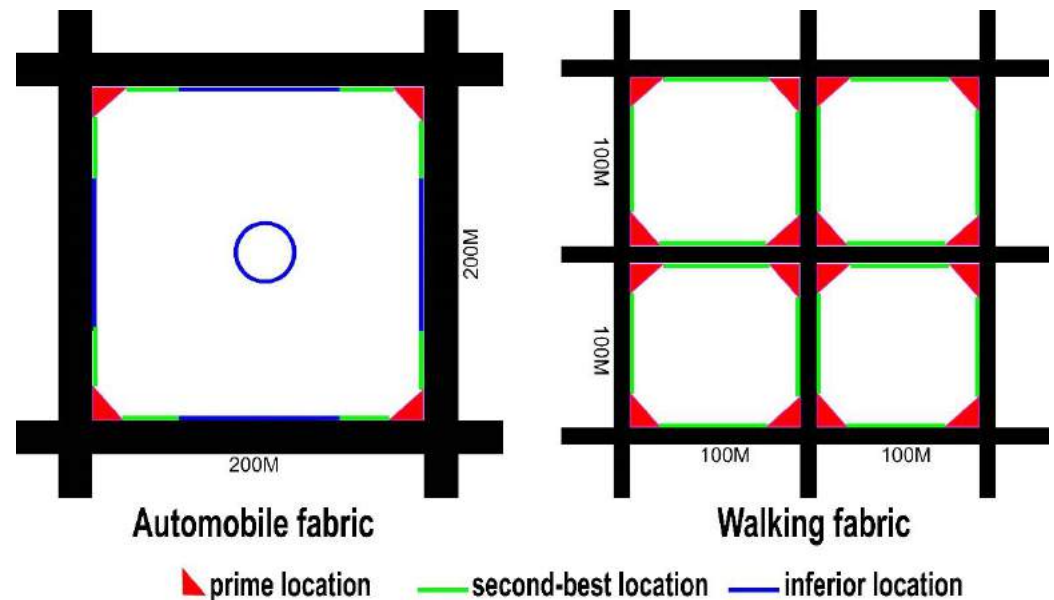


Figure 1. Comparison of business location between the auto fabric (left) and walking fabric (right). Source: Liang Wen.

To further give business a boost, a city street needs traffic calming or pedestrianization to slow down the vehicular traffic and expand pedestrian flow. Plenty of evidence shows that such policies can strengthen the retail location by bringing more pedestrian flow and reducing distances between places of interest [23,24]. On the other hand, certain features of automobile dependence are negatively linked to physical or perceived distances, which affect retail location and performance. For example, multiple lanes, widely spaced intersections and heavy traffic increase the waiting time for pedestrians to cross the street. The installation of traffic barriers further prevents shops from benefiting from traffic flow on both sides of the street. Some extreme cases in cities such as Beijing have led to a half-street economy or even the demise of a shopping street because of the decoupling between traffic and business. Heavy motor traffic makes it increasingly impossible to cross the street [25]. For pedestrians, a simple kerb-side pickup without feeling guilty for jaywalking or traffic disruption, is also impractical. Such street design is “in contrast to the dense and narrow street network . . . where both the local shops and residents benefit from traffic calming and easy pedestrian crossings” [26] (p. 11). Some describe the walking fabric as going back to the future [27], where the town centre re-establishes its prominence with ample opportunities for activities.

Cars are also notorious for their insatiable appetite for space, insidiously taking precious public areas away from pedestrians. For example, “66% of all public space in Paris is reserved for cars. Private cars only move 17% of the city’s population” [28]. Furthermore, despite the common associations between cars and mobility, most private vehicles are parked for 95% of the time [29] and a large fraction of this time is in public spaces. Replacing car trips by more sustainable transportation options, such as walking and biking, is further beneficial to business as these people spend longer periods of time on the street and expend more money. For example, a study in Melbourne, Australia showed that bikes generate five times more revenue per hour compared to cars [30]. As early as in

1979, a survey revealed that in Germany, pedestrianization schemes resulted in substantial growth in the number of pedestrians and business revenues—“141 pedestrianized areas experienced an increase in turnover (83%)” and “153 pedestrianized streets showed an increase in the number of pedestrians” [24] (p. 23).

Not only does narrowing the street for walking and outdoor trade reduce car dependence and bring more foot traffic, it also helps small businesses such as restaurants to overcome the restrictions on their indoor operation capacity. Considering that a typical restaurant allots 45 to 65% of their space to the dining area, the potential for alfresco dining on the pavement means substantial saving on indoor space and rental costs. Reclaiming the role of streets as a public place that facilitates community life and business activities is a long-overdue necessity which has recently been made even more prominent.

The COVID-19 pandemic-imposed constraints on businesses and social life have been compounded by inadequate urban design of the public realm. City authorities were unprepared as planners and their infrastructure decisions were conflating urban identity and quality of life with the presence of cars [31]. Under the COVID-19 pandemic’s social restrictions, many urban dwellers started to take the initiative in transforming the city. People realized and started to reclaim part or all of the road space and transformed so-called carparks from places for cars to spaces for outdoor commercial or leisure use [32]. In cities around the world, pop-up outdoor dining places and bike lanes became a new experiment, occupying spaces that otherwise were carparks or part of the road [33]. Distinct from strategic planning, such changes are described as tactical urbanism which helps transform the urban environment with quick, low-cost and practical solutions that help develop and maintain social capital in the city [34].

There is ample evidence about planners and city councils failing to handle competing demands on the public space in the streets during the pandemic, including for bike lanes, green spaces, outdoor dining, delivery services and shared mobility [35]. Businesses, particularly restaurants and coffee shops, have struggled to stay afloat during the COVID-19 pandemic and then to recover. This particular study based in Perth, Western Australia analyses the changes during the pandemic and the road to a long-term, sustained recovery. We argue for the need to change the way we plan cities by simultaneously designing for accessibility, including sustainable modes of transport, customer traffic and physical distancing. With different coronavirus variants remaining active for the foreseeable future and other commonly transmitted viruses being part of urban life, this new way of designing the city and its neighbourhoods can provide glimpses of hope and resilience against future disease outbreaks, pandemics or even other disruptive events.

3. Methods and Materials

We use a case study methodology [36] based on a single location by providing a solid description [37] of the changes which occurred during the 2020–2021 period of the COVID-19 pandemic. A distinctive feature of the adopted method is that we relied only on observation. This is partially explained by the need to comply with any COVID-19 restrictions and reduce the level of face-to-face interaction. Distinct from controlled observation in a lab or participant observation where the researcher takes part in the observed actions, we used naturalistic observation, which allowed us to observe and record spontaneous behaviours in the natural settings [38] of one particular street, namely Royal Street in the inner-city suburb of East Perth in Perth, the capital city of Western Australia.

Although the study is predominantly qualitative and depends on the ability of the researchers to grasp the nature of the observed phenomena, we also supplemented this with some planning tools, such as mapping, that helped us analyse the set-up and performance of this particular street. Photography was additionally used as a methodology to supplement the description of the observed data with visual images [39]. We used only current photographs taken by the research team, distinct to archival material [40], as this was best suited to the investigation into the process of COVID-19 recovery. This was also a way to document the state of Royal Street [41].

Three sources of data were collected (see Table 1). Firstly, field data were collected through mapping shop occupancies and vacancies to demonstrate the extent to which the COVID-19 pandemic had affected the local small businesses along Royal Street. In addition, local government maps were obtained from the City of Perth for map-based drawing and analysis. Visual and descriptive data in the form of photographs were used for the purpose of comparison and discussion of Royal Street. Most photographs were taken by the research team with the exception of two obtained from Google Street View.

Table 1. Data sources for the analysis of Royal Street, East Perth, Western Australia.

	Field Data	City of Perth Data	Visual Data
Content	Field data of shop vacancies along Royal Street, East Perth	Maps of Royal Street, East Perth	Street photographs of Royal Street, East Perth
Source	Field investigation by the authors	City of Perth, Western Australia	Taken by the authors and from Google Street View
Use	To show the extent to which COVID-19 affected local small businesses	To draw maps and conduct analysis	To describe, compare and discuss Royal Street, East Perth

4. The Case Study: Royal Street, East Perth

Founded in 1829, Perth was established on Noongar (the spelling of names may vary as the Aboriginal languages are only verbal and there is not yet a uniform convention to transcribe them in English spelling), Aboriginal land around Derbal Yeirrigan or the Swan River [42]. Currently having a population of over 2 million, the city stretches for 125 km along the Indian Ocean on the Swan Coastal plain. Its Central Business District (CBD) is located 10 km inland of the Indian Ocean around the place where the Swan and Canning Rivers meet, towered by Kings Park, one of the world’s largest parks in a metropolitan area (see Figure 2). Linking the eastern part of the CBD with a park on the beach of the Swan River—Victoria Gardens—and running parallel to a small river cove (see Figure 2), Royal Street is a vibrant mixed-use area where small businesses, government departments, light industry, shops, a City of Perth-operated carpark, restaurants and cafés are located surrounded by residential homes, home-units and apartments. Victoria Gardens, which is at the eastern end of Royal Street, was planted on the Swan River’s bank in the 1800s. It is one of the earliest parks in Western Australia, where among many of the original trees, artworks celebrate the Aboriginal history and culture of the place [43], such as the Chranock Woman Mosaic telling a Noongar Dreamtime story.

Initially known as Water Street [44], the origin of the name Royal Street is unknown [45], except for the obvious association with the British monarchy. Although the actual configuration of Royal Street has slightly changed throughout the years to absorb what used to be King Street (named after Captain Phillip Parker King, an early explorer of the Australian coast), its importance as a corridor linking the CBD with the river front roughly from west to east, has remained. Royal Street cuts across the suburb of East Perth with a population of around 11,000 [46]. This suburb also hosts East Perth Cemeteries—the first colonial-era cemetery, located at what used to be the edge of town, where all people who died in Perth between 1829 and 1899 were buried. Representing seven different religious denominations, sections and cultural groups who had their own cemeteries plus an eighth burial ground for “felons” [47], it is estimated that around 10,000 people were laid to rest there, but only 800 graves are now identifiable, with the others lost due to neglect, decay or malicious destruction [48].

In the 1990s, East Perth was redeveloped from light industrial (including railway yards) to quality inner-city urban fabric, conceptually influenced by the new urbanism [49]. Easy access to the CBD and other parts of Perth is further facilitated via public transport—a free central area transit (CAT) bus running on Royal Street, and train and bus services in its

vicinity. Royal Street has become an iconic residential address with properties attracting higher prices due to its location.

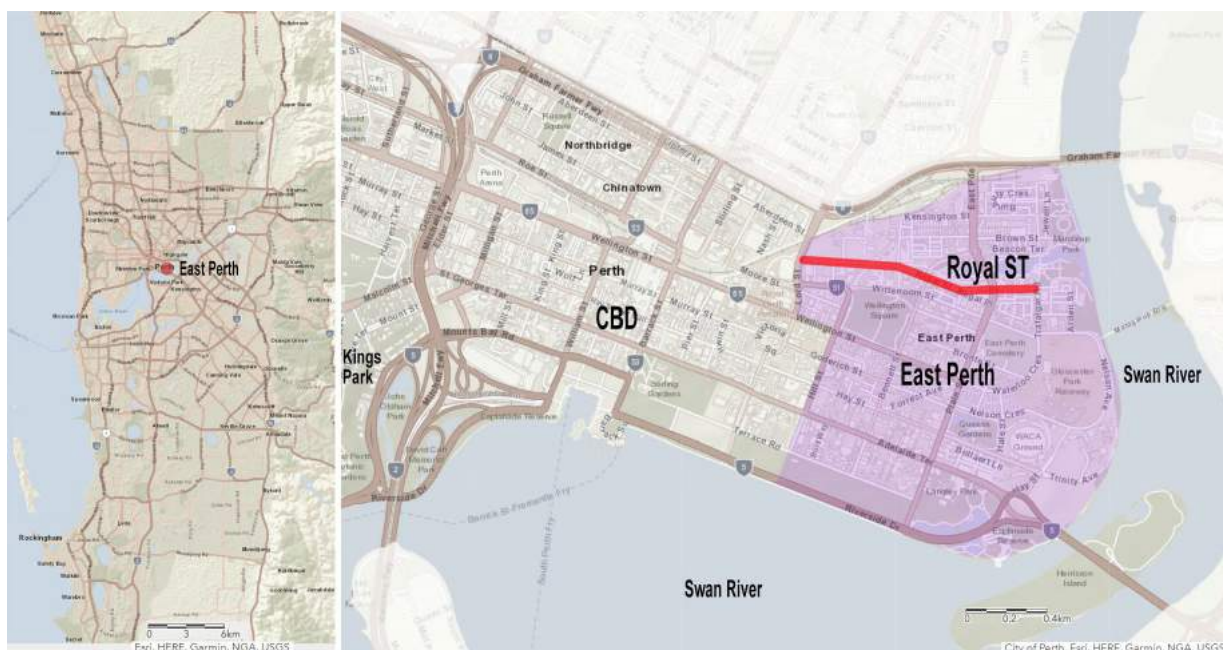


Figure 2. Location of East Perth and Royal Street. Map Source: City of Perth, modified by authors.

The start of the COVID-19 pandemic seriously affected local business, and this was felt strongly along Royal Street. In total, 25 out of the 52 shops and other commercial premises (from Bennett Street to Victoria Gardens) became vacant or closed at the end of 2020 (see Figures 3 and 4). This was in stark contrast to the booming character of Royal Street prior to the pandemic. November–December 2020 was the time when business activities were expected to be at their peak considering the absence of a long quarantine period in Western Australia and the summer holiday season. By looking at the design of the street environment, this study attempts to find some clues about traffic, which might be of help to explain the dilemma of Royal Street and thus to assist in its recovery.



Figure 3. Empty shops for lease on Royal Street. Copyright: Liang Wen.



Figure 4. Mapping of vacancies in Royal Street. Map source: City of Perth, modified by authors.

When it comes to the street network and traffic composition, it is difficult to say that the iconic Royal Street is well-connected, particularly for foot traffic. Linking the idyllic Victoria Gardens in the east and having a shops and cafés cluster around Claisebrook Cove in the north (see Figure 5), Royal Street functions more as a local Main Street that is well-integrated with the tranquil waterfront and the stylish apartment clusters. Looking further, however, the few small blocks around Royal Street seem to be isolated, cut off by vacuum edges such as rail lines, the freeway and mega-blocks, such as the old cemetery, the Western Australia Cricket Association (WACA) ground, Gloucester Park—a harness racing course—and massive carparks among them. Notwithstanding being a stone’s throw away from the Perth CBD in the west, Royal Street feels content with limited customer traffic and its retail ambition stops right at Fielder Street, thus losing its direct business connection to the bustling CBD. This is further exacerbated by its T-junction with Lord Street, which cuts it off from a direct connection to the CBD (see Figure 6). One of the traffic problems lies in Royal Street’s broader connectedness with other streets. In 1992, Kenworthy and Newman [50] pointed out that the redevelopment of East Perth could play a vital part in revitalising Perth’s central areas, if undertaken properly.

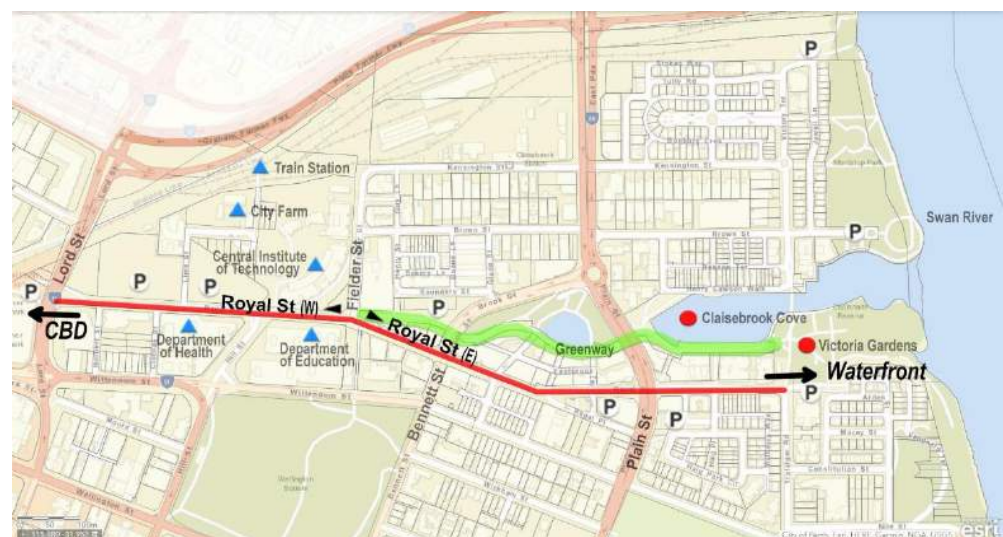


Figure 5. Layout of Royal Street. Map source: City of Perth, modified by authors.



Figure 6. Street network of East Perth. Map source: City of Perth, modified by authors.

Disguised in stylish apartment living with extensive cycle and walking trails along its picturesque waterfront, East Perth is, in essence, characterised by auto-city fabric [51], and so is Royal Street, which is surrounded by up to seven public parking lots (see Figure 6), without any traffic-calming practices in place. Walking along Royal Street, it is difficult not to notice the spaces occupied by cars, on the ground and above-ground—from 24 h carparks (see Figure 7) and parking structures to interim on-road parking and private garages that line the back laneways (see Figure 8).



Figure 7. Parking structure. Copyright: Liang Wen.



Figure 8. Back laneway. Copyright: Liang Wen.

The mere 700 m shopping section of Royal Street, its east section, is not only severed by two arterial roads, but also broken up by driveways, making the pedestrian flow intermittent and potentially dangerous, especially for families with children. Ignoring pedestrians in favour of cars, Royal Street has distanced itself from the nearby Claisebrook Train Station, the popular City Farm—an oasis of urban agriculture (see Figure 9)—and the Central Institute of Technology, Perth’s largest Technical and Further Education (TAFE) college, disregarding the fact that these traffic generators are spatially right at its doorstep. Such problems of automobile dependence have long been recognized by Jane Jacobs [52], who looked to attrition of automobiles as a practical solution. The logic behind this is to make conditions less convenient for cars, thereby bringing back street space and non-motorized traffic.

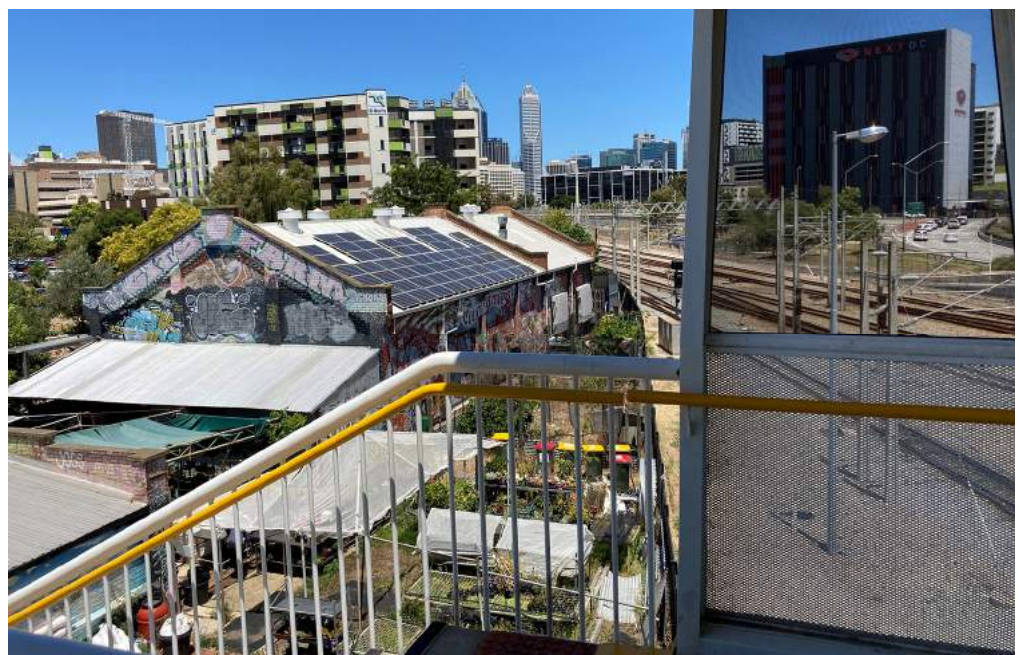


Figure 9. City Farm along the edges of the railway and freeway. Copyright: Liang Wen.

In the case of Royal Street, the focus so far has been on car traffic and to a lesser extent public transport, mainly via the CAT bus, either by improving the connection to the CBD or via transfer between traffic modes. There is no doubt that traffic volume matters to retailing, but what is equally important is how to slow it down and engage with it. Smart retailers know this well and often utilize store layouts to attract and direct foot traffic to where they want it to go, and use endcaps and promotional islands to encourage shoppers to stay longer, see more and buy more [53]. Likewise, instead of a mere conduit for cars or pedestrians to drive/walk through, Royal Street needs to be an inviting public open space with various anchors for people to stay and enjoy. Excessively wide and empty streets only prompt traffic to rush through without encouraging stopping and allowing people to get out and browse. For instance, amenities such as drink fountains and restrooms provide short stops for pedestrians, while shading and seating support shopfronts to extend their business to the outdoors, which in turn increases dwell time as well as footfall.

Inviting street design and proper website representation can also convert online searches into offline footfall [54], with Google data showing that 46% of all searches are for local information with 97% looking for a local business and 88% of consumers visiting within 24 h [55]. The online presence of businesses is as important as their physical existence. However, despite Australia rolling out its National Broadband Network (NBN), which provides fixed-line telephone and internet connection infrastructure, as of January 2022, not all premises along Royal Street in East Perth were NBN-ready. The available option was 5th-generation wireless mobile network (5G), which is yet to deliver reliable services across Australia [56].

The alfresco dining by Claisebrook Cove (see Figure 10) is a good example of attractive street design. An active street front is essential for businesses: “When commercial tenancies open onto the verge and the footpath amenity is improved with landscaping, it creates a more comfortable environment for pedestrians who are now more likely to spend more time and potentially more money in these businesses” [57] (n.p.). Public buildings such as libraries, schools or city halls could also serve as anchors similar to commercial ones, drawing substantial foot traffic and making people linger for a while. Unfortunately, this is not the case for many similar establishments along Royal Street—the Central TAFE College, Department of Education (see Figure 11) and Department of Health (see Figure 12) appearing to be somewhat isolated with restricted access for pedestrians. Potentially, they can choose to open their most valuable ground floor for commercial or other public use, rather than parking.



Figure 10. Claisebrook Cove. Copyright: Liang Wen.



Figure 11. Ground floor of the Central TAFE College (on the left side) and Department of Education (on the right side) used for parking. Source: Google Streetview.



Figure 12. Department of Health and the large public carpark across Royal Street. Source: Google Streetview.

To further exploit people traffic, it is advisable to spread the flow of shoppers across the day and extend it to night-time, which would help mobile vending as well as fixed shops along Royal Street. Street vending and the night-time economy are commonplace in many tourist/visitor-oriented and attractive cities around the world. Characterized by periodic markets, pop-up stores, food trucks and hawkers chasing the pedestrian flow, such an economy creates a beat which is equally attractive to dwellers and visitors. Hernandez [58] (n.p.) eloquently describes this for Los Angeles: “Filling streets with the smell of grilled meats, makeshift lights and chatter, these small business owners activate our streets, provide culturally relevant foods that tourists flock to and create opportunities for a diverse group of people to interact with each other”. Such a vibrant economy provides local business opportunities and generates a stable revenue stream [58]. In Thailand, street vending is very common and “70% of fixed vendors had worked as mobile vendors earlier” [21] (p. 38). Prolonged trading time along with widened pavement not only eases concerns over congestion and safety, it also provides market entry to mobile vending, which has the inherent advantage to better catch and utilize traffic flow.

Last, but not least, Royal Street could use digital support as well as physical infrastructure to leverage network traffic. It is reported that in 2020, just over one in five accommodation and food businesses in Western Australia were satisfied with their internet service quality [3]. A growing number of retailers across the globe have an online presence, generating big sales revenue, especially during the COVID-19 pandemic. Offering digital trolleys and door-to-door delivery not only avoids indoor customer crowding and the spread of disease, but it also increases sales without missing out on potential visitors

when physical stores are closed or restricted in trading hours or capacity. According to Johnson [59] (n.p.), “in 2020, nearly 41% of customers said they were currently shopping online for things they would normally buy in-store”. Getting businesses listed on websites such as Google or Facebook, and providing click-and-collect services, would also drive more traffic to the physical location. Research shows that “about a third of shoppers would prefer to have an item delivered to a location other than their home . . . ” and many “bought something else during their trip to the store” [53] (n.p.). This brings more foot traffic in-store. Furthermore, “blurring the boundaries between the physical brick-and-mortar space and virtual eCommerce stores” is becoming the future of the retail industry [60] (n.p.). Digital notifications about discounts can be delivered through mobile devices which aim at bringing more people to the physical stores [60]. The locations of these businesses need to be convenient and attractive to all types of pedestrian traffic. It seems that Royal Street has not yet capitalised on all of these opportunities and remains vastly underutilised. Its COVID-19 recovery has been conflated not only by the health-related threats but also by factors linked to the urban design of public places and traffic.

5. Discussion

From the case of Royal Street, it is not difficult to see that traffic amelioration can contribute to both the containment of COVID-19 and business recovery. First, from the seamless online transactions and streamlined delivery or pickup, the growth of e-commerce and virtual traffic not only reduces the number of vehicles needed on the streets but avoids unnecessary physical contact as well. Second, extended trading time and widened pavements can make room for street vending, easing the pressure from business restrictions related to indoor operation capacity. Third, treating streets as public open space (POS) assists in the diversion of traffic that otherwise overly concentrates in big-box shopping sites. Splitting the volume of traffic and reorganizing it around various anchors help to better control the flow, allowing for disease control as well as contributing to an efficient conversion of revenue from the improved traffic of shoppers.

Traffic improvement and virus control have much in common, and flow control is one of these factors. It is common sense that having more domestic and local traffic makes COVID-19 situations less complicated and more controllable than long travel that potentially turns asymptomatic virus carriers into super-spreaders, who are often found traversing a greater part of the city and visiting multiple places. This has been the case with many COVID-19 exposure sites in Australia and around the world. Urban design needs to help keep people safe and support local economies. Realizing this, Baltimore, USA launched the Design for Distancing initiative, which aims to reconfigure the public street space to guide traffic for the needs of the beleaguered small businesses, while better observing hygiene requirements [5]. According to these urban planners: “When we step outside of our homes, safely patronizing neighbourhood stores, services, and restaurants will be crucial to our total recovery. When our small businesses thrive, our residents and neighbourhoods do also” [5] (p. 6). In this respect, it is essential to transform long-distance travel into short-distance local and domestic trips, which need a vibrant street network in place that is interconnected digitally, temporally as well as physically. This requires allocation of sufficient land to street development that allows for more direct mixed-use right at the street level and investment in fast and reliable internet and broadband to facilitate the convergence of the physical and virtual economy.

Once the connection between traffic and infectious diseases is understood, it is important to recognize the relationship between traffic and location. In business, “knowing the terrain can make all the difference between winning and losing, success and failure” [61] (n.p.). “Location, location, location” is a mantra that is often used to stress the importance of location—the economic terrain in starting a business [62]. Retailers are especially seeking various advantages of good location, such as spatial proximity to customers or suppliers. One of the major advantages lies in the location’s capability to attract a substantial flow of traffic and turn part of it into revenue owing to its superior accessibility and visibility.

According to Nicasio [53]: “More traffic means more opportunities for sales and customer engagement, which in turn leads to higher revenues” (n.p.). The closer the business to a place with high traffic, the more desirable the location is. However, this can also mean high rental cost to the business due to fierce competition for premises located in a well-trafficked area. Retailers who are willing to pay a high price for a desirable location tend to believe that they will profit from traffic—the core of business location. This is a well-known situation: “The location-rent curve indicates land uses compete for the most accessible location and are ‘sorted out’ on the basis of their location rents which reflect their ability to pay for a particular site” [20] (p. 43). The question is whether “the location” is fixed or whether this can change for the good of small business without soaring rental costs.

There is a belief that: “You can change a property, but not its location” [63] (n.p.). Hence, location is permanent. It may be true to a large extent but through zoning and planning we have seen many examples of when the characteristics that make a location attractive change. Too often, for the sake of congestion alleviation, present transport policy is literally closing down streetside shops, not to mention other informal or mobile retail modes, with the aim to reduce the impact on the free-flow of traffic, or driving customers into the big-box stores at the local mega-plaza with seas of parking bays. In the name of protecting business interests from the oversupply of retail floor space, current problematic retail planning is actually practising retail rationing that is based on “scientific” prediction, strict hierarchy and “precise” provision of retail areas with designated catchment zones. More often than not, “it is the lease income from the shopping center’s smaller inline retailers that, in effect, subsidizes the anchor” who usually receives “either free land or deeply discounted leases” [19] (p. 32). Losing their natural ground—the street—small businesses are consequently having a difficult time finding affordable good locations near homes with free usable traffic. It is small retailers, rather than big ones, who are more vulnerable to the high rentals associated with shopping centres and malls where high traffic comes at an extra price. However, as discussed previously, traffic can be improved and free to use in public streets.

Furthermore, location can change in one way or another as time goes by for various reasons. For example, locations such as the crossings of major transport routes may consolidate their positions over time by catering to traffic flow passing along either route; such prime locations can soon lose their attractiveness with a closure or rerouting of a highway or railroad [19]. Jane Jacobs also describes a force of self-destruction “purely as a result of being successful” which “causes our downtown continually to shift their centers and move” [52] (p. 242). To withstand this force, she suggests “the sheer supply of diversified, lively, economically viable city localities must be increased” [52] (p. 255). In other words, the urban fabric does not necessarily need the highways reinstated with heavy vehicular traffic and pollution to consolidate the retail positions. An increase in the provision of well-connected walking fabric, for instance, can potentially eliminate the undesirable locations and quadruple the “golden corners”. Partnering with social influencers and benefiting from massive visits on platforms, such as Taobao in China, give rise to many online celebrity shops, which have substantially changed the overall business location previously constrained by physical geography. Sometimes, small interventions can succeed, and can be as simple as keeping the shopfronts clean and well-maintained to increase kerb appeal, or just placing planters at the entrance of the street or changing traffic signs to discourage cars.

The supply of streets that are open to business and offer more affordable locations can generate the Vernon–Chinitz effect on entrepreneurship, where small businesses benefit more from banding together along the street than big firms do [64]. To start a business, an entrepreneur must in the first place take costs, demand and scale into consideration and choose the right location that offers a favourable external environment. Historically, markets emerged first along roads not only to take advantage of the flow and concentration of goods, people and information but also for the constant availability of retail space of all kinds that can be taken up or discarded to meet different needs—fixed or mobile, permanent

or periodic, formal or informal. Urban fabrics prior to about 1850 were walking cities, and so all roads were pedestrian-based, or at best based on traffic moving at animal-drawn speeds, less than about 8 km/h [51]. This is very different from the automobile-dependent fabric. Gibbs [19] (p. 47) in his book “Principles of Urban Retail Planning and Development” explains:

“The timeline for locating a space, negotiating a lease, obtaining the necessary government approvals, and coordinating the store’s construction is too unpredictable for most small businesses. The uncertain and often subjective building permit process required in most cities is an unreasonable hardship for the independent and often undercapitalized store or restaurant owner. In many cases, the business owner must pay rent (with no sales revenue) for months while building a new store.”

While it is sad to see a business fail, such failures are unavoidable and sometimes a necessary evil, not just for a quick exit to reduce the cost, but also for a fast market entry for a new firm. The combination of traffic and trade, and the easy market exit and entry, can change the general location of the street and lower the barrier for businesses to enter the marketplace by saving on transaction costs such as land, floor area, transport and time.

In addition, with the congregation of firms into clusters along public streets, individual businesses are more likely “to derive cost economies at second-hand from scale factors operating outside themselves . . . without necessarily raising their own scale of production” [20] (p. 287). Take a cluster of restaurants as an example; the collective demands lead to economies of large-scale purchasing, thereby obtaining favourable rates on items such as food products, packaging, napkins and restrooms. Even better, it also comes with the economies of common reserves that need far less capital and space to be immobilized in inventories unlike large firms which usually have to prepare for unexpected delays in delivery or temporary shortages [20], as has been occasionally the case during the COVID-19 pandemic. Because of a high level of aggregate demand for fresh produce or other ingredients, food suppliers can use this steady flow, combine shipments and thus make daily delivery economically viable, even at short notice. In other words, individual restaurants, cafés, pubs and bars enhance the location via combined demands and traffic, turning the tables on larger firms yet without the burdens of being big. The vision of a 15 min city (e.g., C40 Knowledge [65]) is expected to rediscover the business location of streets by helping small businesses to exploit the local traffic, establish linkages and benefit from positive externalities. Some of the advantages the 15 min city offers are a boost to the local economy, reduced travel-related emissions, a healthier environment and more equitable, inclusive and stronger communities, helping people to live with COVID-19 and build better [65].

After discussing the street, the economic terrain for small business, and the favourable timing for a change, namely the pandemic reboot, the slogan also needs to change to “people, people, people”. Not only are people the core of traffic and location, they are also the key to street recovery. The thriving street vending in Los Angeles and the legalization that followed are a case in point that shows the extensive support from the community, without which nothing could have been accomplished. Failing to mobilize people, it is unlikely that cities can fundamentally change the business-location model and restore the glory of streets, especially given the entrenched car-centric, retail rationing system in place. From garage sales to the Marketplace in Facebook, from home-based businesses to a stall economy, it seems that everybody has something to sell. In fact, 62% of Americans expressed a desire to own their own business [66]. Given that entrepreneurship is playing an increasingly important role in modern urban growth, it is time to ask what a city could offer to its citizens to encourage local enterprise. In addition to the mere shopping centres and mega-structures, we need more city streets and pavement that are open to entrepreneurship where everyone can find their niche and fulfil their business dreams.

In finding an alternative route to the problematic approach to retail and transport planning, we find some inspiration from the activist website ParCitypatory [67] (n.p.) about

tactical urbanism—“a city and citizen-led approach to neighbourhood building using short-term, low-cost, and scalable interventions intended to create long-term change”. From pop-up bike lanes to semi-enclosed “streeteries” that keep emerging across the globe, a truly community-driven development is gaining momentum which is characterized by “crowd sourced rather than close sourced, entrepreneurial rather than bureaucratic, networked rather than hierarchical” approaches [68] (p. 25). Active citizens know well that it is better to put the fate in one’s own hands than place everything in the hands of a few licensed professionals. If we cannot accommodate the rising demand for shopping locally and safely in a timely manner, the mounting cost of inaction is no longer limited only by business failures and job losses. It also means that more lives are at stake from the threats of diseases, vehicles and climate change.

Recovery in the age of COVID-19 means street design that caters simultaneously for sustainable mobility, customer traffic and physical distancing, while protecting the neighbourhoods and improving the quality of life and well-being of urban dwellers. The case study of Royal Street, East Perth in Western Australia shows that a lot more effort needs to be put in place to bring all these aspects together.

6. Results and Findings

This case study analysis shows that Royal Street was not able to recover after the restrictions from the COVID-19 pandemic were lifted. The contributing factors were not only related to the business environment, but also to the street setting, which was not designed to be resilient and cater simultaneously for individual health, economic prosperity and customer mobility. Any successful street recovery is related simultaneously to traffic amelioration, improvement in retail location and the containment of infectious diseases, which require various infrastructure to be put in place (see Table 2). This infrastructure needs to cater for the physical, informal, digital and social characteristics of the streets to create a thriving and resilient urban environment. Table 2 summarises these characteristics and relates them to improvements in customer traffic, retail location and disease containment.

Table 2. Connecting traffic, location and disease control with required infrastructure.

	Physical	Informal	Digital	Social
	<ul style="list-style-type: none"> Well-connected street network; traffic calming and pedestrianisation; streets as Public Open Spaces with various anchors 	<ul style="list-style-type: none"> Widened pavement; prolonged business hours for street vending and night-time markets 	<ul style="list-style-type: none"> Internet and broadband service; e-commerce stores; streamlined online transactions and delivery/pickup 	<ul style="list-style-type: none"> Traffic calming and self-governance; self-building and adaptation; small business and self-organisation
Traffic amelioration	Generate and better engage more foot traffic	Split and spread spatially and temporally traffic flow	Increase internet traffic and reduce motor traffic	Reduce cross-city car travel and increase local active travel
Improvement of retail location	Increase foot traffic and time spent shopping; overcome indoor capacity restrictions	Expand free traffic for the benefits of informal business, night economy and tourism	Boost online and offline visits to combine physical and virtual economy	Increase local economic turnover and customer base with more localized business opportunity and community support
Containment of diseases	Ease indoor crowding	Ease crowding at major retail premises	Reduce unnecessary direct contact	Prevent cross-community spread

Will the 15 min city be the needed sustainable spatial structure to truly simultaneously promote health, prosperity, equity and resilience? It is indeed an improvement from the present mobility-centred spatial pattern characterized by car dependence and the sprawled suburban fabric as shown in the 20 min city of Melbourne, the Parisian 15 min city or Barcelona’s superblocs [69]. However, such a model hardly touches the social or informal infrastructural characteristics that small business needs. It is also still based on a top-down

approach, mainly from the perspective of physical and transport planning. While claiming to be a city of proximities where everything a resident needs can be reached within a quarter of an hour by foot or bike, the 15 min city concept actually pays attention mainly to accessibility, with the focus on travel options, travel time and comfort via setting up vehicle barriers in a few chosen streets or installing cycling paths on neighbourhood greenways (see Figure 13).

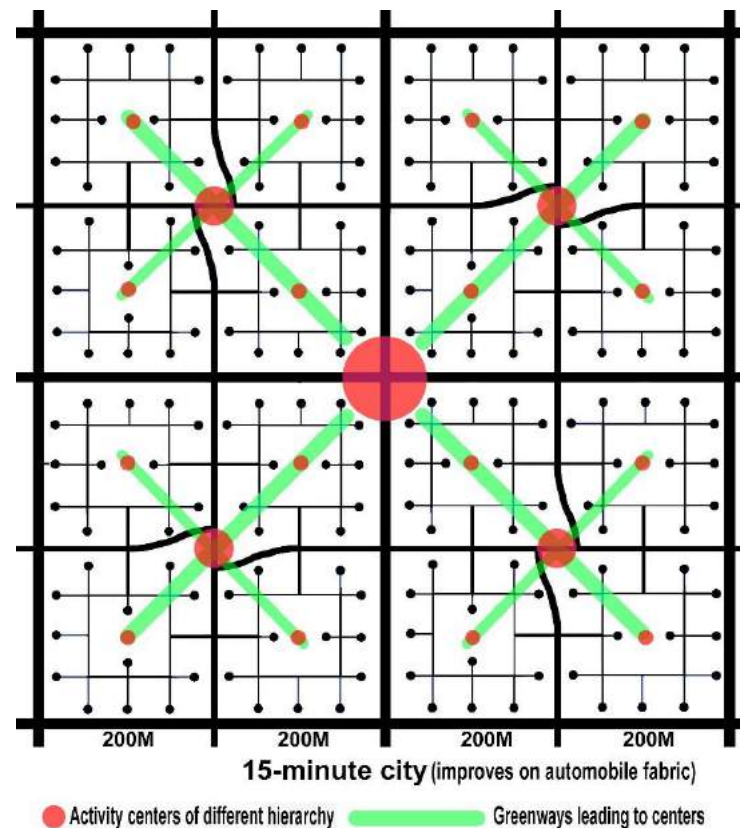


Figure 13. The 15 min city—an improvement on the automobile-dependent urban fabric.

The concept of the Minute City is thus being put forward by this study not just to give the struggling small business full support but also to respond to the ongoing health and sustainability crisis of the planet (see Figures 14 and 15). In comparison to the 15 min city, the Minute City incorporates all infrastructure characteristics listed in Table 2 through which small business can gain access to customers and support street recovery. On the one hand, it is a real proximity-focused spatial pattern without the imposed 15 min radius of 500/800 metres. Instead of getting to and from destinations, such as the shopping centre, park or other places of interest in a well-ordered hierarchical system of urban amenities, the Minute City sees the street space right outside our front doors as a multi-purpose, public open space (POS) and not just movement corridor. This breaks the spatial separation between the journey and the destination, and also opens up opportunities for small business, local employment, shopping, street play and for a safer, resilient and self-sustained community.

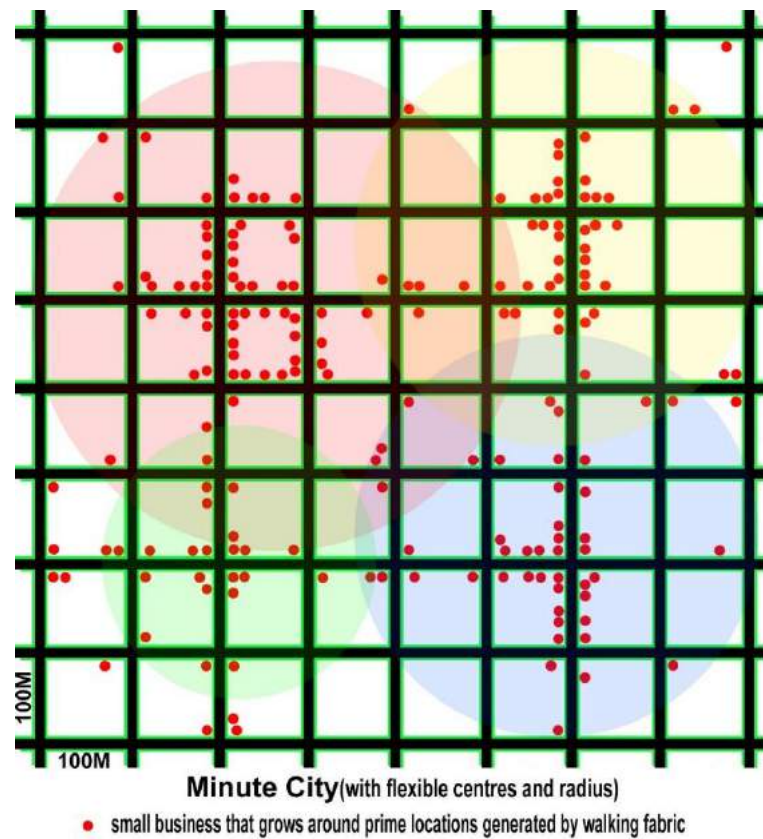


Figure 14. The Minute City—built upon a walking urban fabric.

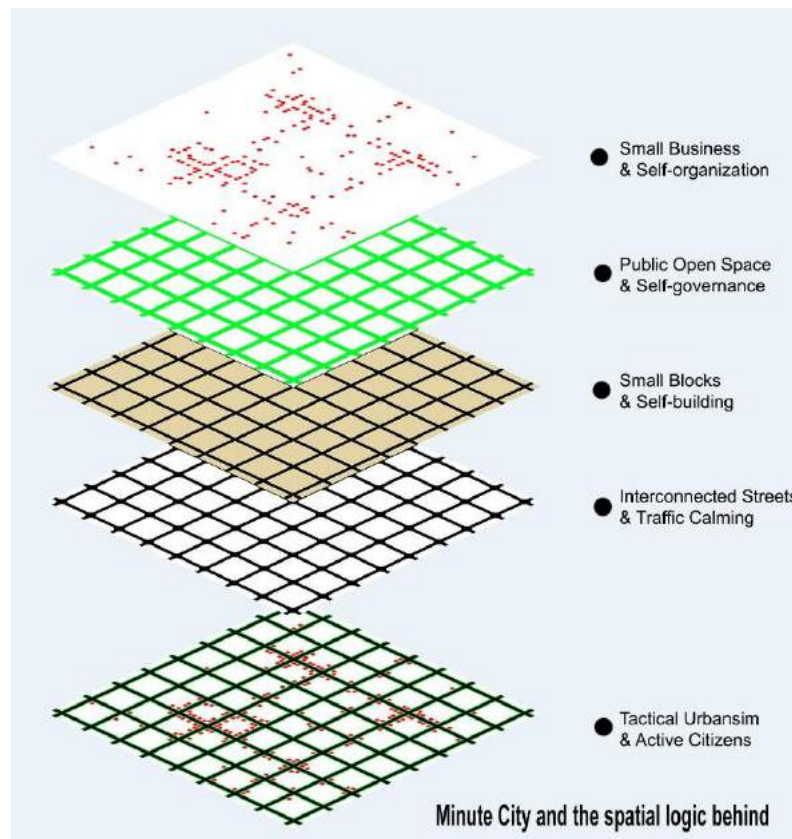


Figure 15. The Minute City and the logic behind it.

On the other hand, the Minute City as a new spatial pattern is informed by a complex adaptive system (CAS) perspective and relational ontology [70]. It can bring socially driven transformation by incorporating tactical interventions and self-organisation into spatial planning. Rather than being physically adjacent in identical walled communities with a similar shopping-scape that features nonplace and almost stops growing, neighbours and small business owners in the Minute City are connected by common interest and can make small and everyday changes to their immediate environment, improving together their location and creating neighbourhood centres. Unlike the fixed 15 or 20 min slogan, the Minute City can involve 1 min or 15 min of walking, largely dependent on the shared vision of the local residents and the efforts they put in, in addition to the constantly changing external economic, social or public health environment.

As a micro-spatial approach commonly seen in organic ancient towns, the Minute City is not without its challenges in the present-day context. The current hierarchical retailing system that is embedded in the auto fabric reveals “the political economy of urbanism” where “(l)ocation decisions . . . are not the outcome of the free play of market forces” [71] (p. 197). Barriers exist not only in the entrenched pro-car political economy and the ubiquitous automobile culture [72], but also in the land use and spatial planning system which has been influenced by and is acting on the unrealistic assumptions of traditional retail location theories [71,73]. Instead of valuing the combination of travel and shopping along a linear market that widely existed in traditional human settlements, today’s uniform market centres with rigid catchment areas or a concentric zonation of retail types typical in Christaller’s Central Place Theory or Haig’s Bid Rent Theory [74,75], have fundamentally been built on wheels. They are determined by the simplified measurement of transport cost or accessibility and ill-prepared to deal with present-day priorities. Such unsustainable economic organizations totally ignore other human needs, including exercise and socialization that are taking place synchronously on a routine shopping trip, not to mention taking into account the ongoing shift of human attitudes towards mobility, retail and the urban environment brought out by the pandemic and climate emergencies.

Rather than taking a temporal and dynamic perspective derived from the numerous agents that transform a city into a complex system [76], a mere physical/spatial approach has been extensively adopted. It is static, fixed and features a dichotomy between the consumer and the good/service supplier. In the scenario of the Minute City however, a blurred and overlapping boundary can be expected between living and retailing, as illustrated by Wen et al. [77] in the case of innovative streets/districts. The Minute City is not only for the self-organization and adaptation of individual housing and neighbourhood streets for commercial and public use, but also for shared interests and mutual support between local residents and small retailers. Without disrupting the existing system, overcoming car dependence and incorporating tactical intervention critical to the working of the Minute City, are less likely to happen.

Despite the challenges, the good thing about the Minute City is that “the detailed outcomes of such a system cannot be determined in advance but rather ‘emerge’ from practices of adaptation and self-organisation” [78] (p. 355). Instead of sticking to specific spatial structures and demanding planned outcomes, the Minute City places a premium on the embedded do-it-yourself DNA which gives citizens the individual right to the city in an incremental, piecemeal strategy. Notwithstanding the unpredictable nature of a complex urban system, this new pattern creates a more diverse and fairer environment for all possible retail formats, mobility options and most importantly, active citizens, by integrating not just the journey and destination but the means and ends as well. Such a sustainable spatial and social pattern, therefore, can be expected to contribute to the broader sustainability agenda of carbon neutrality, urban resilience, sense of place and community cohesion in addition to street recovery. In this respect, the Minute City originating from this study takes the 15 min city concept one step further with a totally different spatial logic in its core, thus forming a research and practice basis that is open-ended, ready for new additions in the future.

7. Conclusions

While it is pressing to focus on the here and now to ease the economic woes with temporary financial aids of various types, it is equally urgent to seek COVID-19-exit paths and next-normal operating models to support long-term business resilience and prosperity. The comeback of the connected and thriving city streets not only helps with the rediscovery of the business location and the control of COVID-19 via traffic betterment, but it also contributes to breaking business monopolies and overcoming automobile dependence by the revival of street fronts and street corners—the sticky place for niche stores and the livelihoods of small business.

From knowing the terrain to knowing the people, the vision for a decentralised Minute City that is created by the people and for the people requires seeing the pavement right outside the doorstep as the starting point for change. In other words, a COVID-safe and thriving urban village not only needs a street redesign that simultaneously accounts for sustainable mobility/accessibility, customer traffic and physical distancing, but also encourages and facilitates small interventions and improvements by every business owner and local resident in pursuit of their niches and dreams. In this way, urban design and street recovery after the COVID-19 pandemic can simultaneously cater for individual health, business prosperity and people's mobility.

Author Contributions: Conceptualization, L.W., D.M., J.K. and X.G.; methodology, D.M. and L.W.; software, L.W.; investigation, L.W.; data curation, L.W.; writing—original draft preparation, L.W., D.M. and J.K.; writing—review and editing, L.W., D.M. and J.K.; visualization, L.W.; supervision, D.M., J.K. and X.G.; project administration, D.M. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: Publicly available datasets were analyzed in this study. This data can be found here: [<https://perth.wa.gov.au/en>]; [<https://www.google.com/maps>] accessed on 9 January 2022.

Acknowledgments: The authors acknowledge the contribution of the 2020 Curtin High Degree by Research Internship Program Scholarship and Australian Government Research Training Program Scholarship in supporting this research.

Conflicts of Interest: The authors declare no conflict of interest.

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APPENDICES

Appendix A

Our world today

14. We are meeting at a time of immense challenges to sustainable development. Billions of our citizens continue to live in poverty and are denied a life of dignity. There are rising inequalities within and among countries. There are enormous disparities of opportunity, wealth and power. Gender inequality remains a key challenge. Unemployment, particularly youth unemployment, is a major concern. Global health threats, more frequent and intense natural disasters, spiralling conflict, violent extremism, terrorism and related humanitarian crises and forced displacement of people threaten to reverse much of the development progress made in recent decades. Natural resource depletion and adverse impacts of environmental degradation, including desertification, drought, land degradation, freshwater scarcity and loss of biodiversity, add to and exacerbate the list of challenges which humanity faces. Climate change is one of the greatest challenges of our time and its adverse impacts undermine the ability of all countries to achieve sustainable development. Increases in global temperature, sea level rise, ocean acidification and other climate change impacts are seriously affecting coastal areas and low-lying coastal countries, including many least developed countries and small island developing States. The survival of many societies, and of the biological support systems of the planet, is at risk.

(Source: United Nations (2015). Transforming Our World: The 2030 agenda for sustainable development)

Appendix B

Goal 11. Make cities and human settlements inclusive, safe, resilient and sustainable

11.1 By 2030, ensure access for all to adequate, safe and affordable housing and basic services and upgrade slums

11.2 By 2030, provide access to safe, affordable, accessible and sustainable transport systems for all, improving road safety, notably by expanding public transport, with special attention to the needs of those in vulnerable situations, women, children, persons with disabilities and older persons

11.3 By 2030, enhance inclusive and sustainable urbanization and capacity for participatory, integrated and sustainable human settlement planning and management in all countries

11.4 Strengthen efforts to protect and safeguard the world's cultural and natural heritage

11.5 By 2030, significantly reduce the number of deaths and the number of people affected and substantially decrease the direct economic losses relative to global gross domestic product caused by disasters, including water-related disasters, with a focus on protecting the poor and people in vulnerable situations

11.6 By 2030, reduce the adverse per capita environmental impact of cities, including by paying special attention to air quality and municipal and other waste management

11.7 By 2030, provide universal access to safe, inclusive and accessible, green and public spaces, in particular for women and children, older persons and persons with disabilities


11.a Support positive economic, social and environmental links between urban, peri-urban and rural areas by strengthening national and regional development planning

11.b By 2020, substantially increase the number of cities and human settlements adopting and implementing integrated policies and plans towards inclusion, resource efficiency, mitigation and adaptation to climate change, resilience to disasters, and develop and implement, in line with the Sendai Framework for Disaster Risk Reduction 2015-2030, holistic disaster risk management at all levels

11.c Support least developed countries, including through financial and technical assistance, in building sustainable and resilient buildings utilizing local materials

(Source: United Nations (2015). Transforming Our World: The 2030 agenda for sustainable development)


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