Advances in 21st Century Human Settlements

Debnath Mookherjee
George M. Pomeroy
Le Thi Thu Huong *Editors*

Urban Transformational Landscapes in the City-Hinterlands of Asia

Challenges and Approaches

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To:
My students, whom I both taught and learned from, who inspired my academic journey.

—Debnath Mookherjee

The everyday planners, social workers, activists, and other professionals who work each day to make cities better places.

—George M. Pomeroy

My mother and late father, who have always given me their full love and support.

—Le Thi Thu Huong

Preface and Acknowledgements

More than thirty-five years ago, recognizing the importance of the unique phenomenon of Asian urbanization, a group of scholars in the fields of geography and planning at the University of Akron, OH, namely, Allen Noble, Ashok Dutt, Frank Costa, and Larry Ma, established the Asian Urban Research Association (AURA) to foster research and studies on Asia. Over the next three decades, AURA evolved into a premier professional organization— a forum for promoting discourse and understanding of the evolving urban traits of the continent. Since its inauguration in 1985, the Asian Urbanization Conference (AUC), organized by AURA, has taken place every 2–3 years in the USA, UK, and in multiple countries in Asia, drawing scholars, researchers, students, and practitioners from diverse fields and professions from across Asia and the globe.

"Urban Futures: Critical Transformation in Asian Cities" was the theme of the 15th Asian Urbanization Conference hosted by the Secretariat, led by Dr. Ha Thuc Vien and his extraordinary team of personnel at the Vietnamese-German University (VGU), Ho Chi Minh City, Vietnam, November 27–30, 2019. "The leadership skills and careful planning of the activities of the local organizers," as observed by Prof. Pomeroy, Executive Director of the AURA, drew scores of participants from over 90 institutions in 22 countries and territories across Asia and beyond, as reported by the local Secretariat of the AUC. The Conference scheduled over 100 paper presentations in a multitude of sessions and organized other activities such as panel discussions and keynote speeches on a variety of subthemes under the overarching theme of Asian urban transformation.

In keeping with AUC tradition, the publication of a volume of Conference Proceedings was planned from the outset. In addition, in course of perusing the submitted papers, the editors conceived the idea of exploring the publication of an edited book of selected papers on a more focused set of themes. Mookherjee's proposal for a volume on 'The Cities and Regions of Asia: Transformation and Sustainable Development,' addressing the emerging issues and challenges of urban growth management, was supported by the VGU's Secretariat and was subsequently contracted with Springer Nature for publication under their 21st Century Settlement Series.

Thus, the project started, but we were soon confronted with a number of formidable issues common to an ambitious venture of this nature, not least of which involved selecting a small set of papers from amongst a wealth of well-researched contributions. The next steps involved several iterations between editorial suggestions and author resubmissions, followed by the same with the external reviewers, all of which were compounded by logistical and other issues imposed by the COVID-19 pandemic. It is the diligence and collaboration of the authors, who enthusiastically undertook the arduous tasks of revision, that enabled us to produce this volume, albeit on a somewhat longer timeline than expected pre-pandemic.

All in all, this volume represents the outcome of in-the-trenches research and thinking by authors from a wide variety of professions and disciplines across several countries in Asia. We hope these contributions will offer glimpses into diverse traits of the urban transformational dynamics, which in turn reflect observable and interlinked socioeconomic and environmental elements amongst the varied spaces of selected cities and their hinterlands of Asia. In our respective introductions to the volume and to the individual contributions, we have touched on a few of the emerging signs of paradigm changes to offer some broad perspectives to the reader. We believe this volume will be of interest to academic communities, professionals, and citizens alike in this era of rapid urbanization in Asia.

The editors wish to acknowledge the interest and the generous support of the sponsoring organizations for hosting the 15th Asian Urbanization Conference at the Vietnamese-German University at Ho Chi Minh City, Vietnam. We offer our sincere thanks to the sponsors, colleagues, and staff members of the Secretariat and the students at the VGU. The Conference received generous support from a number of local (BECAMEX IDC Corporation; VGU), European (The Technische Universität Darmstadt, Darmstadt, Germany), and American (Shippensburg University, PA) sponsors in addition to the support received from the Southeast Asian Neighbourhood Network (NEANNET) and the Asian Specialty Group (ASG) of the Association of American Geographers (AAG). We would not have succeeded in the completion of this book project, one significant outcome of the Conference, without their support; we are deeply grateful to them all.

The editors thank, once again, the contributing authors for their willingness to participate in this project. Their understanding, cooperation, diligent work, and most of all, patience, in the midst of the challenges created by the COVID-19 pandemic, helped us immensely in pursuing our editorial work. We are also deeply grateful to the external reviewers, reputed scholars from the universities of Asia and the USA, who remain anonymous to the authors, and who readily responded to our request for review. Their insightful comments enriched the overall quality of the contributed papers; we remain indebted to them.

We offer special thanks to the following individuals who provided valuable assistance: Mr. Tran Nguyen Thien An assisted Huong in a number of ways in the early phase of the project; Ms. Adriana Varchetta shaped the map of the study areas; and Ms. Janice Smith and Ms. Erin Windholz copy edited the final versions of the contributed papers. We are grateful to them all. We thank the Springer publication team, especially, Loyola D' Silva, Satish Ambikanithi and Shalini Monica Clement

Selvam, who provided kind and patient guidance throughout the publication process. We also acknowledge, with thanks, the institutional support of Western Washington University and Shippensburg University in providing us with the manuscript preparation grants. We thank Eileen and Megan Pomeroy, two young women, who out of sheer curiosity visited HCM City to observe the working environment of the Conference and provided cheerful accompaniment and assistance to George Pomeroy with a variety of work related to the Conference and to this book. Finally, we want to thank Supriya Mookherjee for her insightful comments and substantive feedback, and for the editorial and organizational help she provided us throughout the project. We are deeply appreciative of her contribution and remain indebted to her.

Bellingham, USA — Debnath Mookherjee
Shippensburg, USA — George M. Pomeroy
Thu Dau Mot, Vietnam — Le Thi Thu Huong
August 2022

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Part I
Introduction

Asian Urban Transformation: The Shifting Paradigms

Debnath Mookherjee

Abstract Asia is undergoing an urban transformational process whose complexity and variability in scale, form, pace, and intensity across diverse landscapes pose formidable challenges. Collectively, the empirical studies presented in this volume offer insights into diverse aspects of this complex process, but individually, they can be described as single-focus snapshots, fixed in space and time. In this introductory chapter to the volume, I introduce a space–time perspective to the perusal of these studies, drawing attention to some space–time effects, as well as to signs of changing conceptual paradigms, including the search for common ground and integrative approaches. Both shifting paradigms and spatiotemporal variations have important implications for Asian urban developmental planning, including, but going beyond, livability, sustainability, and land and infrastructural considerations. I offer some perspectives on the interrelated discourses that arise in the context of land and infrastructural agenda-setting, in recognition of a nexus between these and other conversations taking place in recent years. A brief overview of the collection of papers, in terms of study areas and placement in the volume, followed by a few words on overall organizational structure, concludes the chapter.

Keywords Asian urbanization · Transformational dynamics · Time–space effects · Livability · Sustainability · Land and infrastructure · Paradigm shifts · Theoretical nexus · Development strategies

1 Introduction

Academic discourse as to the exact meaning of 'transformation' aside, that Asia is undergoing an urban transformation may no longer be debatable. Also uncontested are the complexity and variability in scales, forms, paces, and intensities

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of this 'transformation of human settlements represent[ing] rapid and fundamental changes in the structure of Asian society' (Clark et al. 2008, iii) across diverse transnational, national, and sub-national Asian landscapes. However, perspectives differ, and the focus of attention on aspects of the transformational processes varies, per the individual disciplinary and professional orientations of involved actors and stakeholders—academics, planners, policymakers, administrators, citizenry, and others. The significance and the multifaceted nature of these interconnected transformational phenomena, pertaining to changes in all spheres of life, including human activities and livelihoods, habitats/settlement patterns, sustainability/livability/quality of life, and related ecological/environmental/socioeconomic implications, are evident in the vast and growing literature on Asian urbanization. The titles of a handful of books, book chapters, and articles (e.g., McGee 2008; Clark et al. 2008; Montgomery 2008; Sheng 2019; Hartley et al. 2020) in the last two decades explicitly highlight aspects of these phenomena, but even without such explicit titling, a recognition of Asian urban transformation in all its manifestations and nuances pervades the Asian urbanization/urbanism literature of recent years.

Because of its intricately complex and multifaceted nature, discourse on aspects of *Asian urban transformation* spans a vast array of issues and developments, which includes, but is by no means limited to, the evolving nature of the following: globalization in its many forms, and its associated repercussions; trajectories and patterns of urban growth, urbanization, and urban–rural settlement traits; urban spatial expansion and peri-urbanization; the rising trend of in situ urbanization (and urbanism); urban–rural interfacing of the hybrid and uneven transactional zones, pockets, gradients, or places exhibiting varying degrees and kinds of ever-growing and ever-complex urban–rural interactions and linkages; changes in employment, livelihood, ancestral places vs. workplaces, values, mores, and culture; and the *blurring of the urban and rural* as a precursor, concomitant, and outcome of all of the above factors. The list of themes connected to Asian urban *transformation*, as addressed in the literature, is virtually endless, touching all spheres of Asian societies and Asian lives. Within this list, individual themes claim varying degrees of attention depending on the perspective, background, or interest of the observer.

Although a wealth of literature, representing the work of a host of pioneering scholars over the past decades continues to remain foundational to urban research on Asia, the changing dynamics of twenty-first century urban-developmental scenarios in diverse Asian regions, on extra-national, national, sub-national, and local scales alike, demand the ongoing attention of all stakeholders and raise serious questions about the future of urban development. Do the urban-developmental planning efforts made by many Asian countries in fact facilitate desired outcomes? Are there distinctive features and forms of the changing dynamics of spaces in Asia that may help develop some common parameters for strategizing developmental planning? Are there indications of improvement in dwellers' quality of life and environment? Are plans and policies on the right track? And how is the 'rightness' of the track to be determined? Are the emergent patterns and prevalent theories consonant with the Western experience, or do the collective 'Asian experiences' reveal uniquely Asian patterns that demand uniquely Asian interpretations? And if so, are there some common

lessons for us to learn from and act upon proactively? These and other questions underscore the importance of examining the varied elements of the spatial transformation phenomena in Asian urban development from all quarters of the academia, public practice, and community.[1] They also highlight the indubitable fact that any discourse generated by such examination should include the firsthand experience of scholars, practitioners, and individual communities in individual urban settings across the diverse socioeconomic and cultural landscapes of Asia. The current volume is one step in this direction.

As noted in the Preface, the volume is based on papers contributed to the 15th Asian Urbanization Conference under the central theme of "Urban Futures: Critical Transformations in Asian Cities." A broad set of criteria was used by the editorial team in the selection of approximately one-third of the over 100 conference papers for this volume, while the rest were published in a Proceedings volume (Huong and Pomeroy 2021). The selected papers underwent multiple revisions following the comments and suggestions of the editors, as well as those offered by external peer reviewers. Notably, despite the Conference title of the transformations in Asian ***cities***, the selection at hand also reflects a recognition that urbanization in Asia is evolving toward a hybrid urban–rural interface, beyond the cities. Collectively, the selected papers consider aspects of urban transformation in the context of development planning through the lenses of empirical studies across diverse disciplines, geographies, scales, and methodologies.

In view of the numerous calls in the literature for trans-sectoral, multi-disciplinary, and interdisciplinary approaches to urban-regional planning in the developing world, it is heartening to note that the contributions to this volume are the product of inter- and multi-disciplinary collaborations between educators, researchers, post-graduate students, planning professionals, city engineers, architects, and others, representing diverse disciplines and professions. As such, we hope this volume will interest all stakeholders, beyond any particular field or discipline. Thus, this introduction to the volume, discussing some of the signs of paradigm[2] shifts in urbanization discourses toward a more inclusive, multi-focal, and holistic approach and their relevance from the perspective of the thematic context of the volume, is geared to this eclectic audience, a wonderfully multi-disciplinary and heterogenous readership.

I believe that the underlying issues, tensions, and normative principles of the discourse dominating the evolving urbanization-related literature, within and outside of the Asian context, are not only integrally tied to each other but, importantly, also appear to be moving toward a more integrative, inclusive, and holistic outlook. These emerging signs, toward a possible consensus, if heeded, can be expected to have deep and obvious implications for urban-developmental planning in the context of

[1] The descriptors such as scholars, educators, academics, planners, and practitioners as used in this chapter, are inclusive and interchangeable. At the same time, they may also connote the nuanced difference(s) between the theoretical/academic and the planning/practicing focus or orientation that is often encountered in the literature and in reality.

[2] In this chapter, the term 'paradigm' is used, to borrow the words from Herbert and Thomas (1982), "…in its more general form as comprising a body of ideas or a broad model which may be used to guide the development of theory and explanatory research; …" (26).

Asian urban transformation. This is especially significant because, as the studies in this volume explicitly note or implicitly reveal, gaps between the shifting theoretical outlooks and their actual applications in practice continue to persist to varying degrees in the Asian urban-developmental planning scenarios. Sectoral focus on infrastructural planning continues to be more the norm than the exception, and while sustainability, livability, 'livable sustainability,' and 'sustainable livability' have become 'buzzwords' in urban planning, efforts to integrate and reconcile the underlying principles of these concepts into practice continue to fall short of the ideal.

Collectively, the empirical studies presented in this volume offer insights into diverse aspects of the Asian urban-developmental dynamics, but individually they can be described as single-focus snapshots, fixed in space and time. This discussion aims to introduce a space–time perspective to the perusal of these studies. In this vein, and at the risk of repeating materials already well-known to the readership, in this chapter, I intend to draw attention to the shifting stances in a few interrelated discourses pertinent to Asian urbanization that are also germane to the papers presented in this volume. Figuratively speaking, the discussion in this Part, offered prior to the presentation of the actual contributions in Parts II and III, can perhaps be thought of as a subjectively constructed multi-prismed lens for readers, nudging them to approach the individual studies with an inclusive and analytical focus from the perspectives of the emerging theoretical insights applicable (or adaptable) to Asian urbanization. If successful, this chapter should motivate the reader to be on the lookout for signs of these shifting ideas in the individual contributions and for common conceptual threads between the theoretical discourse and empirical studies.

The remaining chapter is organized thus: In the first part, following comments on the emerging dynamics of Asian urbanization, some of the shifting paradigms or notions on the diverse pathways and patterns of urban development across time and space are discussed, the point being that such spatiotemporal variations have important implications from the standpoint of Asian urban-developmental planning. The implications include, but go much beyond, livability, sustainability, and land and infrastructural considerations. Some perspectives on these interrelated discourses, i.e., sustainability and livability issues in connection to some of the *wh* questions (e.g., what, where, why, etc.,) that arise in the context of land and infrastructural agenda setting, are offered next, in recognition of a search for a nexus between these and other conversations taking place in recent years. A brief overview of the collection of papers, in terms of study areas and placement in the volume, followed by a few words on overall organizational structure, concludes the chapter.

2 The Shifting Dynamics of Asian Urbanization

Ever since the shifting of the global urban compass from developed to developing countries brought Asian urbanization to the forefront of global attention, the rapidly growing and proliferating large Asian cities have held prominent positions in the

urbanization discourse. Irrespective of the diverse backgrounds of their host countries, most of the largest cities in Asia have traditionally been the centers of their respective national planning interventions until the readily observable diseconomies of scale and other changes in the global and national arenas made it imperative for planners and policymakers to start looking for alternative approaches. Even so, city growth continued, and the city-centric focus endured, bolstered by globalization-induced economic interconnections and interdependencies, in turn, made possible by sea changes in transportation and communication technologies, mobility of goods, people, and services, economic productions, and consumer responses, and other factors. Cities continued to hold their prominence and be hailed as 'engines of growth,' attractors of global trades, businesses, and FDI, generators of GDP, and providers of employment.[3] Concurrently, in addition to the diseconomies of scale and urban maladies that affected livability, other concerns, such as those related to equity, sustainability, and governance and jurisdictional issues, came to the forefront of awareness for all stakeholders. Both the optimistic and pessimistic camps continued to advance their individual theories of urbanization and development, and debates on the positives and negatives of city growth—cities as parasites versus cities as saviors—started taking shape in the *Asian context* from around the mid-twentieth century (for a succinct overview, see, for example, Ginsburg 1989, 1991). As the ensuing decades would show, the unfolding urbanization trajectories and the urbanizing trends of erstwhile non-urban territories in most of these Asian countries led to some major paradigmatic shifts. Despite arguments to the contrary, there was a rising awareness of the distinctiveness of the Asian urbanization process. The necessity to look beyond the built-up city to the *countryside-in-relation-to-the-city* would become more apparent; notions of the urban and rural divide giving way to considerations of urban and rural *linkages* (e.g., Tacoli 2006). An awareness of the expanding *urban-ecological footprints* on the hinterlands relative to their carrying capacities (Rees 1992) entered the thinking of planners and policymakers. But through it all, the large cities in Asia continued to grow and multiply. Both literally and metaphorically, the large Asian cities came to dominate the physical, socioeconomic, and planning landscapes of their host countries, ushering in an era of urban transformation at scales and paces unwitnessed in the history of Asian urbanization.

In many of the diverse regions of Asia, multifaceted urbanization phenomena have been arguably distinguished as uniquely Asian by some commonalities in their spatiotemporal features.[4] Rapid growth and proliferation of large cities and their outward spread, with corresponding transformative influences on the lives and the livelihoods of residents and the economic and sociocultural hybridization of the urban hinterlands—the *desakota* phenomenon (McGee 1991) as experienced in parts of the *extended metropolitan region* (Ginsburg et al. 1991), and the in situ urbanizing traits

[3] For a fascinating glimpse into the physical, economic, social, and informational dynamics of the transformation of Asian cities over four decades (around 1970–2005) see Yeung (2011).

[4] Lin (1994; as cited in Marcotullio 2004, 38), for example, noted five categories that contrasted Asian urbanization from that of the West: "(1) the role of cities in regional development; (2) the dualistic nature of urban employment; (3) trans-national capital and urbanization; (4) socialism and urbanization, and (5) extended metropolitan regions.".

in the city-regions as observed by these and other scholars came to be recognized as distinctive features of Asian urbanization. McGee (1995) recognized the Asian urbanization process as a 'region based' rather than 'city-based' urbanization and noted its research and policy implications: "This is spatially extended urbanization rather than just population concentration, and it raises a significant number of new research and policy issues that need to be explored" (McGee 1995, 10). In the ensuing decades, efforts to understand and analyze the workings of these phenomena on their own terms and *in the Asian context*, instead of looking through the prism of the urbanization process in the West, would lead to much discussion and research among scholars, planners, and policymakers. Concepts and terms to define and describe these evolving, amorphous, and hybridizing areas that were appearing in the territories around the cities, representing what Douglass described as 'complex fields of rural and urban interaction' (1995, 51), would emerge and gain ground. With more understanding of the spatial and temporal dynamics of Asian urbanization, terms such as 'extended metropolitan region,' 'urban field,' *'desakota,'* 'peri-urban,' 'peri-urban interface,' 'mega-region,' 'mega-urban region,' 'megacity-region,' and 'spread region,' as well as temporal descriptors such as 'time–space convergence,' 'time–space compression,' and 'telescoping' became integral parts of the academic and planning lexicon on Asian urbanization (albeit with some definitional and conceptual ambiguities).

3 Urban-Developmental Pathways and Patterns: Uneven Across Space and Time

Concurrent with the transformational processes taking place in a rapidly globalizing world over the last decades, our understanding of the complex and multi-dimensional processes and patterns (in the shifting urban dynamics) of Asian urbanization and their developmental planning implications has undergone substantial changes and is continuing to do so. Even as we argue about whether there are elements of commonalities and differences that distinguish Asian urbanization and separate it from its Western counterpart, there appears to be a general recognition that the processes and patterns of this phenomenon are heterogeneous across time and space. The following is a brief discussion (drawing largely on the work of Peter Marcotullio and colleagues), from the perspective of paradigm-shifting and its practical implications for developmental planning.

3.1 *Time/Space Effects and Outcomes: Emerging Insights and Shifting Paradigms*

Per the theoretical and empirical literature of recent decades, as countries go through the urbanization process, a host of 'time and space-related effects' come into play, accounting for the diverse nature of their developmental patterns, growth trajectories, environmental challenges, and coping mechanisms. Marcotullio (2005) describes it thus:

> The contemporary development context, as compared to the past, has been impacted by both time and space-related effects. Time-related effects include changes in the speed in which human activities occur…. [They]… speed up and intensify our lives' daily experiences. Space-related effects include processes that concentrate activities in geographically uneven patterns…[and]…create diversity in social and physical landscape. (Marcotullio 2005, 105).

As he went on to add: "Importantly, these effects have changed over human history. Geographers and urban planners have identified a number of influences shaping urban environments that are related to time and space effects and historical urban geographers have identified a number of factors that have had differing impacts over time (Carter 1983[5])" (Marcotullio 2005, 105). Recognition of these two intertwined effects has added to what we hope are paradigmatic shifts taking place in the urbanization literature on multiple fronts, with major implications for planners, practitioners, and scholars. A theoretical discussion is beyond our scope here; however, because of the importance of these potential shifts to the theme(s) of the current volume, a few words on theoretical insights into some of the spatiotemporal characterizations of the Asian urban-environmental transition processes/patterns are offered below, although the integrated nature of the subject matter makes a linear presentation difficult.

3.1.1 Temporally Distinct: Compressed, Overlapping, and Telescoped

The literature on urban studies is replete with debate on various theoretical approaches (e.g., agglomeration, post-colonial, assemblage, planetary urbanism, and others) to the city, and about the comparability of urban pathways and patterns across the globe,[6] discussion of which is beyond our scope here. However, as the discourse shows, there is a general recognition that globalization-induced forces, coupled with rapid technological advancements and other socioeconomic and political developments taking place at various regional, national, and local scales, are affecting and altering the space–time effects across the globe. As such, trajectories of urban development, including urban-environmental transition dynamics, for developing Asian

[5] Bibliographic details on Carter (1983) as cited in Marcotullio (2005), are provided in the list of references.

[6] For an overview of these arguments and counterarguments, see, for example, Storper and Scott (2016), Scott and Storper (2015), Roy (2009); as well as the essays in the 'Debates and Developments' section in the *International Journal of Urban and Regional* ***Research***, Volume 40, Issue 1 (especially, Robinson and Roy 2016; Roy 2016; Walker 2016).

countries cannot necessarily be expected to follow the historical precedents of the West[7] (nor can they be expected to be uniform across their own ranks). Applicability of traditional theories, such as the Long Waves theories based on *long* (decades-spanning) and *sequential* urban development as observed in the context of the West, or the postulations of the Environmental Kuznets Curve (EKC) hypothesis,[8] has come under increasing scrutiny (see, for example, Marcotullio et al. 2005; Marcotullio and Lee 2003; McGranahan 2007). Alternate theorizations have come to the fore; for example, the Urban-Environmental Transition (UET) theory (McGranahan et al 1999, 2001) which focuses on the shifting spatial and temporal nature of environmental impacts, and a 'staged-type environmental evolution' (STEE) model (Bai and Imura 2000, as cited in Lee 2007), which postulates a sequential experiencing of the environmental problems by cities. Simply stated, the UET hypothesis tied stages, types, timings, and spatial scales of the various brown, gray, and green environmental issues to wealth, predicting, with increasing industrial development and affluence, a progression from brown to gray to green issues at an ever-expanding scale (from the city to the city-region to larger scales of regional or global proportions), with obvious intra/intergenerational socioeconomic and transfrontier equity issues. The STEE model, based on an examination of environmental conditions of some cities in East Asia, hypothesized three types of environmental concerns related to poverty, rapid growth, and wealthy lifestyle; cities in each of these groups were predicted to go through these environmental problems in a sequential manner, but not necessarily in a linear fashion (Bai and Imura 2000, as cited in Lee 2007, and Marcotullio 2004).

These emerging theoretical insights, primarily based on observation of the differential nature of time and space effects across countries and cities in Asia and elsewhere, helped usher in a gradual but consequential shifting of the urban-developmental paradigms for the developing world, Asia in particular. Referring to one of their earlier works, Lee (2007) noted: "combining elements from the UET model and the STEE theory, as well as empirical observations gleaned1 from the rapidly growing cities in the Pacific-Asia region, a 'compressed and telescoped transition' (CTT) framework, was […] proposed by Marcotullio and Lee (2003) to deepen our understanding of the complexities of the fast-changing urban scenes in Asia" (Lee 2007, 180). Marcotullio (2007) precisely describes the essence of time–space telescoping:

[7] Interestingly, it appears that even Allen J. Scott and Michael Storper have disagreed (e.g., 2015, 2016) with the idea of an eventual convergence of cities, the world over to the extent envisioned by Dick and Rimmer (1998). Their conception of the 'urban land nexus' [which, as they put it, is 'a related feature' of agglomeration, corresponding 'to the essential fabric of intra-urban space' (Scott and Storper 2015, 8)] has five variables [namely economic development, resource allocation, social stratification, cultural norms and traditions, and political authority and power] that would "shape the *principal variations* of the urban land nexus at different *times and places*," (Storper and Scott 2016, 1116; emphases added).

[8] The EKC hypothesis envisioned a similar path of development for all countries (and cities) of the world and suggested an inverted U-shaped relationship between national income and environmental problems, so that with income rising, environmental problems would first get worse, then get better.

> Outcomes from the process of time-space telescoping help to distinguish the experiences of developed and rapidly developing cities in terms of sets of urban environmental conditions and the temporal and spatial scales at which they occur. Specifically, in terms of shifts in temporal scales, the perspective [of time-space telescoping] suggests environmental challenges in developing cities are occurring *sooner* (at lower levels of income), rising *faster* (over time for similar ranges of income) and emerging more *simultaneously* (as sets of problems) than previously experienced by developed cities. In terms of spatial scales, we find greater variety of environmental impacts, concentrated at smaller scales than seen previously" (2007, 46; emphasis in original).

While the notion of *telescoping,* with its elements of 'developmental overlapping' and 'simultaneity,' can be argued to be of more recent origin, borne largely out of the experience and 'anecdotal evidence'[9] gained by scholars such as Marcotullio, those of time–space *convergence* and *compression* can be said to have evolved over a longer period of time, as scholars started noticing the changing 'time–space effects' brought about by technological advances and increasing globalization trends. Janelle's (1968, 1969) novel concept of 'time–space convergence,' for example, was first posited over fifty years ago. As he explained, "…as a result of transport innovations, places approach each other in time–space; that is, the travel-time required between places decreases and distance declines in significance (1969, 351). Harvey's notion (1989 as cited in Marcotullio 2004) of 'time–space *compression,*' per Marcotullio, reflected "the increasing speed with which transactions have been taking place at all scales, as processes revolutionize the objective qualities of space and time" and thus "provide[d] ideas missing, for instance, from the concept of time–space *convergence*" (Marcotullio and Lee 2003; Marcotullio 2004, 45–46; italics added).

The concept of a 'compressed *and* telescoped' development process in the context of Asian cities, as proposed by Marcotullio and his co-researchers (e.g., Marcotullio and Lee 2003; Marcotullio et al. 2005), which synthesized elements from environmental transition theories, as well as notions of time–space convergence or compression, was thus born, tested within prevailing data constraints, and developed in context of the rapidly developing Asian countries and cities. In doing so, Marcotullio (2005) also considered the changing nature and diverse impacts of 'driving forces,' such as economic growth, population/demographic shifts, technological changes, and other direct and indirect factors, whose distinctiveness for rapidly developing Asian countries and cities (in contrast to those of the West) would explain the hypothesized phenomenon of time–space telescoping. From the perspective of the empirical studies included in this volume, his observations on the implications of some of these driving forces and associated factors (e.g., the importance of institutions and 'changes in local land use and land cover'), as well as his concluding comment are worth noting: "The change in drivers has had specific impacts *on environmental transitions,* although

[9] Re. 'anecdotal evidence': In offering empirical support to his notions of compressed and telescoped development, Marcotullio readily acknowledged the data constraints. Noting that 'adequately testing' the claims made by his notion of space–time telescoping on rapidly developing Asian countries and cities would require 'an enormous amount of standardized data across time and for individual cities' that were unavailable at the time, Marcotullio (2005, 118) presented his observations as 'anecdotal evidence.'.

according to the theory, *these transformations have impacts on other spheres of urban development as well*" (2005, 122; emphasis added).

Notably, in addition to its focus on *temporal* aspects, the model also acknowledged a *spatial* heterogeneity in environmental burden: "In terms of spatial scales, we find a greater variety of environmental impacts, concentrated at smaller scales than seen previously," (2007, 46). Although the scalar extent ('smaller scales') is unspecified and open to interpretation, this acknowledgment of *differential impacts on smaller scales* than seen before is important from both planning and research perspectives. The brief discussion on spatial diversity, as offered below, takes note of such recognition by other scholars that goes beyond the environmental realm, in the context of various (often contextually and/or less-than-precisely defined) city-hinterland scales (e.g., peri-urban, city-region, megacity-region, mega-region, spread region). For the perspective of this volume, our focus is primarily on cities and their hinterlands—areas in close proximity to cities and other urban settlements.

3.1.2 Spatially Diverse: A Multi-scalar, Uneven, Hybrid Rural–Urban Landscape

From a *spatial* perspective, the non-uniform, nonlinear developmental nature of spaces at various city-regional scales and at varying distances from the urban core(s), and the 'integrative' and 'differentiating' influences of all external and internal forces shaping such variations, have received much recognition over the years (e.g., Harrison and Hoyler 2015a; Jones and Douglass 2008; McGregor et al 2006; Simon et al. 2004). Schafran (2014, 2015) considered these diversities across a 'megaregional space,' in terms of 'spaces of the megaregions'—"specific spaces impacted by the process" (2014, 90)—from the standpoint of strategic [planning] intervention. Harrison and Hoyler (2015b, 239) noted that Schafran's identification of this 'distinction' enabled them to consider 'two distinct, yet interrelated [integrative and differential] forces,' the latter contributing to the geographic unevenness across the megaregional space(s). This consideration prompted them to call for 'both macro and micro-level analysis of megaregions.' The importance of 'local level research,' 'localized knowledge,' and 'indigenous' and 'micro-scale' research in the city-regional context in Asia has also been recognized by many other scholars over the decades (e.g., Friedmann and Douglass 1975; Douglass 1998; Forbes 1997; Mookherjee 2020).

Most of the discourses (including the examples cited above) have different scalar or locational connotations, ranging from the consideration of the built-up city space to city-regionality, peri-urbanity, or the peri-urban interface, as viewed in the context of global urbanization, urbanization in the developing world in general, or in specific countries thereof. The notion of 'space-related effects' as noted above (Marcotullio 2005), for example, was formulated in the context of cities in the developing world but was subsequently applied with more specificity to cities in the Asia–Pacific region (Marcotullio 2007). My point, arguable as it may be, is that despite scalar and locational variance, the *reasoning* behind this discourse on spatial diversities should

potentially be applicable to the developmental dynamics of other scalar entities, such as those in the immediate surroundings of the large cities of Asia, as well. Per this line of thought, in addition to the converging and diverging influences of an array of external and internal forces ranging from global to local, other factors (e.g., location, socioeconomic, geographic, political, administrative traits, etc.) and urban–rural linkages—as well as the nature and degree of such linkages—can contribute to the diversities and the unevenness of the transactional spaces in the hinterlands. Even spaces with similar characteristics, and presumably subject to similar forces, can reveal dissimilar developmental dynamics at local levels, accounting for much of the observable (but at times seemingly inexplicable) variances within and among the city-hinterland spaces in Asia and elsewhere. From this standpoint, collaboratively formulated and 'locally grounded' multi-locale research studies can be of significant help toward informed and targeted strategic planning.

4 In Search of Connections: Sustainability, Livability, Land, and Infrastructure

The complex, multifaceted, and interconnected connotations of some of the theoretical and empirical insights into the differential nature of the time-place effects upon the diverse multi-scalar city-hinterland landscapes, as discussed above, have potential implications that span entire space–time continua (from local to global and beyond[10]; from now to hereafter). From this perspective, they have direct relevance for a broad spectrum of development planning and policymaking, including integration and operationalization of the basic principles ingrained in the concepts of sustainability and livability, and by extension, for some of the 'who, what, where, when, and why' questions related to issues such as land use changes and infrastructural development and their socioeconomic and environmental/ecological effects across space and time. There are signs of rising interest in the academic and planning communities in searching for the complementarities and linkages between these and other related concepts in the recent literature (e.g., Ramaswami 2020; Marchese et al. 2018; Advisory Committee for Environmental Research and Education 2018; Kashef 2016); such interest bodes well for finding an integrated approach to meeting the complex challenges of Asian urban transformation.

Although, as noted earlier, the concepts of sustainability and livability and their relationship to land and infrastructural development are not explicitly identified as the central focus of this volume, aspects of these concepts and their relationships are at the core of all or most of the papers. As for sustainability, while the focus of only a handful of the studies directly relates to the concept, an undercurrent of it runs through the entire volume. Compared to the subtler presence of sustainability, urban

[10] Thinking, for example, in terms of the Earth's ozone layer depletion, climate change effects on the atmosphere, etc.

livability—specified or unspecified as the focus of the individual studies, and irrespective of the topic—never seems to be far from the ultimate research goal. In this vein, under the common umbrella of developmental issues in varied (but interconnected) areas such as infrastructural development, land use and land cover, quality of life, community/citizen participation, and governance and jurisdictional issues across horizontal and vertical scales, these studies examine a range of important topics (e.g., flooding, transportation, housing, open space/green space, vertical gardening, and such), almost all of which boil down to enhancing livability at city or city-hinterland settings. Furthermore, in one way or another, and almost without exception, land and/or infrastructure proves to be connected to, or at the root of, livability issues. Taken together, the studies add insights into varied aspects of the transformational processes and patterns, locational attributes, and transitional dynamics within the urban and peri-urban areas in the context of a handful of large cities primarily in South and Southeast Asia. On the flip side, collectively considered, they also point to a continued want of an integrated—and integrative—approach to the vital concepts such as sustainability and livability from the perspectives of land and infrastructural issues.[11]

Despite debates and disagreements on the individual interpretations and applications of these concepts, there appears to be a general agreement in the literature on the importance of such an approach for the purpose of operationalizing sustainable infrastructural goals in order to create livable spaces within and beyond Asian cityscapes. From this standpoint, the brief discussion that follows is intended to offer some background and perspectives on the interconnections among sustainability, livability, and land/infrastructural considerations.

4.1 Sustainability and Livability

Of the two concepts, discussion of the basic tenets and implications of the concept of sustainability is more prevalent in the urban/developmental literature and therefore will be addressed much more succinctly in this space. Despite such a presence, however, the concept of sustainability has been a nuanced and charged subject with scores of definitions, interpretations, and foci that evolved through the decades.[12] The intergenerational consideration injected into the sustainability discourse by the

[11] It is worth remembering that the conceptualization of what constitutes livability or sustainability as implicit in the presented studies has been based on the subjective, and likely contextual, interpretations of the individual or teams of researchers from different countries with different disciplinary/professional backgrounds.

[12] As an inevitable corollary of this evolving discourse, conceptual dichotomies (e.g., sustainability vs. sustainable *development*, weak vs. strong sustainability based on whether natural capital is substitutable for man-made and other capitals, conservation vs. preservation; growth vs. development vs. steady-state vs. minus growth; green vs. brown vs. gray, and such) have dominated the literature, adding to the challenges faced by planners and policymakers in coming to an agreement on operationalizing the principles of sustainability.

Brundtland Commission (UN WCED 1987) and the evolving thinking on the nature of and relationships among the economic, social, and environmental components of the tri-pronged models (the 'three Es,' the 'three pillars' or the 'triple bottom line'), progressing to the multi-domain, more ecologically sensitive constructs with political underpinnings of more recent years, have widened the meaning and the scope of sustainability, making it more complex and even more elusive.

The literature is rich with discussions of these, and other concepts as related to the evolving nature of sustainability, requiring no elaboration. (For an excellent historical overview, see Klarin 2018). Briefly speaking, the assumption of a 'co-equal' and 'balanced' relationship among the three components of the tri-dimensional models (e.g., 'economy, equity, and environment,' or the business-oriented 'people, planet, profit') implied an economistic approach that was contested as 'misleading'; instead, a 'nested dependency' model was advanced "with economic activity providing the building blocks of and nested within human society, and with the economy and society ultimately dependent on the natural environment and the services it provides" (Mazmanian and Blanco 2014, 449). Others (e.g., Allen 2001; Allen and You 2002) have acknowledged the validity of the environmental, economic, and social components, but considered that "perhaps they did not go far enough," and argued that in order "to assess whether any given practice, policy, or trend is moving toward or against urban sustainability," it would be necessary to consider five dimensions of urban sustainability relative to the carrying capacity of the urban region, namely economic, social, ecological, and physical [built environment), with a general underpinning of the political component (Allen 2001, 154; Allen and You 2002, 16–17). That all the dimensions should be approached simultaneously, appears implicit in their model. Others, such as Mahadevia (2002), also advocated a *simultaneous* application of what she saw as the "four pillars of *environmental sustainability, social equity, economic growth with redistribution,* and *political empowerment of the disempowered"* for sustainable cities in the Global South, emphasizing the pitfalls of the prevailing practices of a 'fragmented and sectoral approach' that gave precedence to one component over others (2002, 140; italics in original).

Along with these developments in academia, the deliberations, reports, and agendas put forth by the United Nations bodies and partners (e.g., the Rio Declaration, 1992, the Rio + 10, 2002, Rio + 20, 2012, etc.) continued to shape the sustainability discourse and influence urban-developmental planning agendas. These changing approaches are reflected in the debates and discussions surrounding the Millennium Development Goals (MDGs), born out of the Rio + 20 Conference in 2012, and the more expansive (17 goals, 169 targets) Sustainable Development Goals (SDGs) of 2015, with their "five overarching themes, known as the five Ps: people, planet, prosperity, peace, and partnerships, which span across the 17 SDGs" (Mensah 2019, 11[13]). As observed, the SDGs were met with 'two contrasting reactions.' While some disparaged them as 'bloated and lacking in coherence,' others considered them to be more reflective, process-oriented, and transformative as compared to the 'extraordinarily narrow,' 'top down,' and 'technocratic' MDGs (Sakiko 2016). Yet others

[13] Mensah (2019) cited three sources in support of the quote, which are not reproduced here.

viewed them as "a strong sign of global interest in integrating economic, social, and environmental considerations," which emphasized, "the need for a united effort from state and non-state actors at multiple levels of society—a move beyond top-down strategies" (Moallemi et al. 2019, e240). Needless to say, all of this discourse has significant implications for Asian urban transformational challenges.

Concurrently, 'livability,' or more to the point here, 'urban livability,' a subject of intense conversation (and debate) for decades primarily in the West, but perhaps not as prevalent and pervasive in the urban literature as sustainability, has also been gaining momentum in the context of Asian cities. As with sustainability, the conceptual interpretations of livability are also marked by controversy, varied disciplinary foci, and conceptual shifts, the last attributable to shifts in human/societal values "…informing evolving theories and practices of planning"[14] (Gough 2015, 149). Although not necessarily rooted in the Asian urban milieu, some of the indications of potential shifts in academic and planning approaches to urban livability are also of significance for Asian cities and their surrounding areas, and perhaps it can be argued that if for this reason alone, they are of importance to the collection of empirical studies presented in this volume. The three examples noted below are based on my subjective interpretation of some of the more recent voices suggesting or supporting the need to (1) recognize the importance, variability, and fluidity of the human-environmental elements across space and time in defining livability, (2) integrate the different foci of the various strands of the *urban planning fields* for a more cohesive, interdisciplinary perspective on urban livability, and (3) explore and operationalize the conceptual nexus between livability and sustainability from urban-developmental perspectives. Each is briefly discussed.

First, the role of human–environment interaction in defining livability has been long recognized in the literature. Coining his now-famous phrase, 'city in the ground and city in the mind,' Pacione (1990, 2003) repeatedly asserted that

> in contrast to the objective definition of environmental quality, urban liveability is a relative rather than absolute term whose precise meaning depends on the place, time and purpose of the assessment, and on the value system of the assessor. This view contends that quality is not an attribute inherent in the environment but is a behaviour-related function of the interaction of environmental characteristics and person characteristics. […] In other words, we must consider both the city on the ground and the city in the mind (1990, 1–2; 2003, 20).

However, a 'planners/professionals know best' attitude and faith in a standard set of livability criteria across spaces and times continued to prevail. In identifying the two primary (and synced) elements of livability—the biophysical environment of the city, and the socioeconomic and demographic (life course) characteristics, perceptions, and wants/needs of the residents—Ruth and Franklin (2014) emphasized that contrary to prevailing notions, neither element was spatiotemporally immutable

[14] In the context of the USA, Gough (2015) traced the focus of these shifts from the 1960s (civil rights movement), through the early 1970s (protecting the natural environment), the late 1970s to the early 1980s (environmental justice and sustainable development), the 1990s (Smart Growth, New Urbanism, and livable community), to the first decade of the 2000s (community health and food systems), and noted that "Paralleling the examples above, definitions of livability have changed over time and geographically with the associated human values" (2015, 149).

or static: "Specifically, since both the social and environmental elements that define livability vary across space and through time, any effort to promote livability must be based on an understanding of underlying geographic and dynamic behaviors of society and its biophysical environment, as well as their interactions" (2014, 19). The significance of this statement in the context of ongoing localized empirical studies is self-evident.

Second, Kashef's (2016) contribution, based on an extensive overview of the urban livability discourse, seems an apt example of a potential shift in attitude, recognizing the need for the adoption of an integrated planning and policymaking approach across 'disciplinary and professional boundaries' to address urban livability issues. Based on an examination of the entire gamut of discourse on urban livability spanning what he grouped as the design, planning, and popular media and global ranking literature, Kashef advanced an interdisciplinary approach that "drew on the richness and diversity embedded into design, planning, and current ranking tools" (2016, 251). Interestingly, in this process, elements of both the space–time fluidity of the human–environment relationship and the 'tripartite construction' of sustainability are revealed as essential to any consideration of urban livability.

Finally, I see the rising focus on exploring the differences and the complementarities between concepts such as sustainability and livability from the perspective of urban-developmental planning as another sign of a shifting approach to addressing urban transformational issues. Many recent publications have analyzed the multi-dimensional planning, policy, and operationalization implications of the sustainability-livability dynamic in recent years (e.g., Ruth and Franklin 2014; Ahmed et al. 2019; Gough 2015), discussion of which will be beyond our scope. To state it simply, as they and others have noted, there are some readily observable differences between the two concepts. Compared to the global/ecological and intergenerational scope of sustainability (the 'there' and 'later'), the scope of the livability concept is more localized, contextualized, and immediate ('here' and 'now,' and, as Ruth and Franklin 2014 put it, 'about to be'). The contextually responsive livability objectives can be more tangible and focused than the more diffused aspirational goals of sustainability. As Ruth and Franklin (2014) described it, "Sustainability is an elusive concept, hard to grasp by the individual, difficult to operationalize for the planner, and challenging to implement at local scales," whereas "[l]ivability seems more immediate and tangible, and thus more achievable" (2014, 4). In contrast to sustainability, livability "brings a necessary pragmatism to the philosophical visions of sustainability," noted Gough (2015, 146). Compared to the more universal and stable sets of the more forward-looking sustainability goals, the objectives, criteria, and indices informing livability can be argued to be more fluid, inconstant, and variable across space and time, as well as more grounded in the present. That each of these two concepts is best understood when compared with and juxtaposed against the other is noted by these and other scholars.

However, for the purpose of our discussion, it is not the differences or the conflicts between the two concepts, but the efforts by researchers, planners, and practitioners to find linkages, complementarities, and common ground that I find to be of significance. An excellent example of this effort can be found in Gough (2015), who,

based on the prevailing literature, analyzed the differences, similarities, tensions, and complementarities between the two concepts, thereby "showing that *differences between livability and sustainability can be reconciled and perhaps used to drive planning synergies* through three organizing principles: scale, context, and potential" (147; emphasis added). Per Gough (2015), despite some of the tensions between the 'normative and evaluative principles' of the two concepts, "…there is an important nexus between the two that may assist in the other's success." As Gough observes, this is reflected in the term *livable sustainability*: "[l]ivability interventions represent the incremental steps that collectively increase the potential for longer-term strides toward sustainability," while "…sustainability outcomes result over time through a series of livability outcomes" (2015, 147). There are other examples of this search for (and signs of) linkages in the recent literature. For example, following his extensive review of the literature representing different design, planning, and world ranking/popular media views as noted above, Kashef (2016, 248) observed that "[i]n the broadest sense, these views have all addressed livability with the triple bottom line framework that is highly affiliated with sustainability, environment, economy, and society." His next comment is especially noteworthy: "The tripartite construction is perceived by this study as a convenient analytical framework of highly interconnected and overlapping concepts, regardless of whether from a sustainability or livability backdrop." As Ahmed et al. (2019, 168) observed, if livability can be considered to be a subset of the TBL model of sustainability as per van Dorst (2010), then "… it cannot be considered as an independent variable, and no aspect of livability is contrary to sustainability outcomes" (Ahmed et al. 2019; van Dorst 2010 as cited in Ahmed et al. 2019).

From the standpoint of this volume, discussion of the seeming rise of a more integrative focus on two of the most salient concepts related to urbanization, and the efforts to reconcile them, has a relevance that goes much beyond academic exercise. Insights gained from these discourses—including the attitudinal shifts toward more consolidative (and collaborative) approachescan be of immense *practical* value to the planning and policymaking communities as they navigate the complex and circuitous terrains of urban-developmental planning dynamics. Among a multitude of other issues that influence, and are influenced by, these dynamics, those related to infrastructure, and land (in the backdrop of which infrastructural development usually manifests itself) stand out in the urbanization literature. Akin to similar trends observed in some of the other strands of literature on urbanization as discussed, there also appears to be a change toward a more spatially and temporally expansive, integrative, and process-based analytical approach to agenda-setting as relates to land and infrastructural issues. As will be evident to the readers, such an approach is foundational to most, if not all, of the empirical studies presented in this volume.

4.2 Land and Infrastructural Agenda Setting

Land availability and the development of infrastructural facilities are crucial factors in the creation of a desired urban habitat. Throughout history, land has been the prime natural resource base upon which civilization evolved. "Buy land," Mark Twain is said to have quipped, "they're not making it anymore." The rampant demand for land for growth and associated activities has accelerated land prices even as a variety of regulatory measures restricting land use activities, and lack of resources in planning, policy, and management of such activities, have altered the locations, scales, and intensities of land use within cities.[15] Simultaneously, urban influences and other factors have also forced the spread of people and activities outside corporate city boundaries, thus creating and intensifying many land-related issues in the urban–rural hybrid territories outside city boundaries. Debates and discussions on the use, non-use, misuse, and/or the transitory states of mixed-use of land, have varied across time and space and are well-documented in the history of urban development.

Urban transformation in Asia is observable from many perspectives: from the tangible and physical to the more intangible and sociocultural, ecological, and environmental domains, all or most of which can be of both immediate and far-reaching significance. In the realm of the tangible and physical, the impact of population (especially urban) growth on land and its overall connectivity to most aspects of livability, sustainability, and infrastructural planning can hardly be overemphasized. Changes from the non-built up to the built-up land (and associated changes in land covers) both within and outside of city boundaries are among the most glaring and readily visible land changes that we commonly associate with urbanization. The socioeconomic, aesthetical, environmental, and ecological ramifications of these transformations are widely discussed in the literature. From the perspective of ecological implications of such changes, Estoque and Murayama (2017) stressed the "need to examine the trend and spatial pattern of ULCs [urban land changes] in urban areas because such analysis might help in the understanding of human–environment interactions and in the context of land use policy development and landscape and urban planning toward sustainable urbanization" (2017, 395). This argument, in my view, is equally applicable to implications for the socioeconomic and other realms of urban development. It may be apropos to note here that their research, comparing the 'spatial and temporal patterns of urban land changes (ULC), i.e., from non-built-up to built-up land, in 15 major cities (metropolitan areas)' in Asia and Africa, found that in terms of total gain of built-up land, five of the top seven cities were located in Asia.

The impact of the urban transformational phenomena in Asia can also be felt in changes in land availability and land use patterns; the conversion of land from agricultural to non-agricultural and intra-agricultural (e.g., from food crops to forestry); urban pockets and corridors; farmlands interspersed with urban or semi-urban sprawls; lands with mixed rural–urban activities and living spaces; intra-urban and inter/trans-urban availability of land for infrastructural development, as well as for open/green spaces; interest in creative infrastructural planning in the cramped built

[15] See, for example, the Space and the City issue of *The Economist*, April 4th–10th, 2015.

environments of some of the Asian cities. The list is seemingly endless. The literature is replete with examples, debates, and discussions of the many ramifications of these issues, which are beyond our scope here. However, it is worth noting that some of these issues (e.g., green/open space, vertical garden, land cover, and surface temperature, mixed land use, housing, and livability) and their (often implicit) connections to infrastructural planning and policymaking are among the topics discussed in the papers presented in this volume.

While a wealth of literature on land changes, land use features, and infrastructural issues pertaining to urbanization primarily focuses on the city-core or the immediate city-peripheral territories, there is a growing realization that such focus is not likely to yield enough information on the transformational dynamics of the urbanizing territories in the rapidly growing countries in the developing world, including Asia. The place-based approach lacks adequate analytical emphasis on the assessment of land in terms of the city and city-hinterland relationships. Nor does it adequately attend to the linkages between local and distal places and regions, as reflected in elements such as local, national, and/or global policies and programs designed to achieve developmental objectives.

From this standpoint, the concept of a 'process-based' approach as proposed by Seto et al. (2012) can be said to have initiated a major paradigm shift. As in other areas of the urban development, sustainability, and livability discourses as discussed above, Seto et al.'s framework has an integrative focus: "Urbanization and land change are two global processes with far-reaching consequences. Although the two are tightly intertwined, their literatures and analytical frameworks were largely developed separately" (2012, 7687). Answering "a need to improve on classical theories by capturing changes in non-urban places that affect urban places, and vice versa" (7689), they introduced "urban land teleconnections as a conceptual framework that *explicitly links land changes to underlying urbanization dynamics*" (7687; emphasis added). The in-depth and comprehensive treatment of complex subjects in this seminal contribution by Seto and colleagues is hard to capture in a few words. Basically, it recognizes a bi-directional relationship between urban and rural places at a continuum of proximal and distal locations from each other, considering the dual pathways of 'decisions, actions, and land changes' at both urban and rural ends and their overall connectivity to sustainability and equity issues. Challenging the prevailing notions of a place-based, single-scale, discrete land classification system, as well as the arguably path-dependent notions of a sequential and linear land transition pattern across different regions of the world, the teleconnection framework postulated a process-based relationship between urban cores and rural places near

and far,[16] a continuum of classification, and a nonlinear, simultaneous, or 'leapfrogging' land transition pattern that is multi-directional in scope. "The urban land teleconnections (ULT) framework aims advancing conventional conceptualizations of urbanization and land. The conceptual framework thus opens the way to identify and examine the processes that link urbanization dynamics and associated land changes that are not necessarily co-located" stated Guneralp, Seto, and Ramachandran (2013, 445), reiterating yet another sign of a shifting paradigm.[17]

Viewed from the perspective of some of our earlier discussions in this chapter, including the 'time–space' effects (e.g., speeded-up transactions and activities in a world increasingly shrunk by advances in transportation and communication), it can perhaps be said that some of the conceptual elements embedded in the urban land teleconnections frameworks, such as near-to-distal ('not necessarily co-located') relationships, simultaneity and nonlinearity, and the guarding against path-dependency, point to a 'meeting of the minds' that is especially relevant for Asian urban-developmental planning. These perspectives are also likely to be of interest to the readers of this volume, as irrespective of the topic or the focus, land itself (like livability above), is ultimately at the heart of almost all of the contributions.

Intrinsically connected to land-related issues, and integral to the discourses on urban-developmental planning, sustainability, livability, and such, is infrastructure. Planning agendas involving infrastructure have long been fraught with multiple issues and questions related to all the conceivable *wh* questions related to its nature, implementation, and outcomes. Answers to these questions are complex and require integrating insights derived from theoretical discourses with pragmatic and practical lessons learned in a continuum of time–space scales. For example, the *what* is relatively straightforward. Despite some quibbles over exact categorizations and overlaps, basic dimensions such as *hard* and *soft*, and basic sub-groups of these, marked by color codes such as *brown, gray, green* (and *blue*), are well accepted, but their implications and cross-currents for the infrastructural agenda-setting are complex, with far-reaching consequences that are reflected in the other *wh* domains. Responses to the *when* and the *where* are similarly imbued with complexities, and it stands to reason that they should be holistically approached from the standpoint of the dimensions of sustainability, livability, equity, and other related issues.[18] Both, for example, can be approached from two angles: the scalar extents of the time and

[16] From this perspective, it is also interesting to note that only one of the four hypothesized land teleconnections offered by Seto et al. (2012) appears close to a common concept of land change in peri-urban areas when "urbanization processes in a single place (e.g., increase in urban population) leads to land change in one or more urban or peri-urban regions (e.g., land conversion for residential development)" (Seto et al. 2012, 7689). In the other three scenarios, decisions or demands made in one or more urban places can affect land changes in distal places.

[17] Per the authors, "[a]n important consideration in this respect is that teleconnections can extend from short-distances such as the continuum between a central urban area and peri-urban areas to longer distances such as those between places across nations or continents" (Güneralp et al. 2013, 445).

[18] For an insightful recent contribution on the interconnections of urban infrastructure with the environment, health, livability, well-being, and equity under the umbrella of "multi-objective sustainability planning in cities," see, Ramaswami (2020).

the place for *implementation*, and the same for the *when* and *where* their *impact* is likely to be felt. For the time of implementation—as discussed above—while the traditional urban-developmental protocol as practiced in the West may support a sequential, 'first things first' approach as to when to implement the intervention, the 'compressed and telescoped' hypothesis would argue for simultaneity for the rapidly developing countries and cities of Asia. As for *when* the repercussions of specific infrastructural developments are expected to be felt in the future—the responses (although theoretically or empirically based) are mostly predictive or conjectural, and depending on the individual perspective, predictions are colored by both hopes for desired positives (e.g., road development, the opening of new factories), and fears for future negatives potentially tied to the same (e.g., higher volumes of cars on the road, traffic congestion, noise, and air pollution). In the context of the *where* pertaining to all infrastructural agendas, determinations of the *places of implementation* within the city (often said to be differentiated by socioeconomic, demographic, political, and other criteria) and outside of the city (at the various scalar extents of the hinterlands or city-regions), and their *spaces of impact* (socioeconomic, environmental, ecological and others) are at the crux of most, if not all, urban-developmental policymaking and planning. From the standpoint of environmental burden-shifting across space and time, McGranahan's observation (2006, 300–301) that the "severity of the burdens at different scales are interrelated, but not always positively coordinated" highlights the complexities of infrastructural planning. As per his example, "Introducing a piped water and sewerage system is likely to decrease the environmental health burdens within the city, at the cost of increasing the resource and waste burdens the city imposes on the region." In an ideal world, all infrastructural planning and policy decisions made at multiple spatial scales and/or administrative levels involving the *where* (and the other *wh* issues) of the infrastructural planning should recognize and reconcile these embedded complexities, but that is far from what happens in the real world. And finally, it can perhaps be argued that the *why* and the *who,* connoting both reasoning or motivation, and the divisions or shares of responsibilities, jurisdictions, and governance, overlie the entire spectrum of the *what, when, and where* of infrastructural development.

It is at the crossroads of these and other issues and questions pertaining to infrastructural agenda-setting, that insights from the many theories and hypotheses (developed in and beyond the context of Asian urbanization) become meaningful from the standpoint of developmental planning for Asian cities and city-hinterlands. For example, the premise of the time–space telescoping theory, that newly developing countries face simultaneous (instead of sequential) and often faster-growing sets of challenges in relation to environmental burdens at lower levels of income than their more developed counterparts, has been used to at least partially explain an 'infrastructure bottleneck' in road transportation (with a potential connection to CO_2 emission) in a number of Asia–Pacific countries, with associated implications for infrastructural planning (Marcotullio and Williams 2007). In another vein, the literature is full of debate and discussion on urban-environmental agendas as related to brown versus green infrastructure within and outside of city boundaries and their immediate, distant, and cumulative effects across space and time. One way to look

at these issues can be through the lens of their connection to wealth, location, environmental burden-shifting, and transfrontier and other intra and intergenerational equity issues (e.g., McGranahan et al. 2001; McGranahan 2007; Haughton 1999). Guarding against the 'extreme perspectives and stereotypical perspectives' of the two agendas, which may create 'false dichotomies' (McGranahan and Satterthwaite 2000) is critical to effective infrastructural planning for the Asian cities and their hinterlands.

An in-depth discussion of these interrelated (and in practice, inseparable) dimensions of infrastructural development (and their potential impacts) is beyond our scope here. Mention of the *wh*-umbrella of time and space-related questions on infrastructure is made for two reasons: first, to suggest that the insights gained on the shifting and diversifying nature of the time–space effects in the Asian situation have direct relevance to the developmental dynamics examined in the research studies presented in this volume. The second, based on the first, is to underscore the need for an ongoing and contextual examination of the emerging questions across space and time in Asian regions for informed strategic planning and policymaking.

This concludes our discussion. As editors, our goal was to present a collection of empirical studies that would enable a heterogenous group of readers to gain *practical* insights into the varied spatial manifestations of the urban transformational dynamics in several city/hinterland scenarios in Asia. As the author of this introductory chapter, my goal has been to draw the reader's attention to some signs of changing conceptual outlooks in a number of interrelated discourses pertinent to Asian urbanization, including the evolving search for finding common ground and integrative approaches to urban-developmental challenges. In explaining this goal at the outset, I intended the discussion that followed to function as a multi-prismed lens through which the reader could look *at*, and simultaneously look *beyond*, the contextual information gained from the individual studies to search for common threads among individual discourses and across the diverse empirical contributions alike. Obviously, in my own search for these signs amid a vast, rapidly proliferating, and often contentious literature on urbanization, I have gravitated toward those that resonate with my own findings while remaining respectfully aware of and open to consideration of opposing views that continue to prevail in both academia and in practice. In their perusal of the individual empirical studies, it is up to the readers to look for signs of both the presence and the absence of changing outlooks and critically consider not only what has been, but also what can be.

5 The Empirical Studies

As noted earlier, the collection of 31 papers presented in this volume represents about one-third of the papers presented at the 15th Asian Urbanization Conference, held in 2019 in Ho Chi Minh City, Vietnam. Although we strove to make the selection process as criteria-driven as possible, some subjectivity and/or editorial bias perhaps

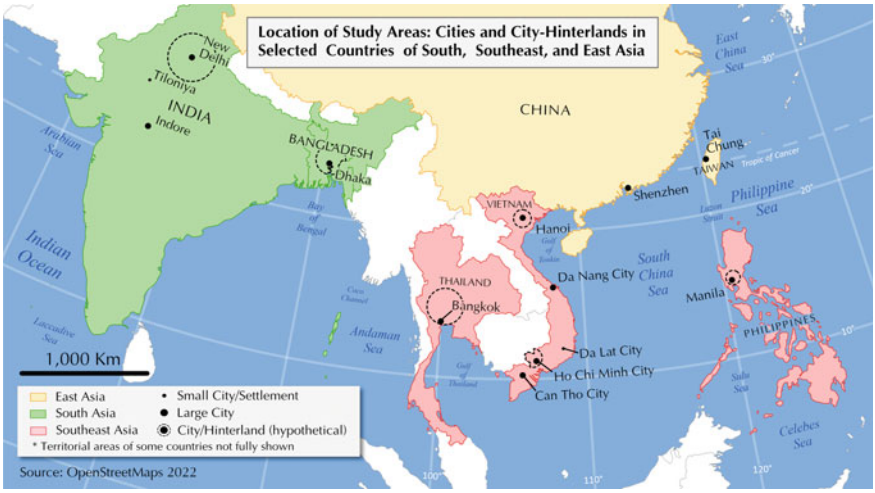

Fig. 1 Location of study areas

could not have been completely avoidable. We hope that the overall quality of the papers and the multifaceted perspectives they offer will help compensate for this.

Most of the studies were confined to aspects of the transformational landscapes of cities and city-hinterlands, primarily in the South and Southeast Asian regions, spread across five countries (Fig. 1); only two papers included here are from China and Taiwan in the East Asian region. In keeping with its leading role in terms of the total number of contributed papers, the host country of the Conference, Vietnam, also represents the lion's share of the total contributions presented in this volume. There are two reasons for this: The first relates to the venue; the Conference was held for the first time in Ho Chi Minh City, which drew more participants from other cities, regions, and provinces within Vietnam than from abroad. And second, the co-occurrence of many factors, such as rapid urbanization and initiation of many new development programs, coupled with Vietnam's quest for transition to a 'market economy,' may have resulted in a heightened awareness of the emerging urban-developmental issues for which the AUC offered a forum for discussion. Together, these two circumstances accounted for a large number of well-researched submissions from Vietnam, which even after much paring down, explains their proportional dominance in the volume. In this vein, the conference was deemed to be an ideal setting for discourse among scholars, practitioners, students, and citizens from diverse socioeconomic, political, and disciplinary backgrounds.

Asian urban transformation is a complex, multifaceted, interwoven spatiotemporal phenomenon. As the current volume shows, efforts to understand the spatial manifestations of this phenomenon, from the perspective of improving urban livability in tandem with steps toward a sustainable future, can cover a wide range of integrally related socioeconomic and environmental elements that depict broad concerns around

infrastructure and land. From an editorial standpoint, dividing this set of conceptually and thematically interconnected papers (especially those on the same topics or themes) was difficult and was based on our subjective interpretation of the primary focus of the study.

The book is organized into four parts. Following this introductory chapter (Part I), Part II presents a set of 19 papers that highlight planning, governance, and jurisdictional issues viewed through the lens of changing planning traditions, as discussed in the introduction to that part. As noted in the introduction to Part III, the set of 12 papers presented in that part of the volume relates more to searches for innovative solutions to urban livability issues. Our closing thoughts, emerging impressions, and suggestions for future research are presented in Part IV.

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Part II
Approaches and Issues

Planning Traditions and Urban Development in the Transformational Landscapes of Asia: An Overview of Presented Papers

George M. Pomeroy

Abstract In this introductory chapter to Part II, I present a set of nineteen papers that highlight planning, governance, and jurisdictional issues viewed through the lens of changing planning traditions. In this context, I offer a few observations on the evolution of planning traditions toward more integrative or hybridized approaches, discussing the chapters in terms of their (typically implicit) theoretical frameworks and drawing attention to how they represent a wider cross-section of theoretical perspectives. I recognize some areas of consilience, particularly with respect to the concepts of livability and sustainability, and note some challenges for Asian developmental planning. A question raised, but not addressed, is how planning-related research can inspire and inform further innovations in planning theory.

Keywords Planning theory · Paradigm shifts · Hybridized planning traditions · Sustainability · Livability · Infrastructure · Public participation · Equity

1 Introduction

As noted in the introduction chapter, cities, the nature of urbanization, and other urban phenomena have evolved and transformed in myriad ways across both space and time, and it is well recognized that such changes are driven by a host of forces. At the same time, the intense complexities of this transformation offer urban theorists, practitioners, and those who study the urban phenomena, a rich vein to mine as they seek to understand these dynamics, their impacts, and the implications of such changes. In turn, as urbanists learn and theorize, there perhaps are also corollary or at least parallel developments (Hall 2002), that "often overlap and wax and wane over time" in planning theory (LeGates and Stout 2020, 441).

In this introductory section of Part II, I briefly discuss a few of these developments taking place in planning theory, noting their connections to some of the concepts (e.g., sustainability, livability, land, or infrastructure) that are either explicitly treated or

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implicitly present in the contributions as a whole. An overview of the empirical studies is presented next, followed by some concluding thoughts.

As our understandings of the new developments in urban and planning theories emerge, prior ideas often remain viable and are rarely discarded. Thus, for both urban and planning studies, there remains a dizzying array of sometimes competing and sometimes complementary ideas. Instead of a consensus development around a few leading theoretical concepts or conceptual formulations, rather there appears to be a splintering, or perhaps even a blossoming, of theoretical ideas. Indeed, as explained and discussed later in this chapter, the various planning-related contributions in this part (Part II) of the volume are variously informed and underpinned by specific and traditionally recognized theoretical foundations that have emerged since the early twentieth century.

Introspectively, however, we will need to consider how might emerging ideas about the planning of Asian cities may inform planning theory. In other words, instead of merely considering planning activities in Asian cities solely informed by perspectives developed in 20th Century North America or Western Europe, it is important to ask, how might planning theory be informed by the planning happening in Asian cities? While it is recognized that Asian cities vary considerably in geographical context, nonetheless, as our understanding of the Asian urban transformation improves, there may be ways in which planning theory and practice can be distinctively enriched and informed in new ways.

In a useful bit of an oversimplification, planners consider urban theory as a theory in planning, whereas planning theory (theory of planning) has to do with how planning is done or should be done. With many fields of study, whether they be applied (planning, for example), interdisciplinary (urban studies), or disciplinary social science fields (such as geography), there have been many cycles of theoretical and ideological innovation, development, and change. Kuhn (1970) offered the most famous portrayal of such theoretical cycles for the physical sciences, which has been widely applied to many fields of social and applied sciences. In Kuhn's description, fields of study typically would move through a cycle of paradigm change, pre-science, then normal science, followed by phases of model drift, model crisis, model revolution, and finally the cycle begins anew with paradigm change and a newly ascendant theory. Oddly, planning differs from this standard model of evolution; older theoretical ideas, planning ideologies and practices, rather than being discarded, often remain valid and consequential that compete with the new theory. At least, they do not become fully discarded.

Various historical accounts and analyses of planning have captured the emergence and evolution of these differing planning traditions, noting which were ascendant, dominant, or carried greater currency during various periods (Birch and Silver 2009; Hall 2002; Klosterman 2011; UNHSP 2009). For example, Peter Hall's Cities of Tomorrow (2002) traces planning traditions across a century of ideological pluralism. Hall identifies eleven distinct planning traditions with several of those still remaining influential at present. Similarly, in his examination of planning theory education over three decades, Klosterman (2011) characterizes the current state of planning theory as rich in breadth and "a very mixed bag." Theoretical consensus in planning then,

as with many other academic and applied fields, lacks unity or consensus. In other words, there are many simultaneous "theories of planning" (or at least ideologies and traditions) that are concurrently operative. One could characterize the situation as theoretically fragmented or shattered, with an assortment of diverse ideas operating alongside one another.

Taking this broader perspective, each of the chapters in Part II at least implicitly reflects a theoretical "center." Considering this, we could very roughly categorize each planning tradition into an appropriate "box." From the perspective of environmental planning, Randolph (2012), presents the work of other scholars from largely an American context, conveniently providing us with some such useful, albeit imperfect, "boxes," a slightly expanded and modified version of which is presented in Table 1. Notably, in the last two categories, the emphases are, at least in part, on elements that are implicit hybridizations of the others. The idea of these traditions being "hybridized" presents a challenge. Randolph does not explicitly share how these planning traditions are fused, coordinated, or otherwise integrated (hence the use of the term "hybridized"). Rather it may be that they are merely bundled. While there is an abundant literature on planning theory, it remains to be seen how theorists can synthesize a planning approach borne out of a critical examination of all the potential individual and synergistic effects of these multiple planning elements or emphases.

In its broadest sense, Klosterman (2011, 325) channels Friedmann in noting that "planning theory is—or should be—primarily "a theory of good practice... whose primary objective is to improve the practice of planning (Friedmann 1995, 157)." Given the varied and hybridized planning traditions, which many of the following chapters derive from, Friedman's definition perhaps is most operative.

The planning traditions as noted in Table 1 appear to be set in a linear, chronological sequence. This is useful, as it helps capture a sense of their origins, development, and ascendancy, and allows us to see the progression of theoretical innovations over time. However, and as alluded to earlier, the linear presentation may obscure the fact that they have in some sense remained concurrently operational, even as the influence of each may have waxed and waned in the planning histories, literature, and practice. Each tradition at its core has remained viable, even though at different times some of them may have been less fashionable in the planning literature and in practice. Recognition of this concurrency of planning traditions is reflected in the hybridized formulations of planning traditions as noted in the bottom two rungs of the table.

As noted in Part I (Introduction), studies with their primary focus on planning, governance, and jurisdictional issues were placed in this part of the volume. In the context of our discussion of the concurrence of planning traditions in practice, it is interesting to note that although rooted in diverse socioeconomic and politically oriented planning traditions, the papers appear to reflect an increasingly hybridized view of planning, instead of merely reflecting a singular planning tradition. While there may be some debate as to the order of presentation of the chapters, I have made an effort to arrange them and discuss some of their salient features in an order that best reflects the planning emphases, pertaining to the theoretical or planning tradition underpinnings (Table 1). In this vein, the design-related chapters are noted first.

Table 1 Evolution of planning traditions (as derived from Anglo-American context)

Emphasis—planning as	Time frame of origin and/or influence	Description
Urban design	Late nineteenth century	Urban designers/planners create our cities
Regulation	1920s to present	Zoning/command/control is core to government action
Applied science	1940s to present	Scientific/economic/policy analysis is problem solving
Politics	1965 to present	Social movements and political action affect decisions
Communication	1970s to present	Public information/participation broadens perspectives
Environmental planning	1970s to present	Environmental protection and resource management
Collaboration	1990s to present	Stakeholders are engaged to reason together
Gendered Cities	1990s to present	Planning that recognizes public and private spaces as gendered
Hybridized formulations		
Planning as integration of policy, science, collaboration, and design	2000s to present	Information revolution and rebirth of design innovation is informed by science, policy and collaboration
Planning livable, equitable, just, and globally/locally sustainable communities, integrating green, brown, and gray agendas	2010s to present	Science, design, collaboration, policy, and place-making are applied to community, economy, equity, ecology, and livability

Source Modified from Randolph (2012)

2 The Empirical Studies: An Overview

Transit-oriented development (TOD) as a term may have been popularized in the early 1990s, but it has many unacknowledged antecedents. As a concept, however, it does incorporate ideas of sustainability and livability, particularly as they relate to urban design, topical notions related to a contemporary vision of planning. Development and transit planning in Chinese cities began incorporating TOD to accommodate rapid urbanization in the 1990s and 2000s. Using a combination of secondary data, field observations, and surveys, Qian ("Travel Behavior of Residents in Transit-Oriented Development (TOD) Neighborhoods: A Study of Two Neighborhoods in Shenzhen, China") assesses how TOD on residents' travel behavior, noting that both developments led to increased use of transit, more so for work commutes. The research conclusions suggest a series of small adaptations (such as discouraging

parking) may have resulted in even greater use of transit. The authors aim to inform TOD design and implementation throughout China, though there may be lessons for wider application to other Asian cities.

Also addressing the notion of livability in terms of quality of life is a consideration of public spaces. There is a long history in planning related to the arrangement, provision, design, and purpose of public and open spaces. In "An Evaluation of Public Spaces in the Peri-urban Areas of Hanoi in the Urbanization Process, 2008 to Present: Comparative Studies in Three New Wards of Hanoi, Vietnam", Hoa, et al. refine the conceptualization of such public spaces and develop a typology for such spaces with reference to three wards in Hanoi, considering indicators of accessibility, comfort, activity types, safety, and inclusiveness. Informed by their evaluation, they make recommendations not only for these case study wards but also for how place-making can be better integrated into planning and design.

Le, Nguyen, and Quang's contribution ("Land Commodification and the Changing Landscape of Peri-urban Villages in Hanoi, Vietnam") is an examination of how market-based forces resulting in land commodification and the production of space clash with and overwhelm traditional and local public spaces and obliterate local informal institutions in the peri-urban areas of Hanoi. This portrayal of land commodification in Hanoi offers lessons for planning and development across Vietnam and in similarly situated urban areas in other countries.

Land use regulation—which from its label alone best fits the notion of planning as regulation—depends on clear concepts of property ownership and land use rights. The evolution of land use regulations, including notions of proprietary property rights, can be easily dated back to the earliest development of a capitalistic system, reaching its heyday in the 1920s. Hien ("Establishing Legal Norms in Vietnam for Compulsory Land Acquisition for Purposes of Economic Development: The Balancing of Public and Private Interests") traces the history of the philosophical, intellectual, and legal ideas of "compulsory land acquisition" (eminent domain) in western countries, before focusing on how these ideas have evolved over the last four decades in Vietnam, coinciding with the country's rapid urbanization and economic growth.

Rapid urbanization and "dramatic socioeconomic transformation" facilitated by the Doi Moi economic reforms have necessitated equally dramatic changes in land management systems within Vietnam, as well as the concomitant refinement of legal concepts related to land use rights and property ownership (as observed by Ho in "Issues with Transformations in Land Management: Ho Chi Minh City, Vietnam"). While the context and history vary dramatically, there are some analogous parallels to "planning as regulation" in other contexts, which led to the evolution of zoning and other land use controls. Even though the particulars vary, many of the dynamics are quite similar and give rise to the concept of "planning as regulation."

The study of environmental planning has taken greater prominence in recent decades, providing much of the foundation for the current focus on sustainability. Nur and Mitra's paper ("Urban Growth and Multi-Seasonal Land Cover Classification of Dhaka, Bangladesh: An Approach Using Google Earth Engine") neatly illustrates how comprehensive research on land use change can be incorporated into the broader

focus of environmental planning and by extension into the development of sustainable communities.

Gatarin's study ("Beating the Traffic: Civil Society Participation in Transport Reforms and Innovations in Metro Manila, Philippines") of civil society-led transport reform initiatives in metropolitan Manila quite nicely illustrates planning as collaboration as stakeholders engage in "reasoning about the future together" (collaborative planning). Many stakeholder groups, such as the colorfully named Bayanihan sa Daan (Collective Heroism on the Road), are identified and their interactions in arriving at innovative transportation reforms are analyzed. Similarly, Dhabhalabutr ("Urban Low-Income Housing in Thailand, manifests on Thai Democratization") reveals the difficult political challenges of participative democracy, stakeholder engagement, and collaboration in the planning and development of a public housing megaproject. These difficulties are reflective of the broader challenges of democratization in Thailand, which, irrespective of political and ideological environment, are also observable in varying degrees in other Asian countries.

Equity and gender considerations are at the forefront of "Perseverance in the Face of Water Scarcity in Hot Summer Seasons: A Case Study of Slum Communities in Indore, India", as Agarwal et al. examine water access for slum communities in the face of growing water scarcity. The chapter, in its discussions, also speaks to planning as a collaborative effort among civil society organizations, including the non-governmental Urban Health Resource Centre. Using interviews and focus group discussions involving poorer, slum-dwelling, and oftentimes lower caste women, the authors uncover a variety of challenges and coping strategies related to addressing water needs. With rising temperatures and decreased water availability, this research addresses a pressing need.

Several less commonly employed perspectives (such as exploring gendered spaces and use of a human capital framework) are featured in Lakshyayog's paper ("Influence of Planning on Physical Activity in Public Spaces: A Case Study of Chirag Delhi Ward, New Delhi, India") on open outdoor gyms in Delhi. At the widest level, it is a critique of modernist top-down comprehensive planning but intersects with contestations over space and issues of gender all in the context of locating physical activity in the broader human capital framework.

The contribution by Hang and Huong ("Limitations of Public Open Spaces in Ho Chi Minh City, Vietnam: Some Perspectives from the Elderly") also addresses equity, along with livability and urban design, in the context of access to public spaces for the elderly in Ho Chi Minh City. As populations age, questions surrounding the limitations of public spaces for the elderly become more pertinent. Considerations of better design, efficient management, accessibility, proximity, security, and use of such spaces for social activities, among others, are critical to improving the quality of life for older urban residents.

The notion of livability encompasses identity, community character, and historic preservation. The area of the Mekong Delta region has many distinctive craft villages amidst a landscape of ornamental flower cultivation, giving it a distinctive character and identity. These craft villages and the surrounding landscapes, however, are at risk of being overwhelmed by the very tourism they generate, as well as the wider

and more pervasive urbanization happening across the region. Nhan et al.'s work ("Tourist Development and Spatial Transformation of Mekong Delta Flower Villages: A Case Study of Tan Quy Flower Village, Vietnam") is designed to understand the relationship between tourist-based economic development and its impact on the "local built form" in Tan Quy Dong village. They are especially concerned with the placement and design of dwelling units along the canals, a distinctive element of "Southern-style" architecture within the country. Through web-based GIS analysis, they offer insights into the impacts and recommendations to preserve the village's livability, foster sustainable tourist development, and preserve the character of the "river civilization" of the Mekong Delta through urban / landscape design.

In "Tracing the Evolution of Resilience in Planning Practices—A Case Study of Taichung, Taiwan", Lu et al. are directly and consciously aware of the theoretical implications of how the concept of resilience is defined. While the term is popular and widely used across a variety of disciplines, it is at the same time employed in a confusing and vague fashion. In the case of waterfront redevelopment projects in Taichung, Taiwan, they note that although the original understanding of the term related to tackling issues of climate change and flood protection, yet, in its final execution, the term is used in terms of the "general desire to recover the city center from an economic downturn." Thus, they hold that the concept of resilience is employed fully within the realm of neoliberal planning. That is planning that rationalizes a growth approach to urban development. She concludes that the use of the term is especially context-dependent. Throughout the paper, planning as collaboration remains a dominant theme.

In Hanoi, sprawl and peri-urban development overshadow broader multi-dimensional transformations of the metropolitan region. These broader transformations in turn mirror wider transitions in Vietnam. "A New Inner-Hanoi via Old Industrial Facilities: From Urban Renewal to Re-urbanization and Urban Regeneration" by Tran et al. examines the evolution of policy and planning responses to these transformations. They suggest that Hanoi and other Vietnamese cities initiate "more sustainable and comprehensive development planning strategies." Such a new approach reconciles very well with the hybridized modes of planning that appear to be emerging in Asian settings.

Public participation and communication have long been topics of emphasis in planning traditions. Tri et al. ("Local Government Decision-making and Public Participation in District 8, Ho Chi Minh City: Do We Know What Works?") present a description and assessment of public participation in the context of Ho Chi Minh City, pointing out that such participation is a "core concept of democratic governance." However, beyond the immediate context, they extend the discussion to a broader vision of planning, which directly and indirectly, alludes to connections with stakeholder groups, building consensus, and policy. These allusions point to an evolution toward a broader and hybridized mode of planning.

In studying the agricultural transformation of Da Lat City, one of Vietnam's leading tourist destinations, Dieu ("Agricultural Transformation Towards Urbanization: A Study of the Peri-Urban Area in Da Lat city, Vietnam") also considers the intersection of sustainability, consensus, equity in planning (such as in terms of

gentrification), and the science of land use change, and planning as regulation, albeit in the context of a smaller metropolitan area.

Climate change looms large across many of the papers in this volume, most notably with respect to increased flooding. Adaptation is one strategy for addressing the impacts of climate change. In "Urban Flooding in the Context of Climate Change in Ho Chi Minh City: A Case Study of Nha Be District" by Ngo et al., in-depth interviews with representatives of stakeholder groups in the Nha Be District of the Mekong Delta reveal the extent, of and a better understanding, of flood impacts on residents. With such knowledge, appropriate adaptation strategies may be developed. Within Ho Chi Minh City itself ("Vulnerability and Flood Risk Analysis for Urban Areas—A Case Study of Ho Chi Minh City"), a multi-method review is used by Song et al., to ascertain current approaches to sustainable flood management. As the authors note, there is a continuing need for traditional flood control measures (planning as an applied science) and, perhaps more importantly, land use planning (planning as policy) as part of a larger program of interdisciplinary risk management not only for Ho Chi Minh City but also for other vulnerable Asian cities.

Planning, like the discipline of geography, is very integrative. Islam and Hossain's study ("Climate Migrants in the Dhaka Metropolitan Region: The Process of Livelihood Adaptation") of climate change-induced migrants in Dhaka, Bangladesh, intersects environmental planning, planning as applied science (in terms of socioeconomic implications), and equity for vulnerable populations. They identify the distinctive features of climate-induced migrants in terms of what disasters forced their migration, the contours of their migration process, and the economic/livelihood adaption paths they have chosen since their arrival in the city. As climate disasters increase in number and scale, this work informs planning beyond the context of Bangladesh.

3 Closing Thoughts

At first appearance, it seems that planners and planning in the Asian context have a kaleidoscope of planning traditions from which they can eclectically, selectively and appropriately draw from, hybridize, synthesize, and innovate upon in their planning efforts. Given this perspective, planners can, in a sense and whether conscious or not of the theoretical underpinnings, pick and choose which combination of "tools" (traditions) to draw from. There may be greater consilience, however, between these disparate strands of thought than what appears at first glance. In other words, earlier traditions are not erased but rather subsumed into a new model. The growing recognition of this consilience is happening simultaneous to the theoretical and ideological debates currently characterizing urban theory.

One area of consilience is in recognizing the linkages between livability and sustainability (Gough 2015; Ruth and Franklin 2014). Traditionally, these are presented as ideas in tension or conflict with one another (Campbell 1990; Godschalk 2004). Gough (2015: 147) argues that "the differences between livability and sustainability can be reconciled and perhaps used to drive planning synergies through three

organizing principles: scale, context, and potential." Gough uncovers similarities and complementarity between livability and sustainability across each of these three organizing principles (148). In examining planning documents for US Gulf Coast communities, she noted (1) plans that had high levels of integration for livability indicators, livability and sustainability reinforced each other; (2) these two concepts "can be integrated through the careful design of principles of livable sustainability, especially if they respond to tensions in scale, context, and potential for change" (157–8); and (3) sometimes practice may more closely address "sustainable livability" than the plans.

Though the perspective varies, a consilience between livability and sustainability is also offered by Douglass (2013). Douglass (p. 2) presents "environmental well-being" as one of the spheres of livability, along with two others ("personal well-being" and "lifeworld"). Environmental well-being is further noted as paralleling the call for environmental sustainability (ibid.).

While the incredibly broad diversity of chapters in this section (as well as the entire volume) defy any opportunity to easily identify and analyze the degrees of consilience across these contributions, that does not preclude points of connection between livability and sustainability.

A particular challenge remains, however, in that that these planning traditions derive almost solely from a Western, even Anglo-American, experiences and contexts (UNHSP 2009). The critique of this reliance on Anglo-American based planning theory is akin to Ananya Roy's critique of contemporary urban theory (2009, 820), where she states that it is:

> Not an argument about the inapplicability of the EuroAmerican ideas to the cities of the global South. It is not worthwhile to police the borders across which ideas, policies, and practices flow and mutate. The concern is with the limited sites at which theoretical production is currently theorized and with the failure of imagination and epistemology that is thus engendered. It is time to blast open theoretical geographies, to produce a new set of concepts in the crucible of a new repertoire of cities.

Bunnell et al. (2012, 2785–6) also present this quandary of how to reconcile paradigmatic approaches to urban studies based on Western Europe and North America with the multiple patterns and distinctions of Asia's "urban frontiers" as a "resource for urban knowledges that are more-than-regional with scope, significance and application)." Just as urban studies and urban theory need a way forward, so does planning theory. Although this statement begs the question, solutions to this quandary may arise organically, as more planning-related research broadens and expands, to inspire and inform further innovations in planning theory and in bridging the gap between planning theory and practice.

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Travel Behavior of Residents in Transit-Oriented Development (TOD) Neighborhoods: A Study of Two Neighborhoods in Shenzhen, China

Zhu Qian

Abstract Transit-oriented development (TOD) has been widely considered an effective urban development strategy and transportation planning instrument to address urban sprawl, land-use segregation, traffic congestion, and environmental degradation in cities. Based on data collected from local subway authorities, field observations, and surveys, this study aims to assess TOD practice in Shenzhen by investigating how the TOD implementation has influenced residents' travel behavior at the neighborhood level in the Grand Theatre Station area, which is located in the old urban center, and the Houhai Station area, which is newly developed. The study finds that both areas have illustrated a significant increase in subway ridership. Comparing residents' travel behavior in these subway station areas has resulted in suggestions for future TOD neighborhood improvements in China, including a reasonable mixture of residential and commercial land uses, better walkability and connectivity, and improved subway services.

Keywords Transit-oriented development (TOD) · Travel behavior · TOD neighborhoods · Subway station

1 Introduction

Chinese cities started to develop mass rapid transit systems by incorporating the concept of transit-oriented development (TOD) to accommodate the accelerated urbanization in the late 1990s and early 2000s. Coined by Peter Calthorpe in 1993, transit-oriented development seeks to increase urban density and achieve compact urban form through extensive use of public transit (Calthorpe 1993). For Chinese cities that have a long history of their urban centers, one of the major challenges in incorporating the TOD strategy has been accommodating the existing neighborhoods that were built long before the introduction of the TOD concept. Chinese cities' urban

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cores have been completely developed, and it is tremendously difficult to incorporate the ideal TOD concept through either redevelopment or adjustment in a short period of time. Therefore, it is common to see a transit station not located in the center of a TOD because the developed environment of the site leaves limited room for better implementation of the TOD concept. These spatial constraints eventually impact the effectiveness of TOD.

This study explores the impacts of TOD implementation on residents' travel behavior and identifies critical elements of TOD practices in Chinese cities that would encourage the use of public transit and other sustainable travel modes. It examines the travel methods of TOD neighborhood residents before and after having access to subways for both home-workplace commutes and non-work-related trips. The study explores the critical reasons why people choose to live in TOD neighborhoods and the features that residents desire most in TOD neighborhoods to facilitate their shift in travel modes. A comparative study of two TOD neighborhoods was conducted to look at one TOD practice where TOD development was completed in a well-established old urban center, and the other TOD practice where the residential and commercial developments were undertaken shortly after the location of the subway station was decided by the city. There have been few studies that examine changes in TOD neighborhood residents' travel behavior by comparing a TOD neighborhood in an older, established urban center with a TOD neighborhood in a newly developed urban district.

2 The TOD Concept and Its Implementation in Chinese Cities

TOD promotes mixed-use developments surrounding a transit station within walking distance of nearby residents (Calthorpe 1993). Bernick and Cervero (1997) technically specify a half-mile buffer zone around the transit station, and a quarter-mile transit village that extends out from the transit station in adherence to the TOD concept. And each village along the transit line needs to be self-sufficient by offering convenient amenities and facilities for village residents' essential daily needs. To develop a successful TOD area, Cervero and Kockelman (1997) propose considering density, design, and diversity. These "3D" factors are then supplemented by distance to transit (Holtzclaw et al. 2002; Lund et al. 2004), and destination accessibility (Cervero and Murakami 2008). TOD strategies aim to achieve three objectives for a more sustainable transportation system: (1) to reduce the need to travel by private automobile; (2) to encourage greater use of public transit; and (3) to shorten travel distance (Banister 2011) through behavioral and technological changes (Steg and Gifford 2005).

The American planning and design concepts behind TOD are not completely applicable in Chinese cities, so they require modification in order to work in China

(Zhang 2007; Hua et al. 2009; Song and Tang 2016; Wang 2016). Main differences include urban development stage, urban density, land ownership, public transit investment, and cultural background (Wang 2016). Before accelerated urbanization started in the 1990s, Chinese cities had many elements in their urban systems that were sustainable and ideal, models that are sought after today. For instance, people traveled on foot, by bicycle, or by bus. Furthermore, the cellular *danwei* system that combined workplace and residence significantly reduced the need for a daily commute. However, all of these urban design elements have shifted due to the marketization of urban land and housing privatization, along with the widespread use of private vehicles, leading to an unprecedented challenge for transport systems in Chinese cities.

In addressing the problems associated with Chinese TOD development, Zhao et al. (2016) posit three improvement areas that would potentially influence people's travel behavior: (1) to increase the ratio of non-residential development to offer residents more employment opportunities close to their homes; (2) to diversify land-use functions to satisfy the needs of residents with different socio-economic backgrounds; and (3) to avoid superblocks in TOD areas and encourage narrow roadways and high-density pedestrian walkways, which would encourage accessibility by walking or cycling.

3 Shenzhen and Its Subway System

Originally a small fishing village, Shenzhen has developed into the fourth-largest city in China with a population of 12.9 million. The city had over three million automobiles formally registered as of 2015 (Shenzhen Statistical Yearbook 2016). The city's developed land area reached 968 km^2 in 2014, leaving less than 8 km^2 land left before the total developed land area reaches the maximum set in its 2020 City Comprehensive Plan (Qu 2015). The Shenzhen 2030 Urban Development Strategy prioritizes public transit in the city's infrastructure development (Shao et al. 2011). The Shenzhen Urban Transportation Planning Center has categorized the city's TOD areas into three types: (1) urban TODs, referring to TOD sites that are situated in urban centers and subcenters and have direct access to the subway system and transit hubs; (2) neighborhood TODs, which are at the center of several residential communities and are well connected to the urban centers or subcenters; and (3) special TODs, which are typically near large-scale integrated transit hubs such as airports, high-speed rail stations, and intercity rail stations.

Shenzhen originally had the idea of developing a light rail transit system in 1988, but it did not come into fruition. Soon after China's takeover of Hong Kong in 1997, the city's subway development plan was approved by the State Council (Zhang 1999). The first phase of the subway system development, with two lines in a total length of 64 km, was completed in 2004, and the city completed a total subway length of 350 km by the end of 2016 (NDRC 2011). The subway system connects two urban centers and five suburban nodes (Shenzhen Statistical Yearbook 2016), and

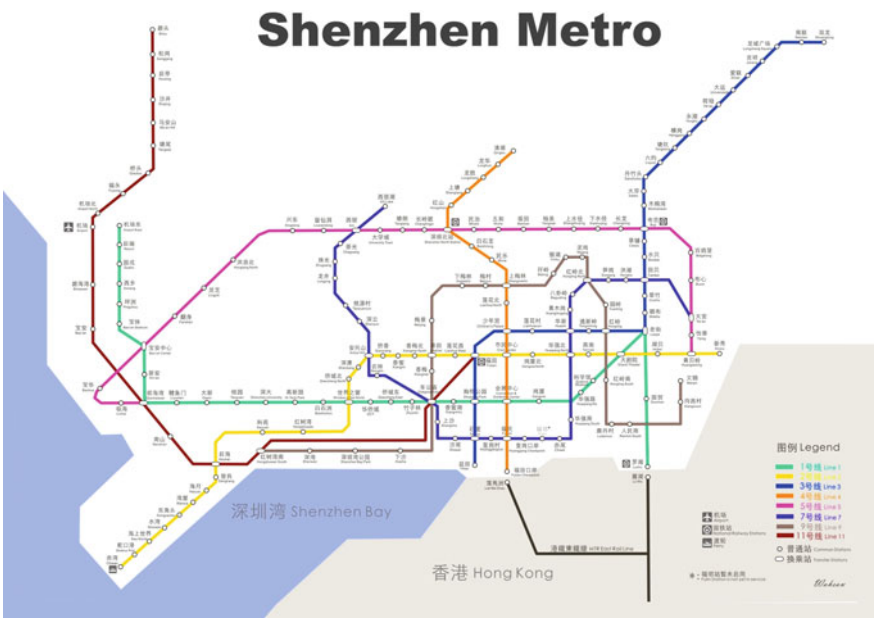

Fig. 1 Shenzhen subway system map. *Source* OntheWorldMap. http://ontheworldmap.com/china/city/shenzhen/shenzhen-metro-map.html

the Shenzhen Comprehensive Plan sets a target of twenty subway lines across the city by 2040 (Deng 2012) (Fig. 1).

4 Research Methods

In this research, a mixed research methodology was adopted. First, the subway ridership data of the two selected study stations were gleaned from the Shenzhen Subway Administrative Authority. Second, field observation of TOD neighborhoods was conducted to assess the built environment changes after the subway stations became functional. Third, a survey was undertaken to examine both work-related and non-work-related travels of TOD neighborhood residents in each of the two study sites. The selected neighborhoods were within a 500–600 m radius circle with the subway stations as the center. At Houhai Station, the circle was shifted to the west to include neighborhoods on the west side of the existing commercial core as the station is situated at the east end of the TOD development; this gave consideration to future commercial development on the east side. At Grand Theatre Station, the circle was shifted to the east to include neighborhoods situated adjacent to the old financial center, as the subway station is not located precisely in the center of the study area (Figs. 2 and 3). In each study area, about 200 resident pedestrians were randomly

selected for the survey questionnaire. They were approached with the questionnaire when they entered or exited their residential neighborhoods. The Grand Theatre Station TOD occurred in a high-density city center while the Houhai Station TOD was built in a green field. Grand Theatre Station was completed in 2004, and the redevelopment around the station was completed by 2017. The Kingkey Financial Center, north of the subway station, and the MXIC Center, south of the subway station, are two large mixed-use developments that have a direct connection to the station. Houhai Station was opened at the end of 2010 after a few residential and commercial projects were completed.

The survey questionnaires were devised to: (1) obtain basic information about the participants, such as how long they had lived in the neighborhoods and the reasons why they had originally moved into the areas; (2) identify residents' travel method choices and the shifts in travel methods after the availability of a subway system; and (3) assess the services and amenities in the study areas to see if they fulfill the needs of residents. The survey was conducted in June 2017. While the survey sample target was 200 for each of the study areas, a total of 205 valid samples were returned at

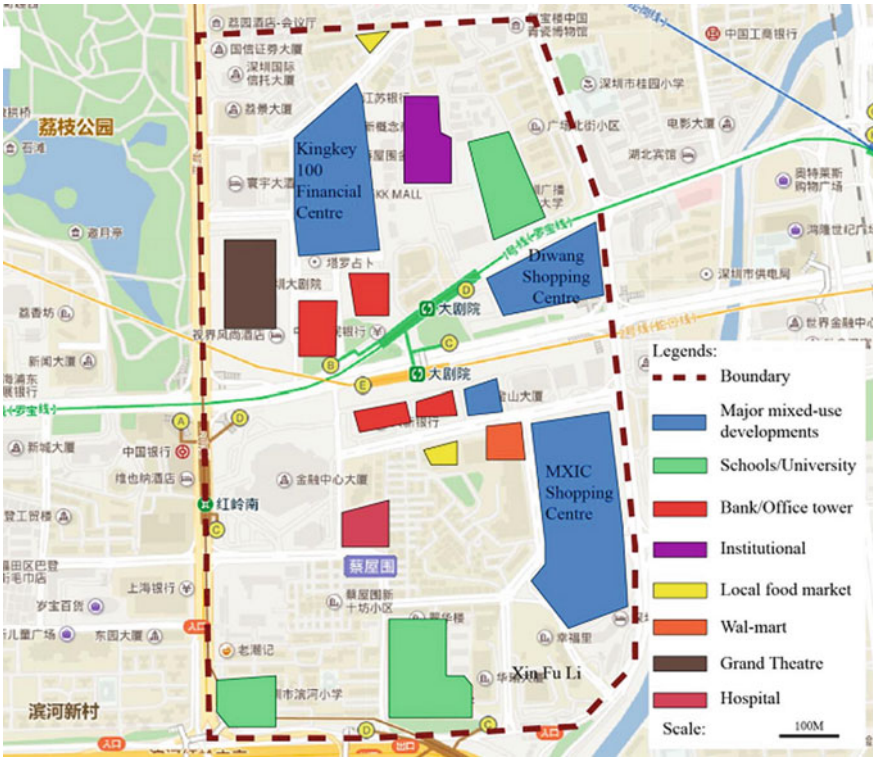

Fig. 2 Major amenities and services offered at the Grand Theatre Station study area. *Source* Compiled by the author. Base map: Baidu Map

Fig. 3 Major amenities and services offered at the Houhai Station study area. *Source* Compiled by the author. Base map: Baidu Map

the Grand Theatre Station area, and 202 valid samples were collected in the Houhai Station area.

The study used the chi-square test for the independence of two variables which can determine the dependency of two variables at different levels. The chi-square test formula is: $\chi^2 = \sum_i \frac{(O_i - E_i)^2}{E_i}$, where χ^2 represents the chi-squared value, o_i is the observed value in category i, and E_i is the expected value in category i. Then Cramer's V Test was utilized to show the strength of the association of two variables, based on the chi-square value.

Cramer's V is defined as: $V = \sqrt{\frac{\chi^2}{nt}}$, where V is Cramer's V, χ^2 is the chi-squared value, and n is the sample size. The same contingency table that has been used to determine χ^2 is used here as well, where t is the smaller of the number of rows minus one or the number of columns minus one. The strength between the two variables is strong when the value is closer to 1, and weak when closer to 0.

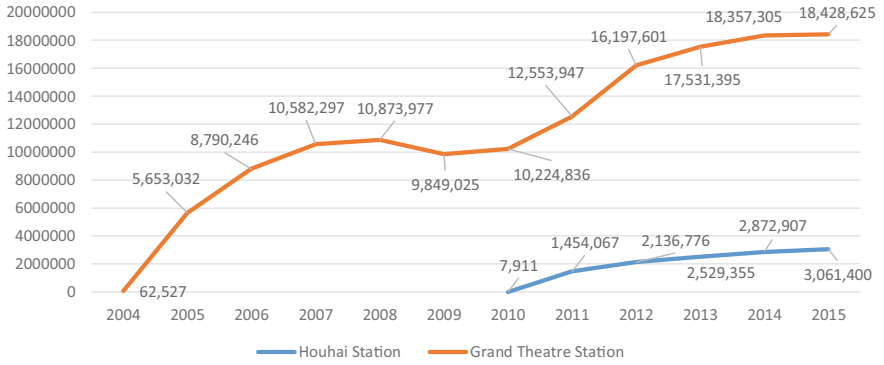

Fig. 4 Subway ridership at Grand Theatre Station (established in 2004) and Houhai Station (established in 2010). *Source* Shenzhen Subway Administrative Authority

5 Research Findings

5.1 Subway Ridership Changes

Evidence from both stations shows that the ridership has constantly increased over the years, supporting the belief in the positive impact of subway travel on Shenzhen citizens in general (Fig. 4). The drop in ridership between 2009 and 2010 in Grand Theatre Station was determined to be caused by the opening of subway Lines 2 and 3 that effectively diverted passengers away from Line 1, where Grand Theatre Station is one of the stops.

5.2 Questionnaire Results

The average age of survey participants in the Grand Theatre Station area was 31 years old, and the ages ranged from 18 to 52, with a median of 30. In the Houhai Station area, the average age was 34 years old, and the age range was between 21 and 60, with a median age of 34. In the Grand Theatre Station area, 105 survey participants were residents who had lived in the area for less than 5 years. Fifty-four survey participants had lived in the area for 5–10 years, and 31 survey participants had lived in the Grand Theater Station area for 10–15 years. There were 15 participants who had lived there for more than 15 years. In the Houhai Station area, 88 survey participants had lived in the area for less than 5 years, 71 participants had lived in the area for 5–10 years, and 40 participants had lived there for 10–15 years. Only 3 participants had lived there for more than 15 years.

The survey investigated the participants' main motivations for moving into the study areas over the past 10 years. Proximity to workplaces (27%), good services and

amenities (26%), and easy access to subway stations (25%) were the three decisive factors for people moving into neighborhoods in the Grand Theatre Station area. For participants in the Houhai Station area, proximity to workplaces was the primary impetus for most participants (32%), followed by good services and amenities in the area (27%). Being close to the subway station (24%) was not as greatly valued by residents there as the other two factors.

As for travel method choices, 14.1% of the participants in the Grand Theatre Station area drove to work, 46.3% of the participants took the subway, and 17.1% of the participants went to work on foot. In the Houhai Station area, the corresponding numbers were 28.8% driving, 35.1% taking the subway, and 7.4% walking. The majority of the participants in both study areas used to take the bus to workplaces prior to the availability of subway stations. Participants in the Houhai Station area showed a higher percentage of using private vehicles and a lower percentage of choosing to walk to the workplace when they were compared with participants in the Grand Theatre Station area, where the survey revealed that more participants had converted to taking the subway to work since the opening of the subway service (Fig. 5).

The survey also asked participants to name their primary reasons for not riding the subway to work. About 30% of the participants in the Grand Theatre Station area and 25% of the participants in the Houhai Station area cited crowdedness as the main reason for avoiding the subway. About 20% of the participants in both areas cited long walking distance to the stations as the main reason, and having too many public transit transfers was also one of the main reasons flagged by 17% of the participants in the Grand Theatre Station area and 13% of the participants in the Houhai Station area (Fig. 6).

For non-work-related travel, 16.1% of the participants in the Grand Theatre Station area chose to drive private vehicles, comparable to the percentage of the same participants who drove to work. However, in the Houhai Station area, a significantly higher 45.5% of the participants chose to drive private vehicles when away from work.

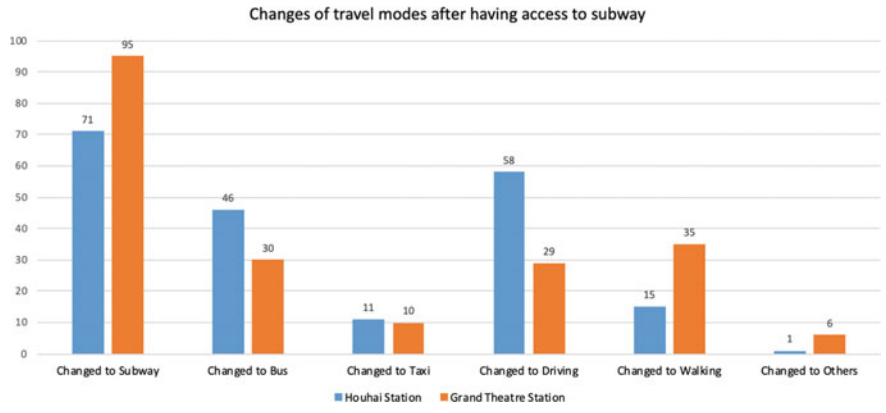

Fig. 5 Changes of travel modes after having access to Houhai Station and Grand Theatre Station

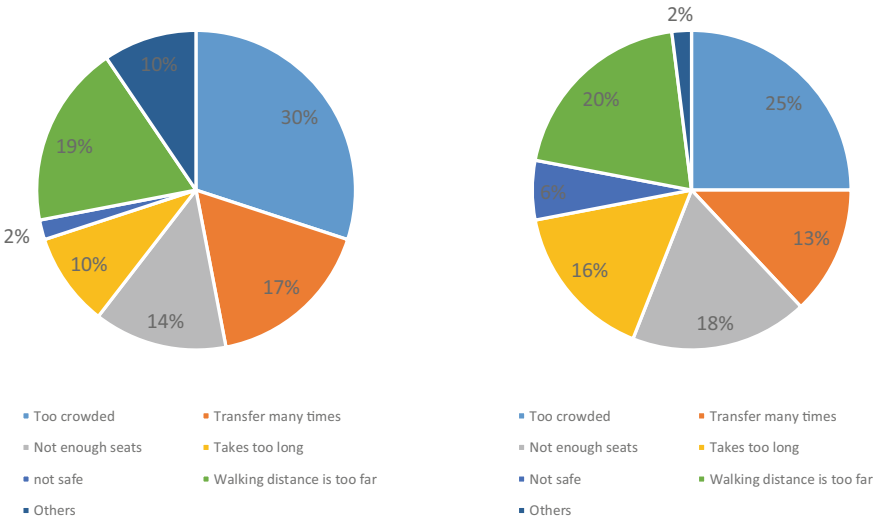

Fig. 6 Reasons for not taking the subway to work in the Grand Theatre Station (left) and the Houhai Station areas (right)

Further, 11.0% of the participants there chose to walk, much lower than 33.7% in the Grand Theatre Station area. In the Houhai Station area, about 15.8% of the participants chose to take the subway, also much lower than 30.2% in the Grand Theatre Station area.

5.3 Chi-Square and Cramer's V *Tests*

The test results showed a progressive decrease in the number of participants who took the subway to work and an increase in the number of people who drove to work as their age increased. Travel mode choices were also related to neighborhood locations and housing types. Older neighborhoods dominated by rental housing had a higher percentage of residents taking public transit compared with newly developed, high-end, residential neighborhoods. Affordable and convenient rental housing units attracted young workers and professionals that worked in places accessible by subway (Table 1).

6 Conclusions

This research aims to understand the impacts of TOD on residents' travel behavior in Chinese cities and to identify the critical elements that would improve TOD concept

Table 1 Selected results of the chi-square and Cramer's V tests

The relationship between	Study area	Chi square χ^2	P value	Cramer's V
Current work travel methods and age groups	Grand Theatre Station	$\chi^2 = 34.5$	$P < 0.0001$	$V = 0.29$
	Houhai Station	$\chi^2 = 45.4$	$P < 0.0000001$	$V = 0.34$
Current work travel methods and the location of the neighbourhoods	Grand Theatre Station	$\chi^2 = 37.3$	$P < 0.00001$	$V = 0.30$
	Houhai Station	$\chi^2 = 72.8$	$P < 0.0000001$	$V = 0.35$
Current work travel methods and number of years living in the neighbourhood	Grand Theatre Station	$\chi^2 = 34.5$	$P < 0.05$	$V = 0.22$
	Houhai Station	$\chi^2 = 40.1$	$P < 0.0000001$	$V = 0.32$
Current work travel methods and reasons for moving to the neighbourhood	Grand Theatre Station	$\chi^2 = 151.2$	$P < 0.0000001$	$V = 0.47$
	Houhai Station	$\chi^2 = 67.0$	$P < 0.0000001$	$V = 0.31$
Current work travel methods and work travel methods used before having access to a subway	Grand Theatre Station	$\chi^2 = 74.1$	$P < 0.0000001$	$V = 0.46$
	Houhai Station	$\chi^2 = 120.7$	$P < 0.0000001$	$V = 0.57$
Current work travel methods and non-working travel methods	Grand Theatre Station	$\chi^2 = 80.3$	$P < 0.0000001$	$V = 0.40$
	Houhai Station	$\chi^2 = 93.1$	$P < 0.0000001$	$V = 0.43$
Willingness to shop at the recently developed shopping centres and the locations of the neighbourhoods	Grand Theatre Station	$\chi^2 = 0.27$	$P > 0.05$	Independent
	Houhai Station	$\chi^2 = 6.2$	$P < 0.05$	$V = 0.18$
Non-working travel methods and number of years living in the neighbourhood	Grand Theatre Station	$\chi^2 = 15.4$	$P > 0.05$	Independent
	Houhai Station	$\chi^2 = 23.4$	$P < 0.005$	$V = 0.24$
Reasons for moving to the neighbourhood and the locations of the neighbourhoods	Grand Theatre Station	$\chi^2 = 9.04$	$P > 0.05$	Independent
	Houhai Station	$\chi^2 = 14.1$	$P < 0.05$	$V = 0.17$
Reasons for moving to the neighbourhood and age groups	Grand Theatre Station	$\chi^2 = 17.0$	$P < 0.01$	$V = 0.19$
	Houhai Station	$\chi^2 = 25.1$	$P < 0.001$	$V = 0.23$

(continued)

Table 1 (continued)

The relationship between	Study area	Chi square χ^2	*P* value	Cramer's *V*
Non-working travel methods and age groups	Grand Theatre Station	$\chi^2 = 23.6$	$P < 0.005$	$V = 0.24$
	Houhai Station	$\chi^2 = 38.7$	$P < 0.0000001$	$V = 0.31$
Non-working travel methods and the locations of the neighbourhoods	Grand Theatre Station	$\chi^2 = 16.5$	$P < 0.05$	$V = 0.20$
	Houhai Station	$\chi^2 = 39.5$	$P < 0.0001$	$V = 0.26$

implementation so that more TOD neighborhood residents choose to take public transit and other sustainable travel methods. The study finds that both TOD areas—the Grand Theatre Station area and the Houhai Station area in Shenzhen City—demonstrated a much stronger influence on commuter modes of travel than non-commuter modes of travel. Compared to their work-related trips, a higher percentage of participants drove to non-work-related trips, such as shopping, dining, and entertainment in both study areas. The higher percentage of subway riders in the Grand Theatre Station area suggests what old urban centers can offer to TOD development, suggesting that the cellular *danwei* system that combines workplace, residential, commercial, and entertainment functions together to reduce both work-related and non-work-related trips is still beneficial (Zhao and Chai 2013; Wang and Chai 2009).

One would assume that a subway station area which was designed and developed based on the conventional TOD concept, like the Houhai Station area, will have a greater impact on residents' travel behavior than incorporating the TOD concept in a fully developed, older neighborhood in the city center, such as the Grand Theatre Station area. The results, however, indicate that the TOD realized in the Grand Theater Station area was more successful in terms of its ability to influence residents' travel methods when compared with the TOD implemented in a green field in the Houhai Station area. This conclusion can be attributed to two main causes. First, demographic and housing conditions lead to the seeming contradiction between the design concept and the realities revealed in this comparative study. Almost all communities in the Houhai Station area were high-end gated communities. The average age of residents there was higher than that of residents in the Grand Theatre Station area. Many of the residential communities in the Grand Theatre Station area were developed in the 1980s and early 1990s. Many original residents had moved on to new apartments elsewhere and leased their old apartments to young professionals who worked in the area or close to the subway station. Second, the characteristics of the built environment around the station areas matter. In the Houhai Station area, subway riders had to walk outdoors to exit or enter the station, which was not desirable during the warm summer and typhoon season. The Grand Theatre Station area is situated in the old city center, where residential communities, offices, commercial facilities, and public amenities are fully developed, generating a much better integration between the station and other land uses when compared with what the Houhai Station area could

offer. For instance, the underground pedestrian connections between Grand Theatre Station and the malls nearby provide a great walking and shopping experience for subway riders. Retail units at grade level near Grand Theatre Station open directly toward streets, providing convenient access to subway riders. On-street activities create natural public surveillance and help to protect the safety of transit riders and local residents. The atmosphere created by on-street activities and pedestrian movements strongly influences the positive walking experience. However, expensive prices of merchandise and services in new luxury shopping malls exclude many residents and subway riders. TOD station area development needs to provide amenities and services that accommodate residents with various socio-economic statuses.

Residential development should provide a mixture of different housing types such as rental housing, social housing, and affordable housing aside from commodity housing, to encourage better use of public transit stations developed with the TOD concept. Close to subway stations, commercial development that provides a variety of services and amenities for residents with different income levels is also necessary for achieving a successful TOD project. Better walkability and connectivity would encourage more public transit users. Less crowded services and shorter travel time and distance would also attract more subway riders. Looking beyond the subway system, parking restrictions such as fewer parking lots and higher parking charges, along with license plate issuance controls should be implemented hand in hand with TOD development. In developing TOD projects, planners should focus on both good design and quality amenities. The following recommendations are proposed from this study, which would be helpful to other cities in China and beyond to design better TODs: (1) consider a rich mix of residential and commercial land uses; (2) aim for spaces that encourage high walkability and connectivity; (3) improve public transit services; and (4) create transport policies that encourage public transit ridership.

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An Evaluation of Public Spaces in the Peri-Urban Areas of Hanoi in the Urbanization Process, 2008 to Present: Comparative Studies in Three New Wards of Hanoi, Vietnam

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Abstract Public spaces play an important role in urban social life and have a dramatic impact on the quality of life for residents. However, regardless of whether or not the quantity and quality of public spaces can meet the growing demand, both aspects of public spaces have become a critical issue for the urbanized regions of many developing countries in Asia, and Vietnam is not an exception. In Hanoi's peri-urban areas, where a significant spatial transition and socio-demographic change can be noted, examining and evaluating public spaces as well as re-conceptualizing public spaces for people are essential for planning and development. This chapter aims to clarify the definition of public spaces in the context of Vietnam and to analyze various patterns of public spaces in the peri-urban wards of Hanoi city. Of special concern is the typology of public spaces in selected wards where it is necessary to evaluate the quality of such spaces in these areas. Based on the analyzes of some of the most significant theoretical studies and outstanding practical projects, the authors have established a set of indicators to assess the quality of public spaces in peri-urban areas in the Vietnamese context, including accessibility, comfort, meaningful activities, safety, and inclusiveness. The public spaces in three peri-urban wards of Hanoi are analyzed by means of on-site observations and questionnaire surveys. Finally, a number of recommendations based on the survey outcomes offer valuable input for city planners, urban designers, and project managers in terms of improving the quality of public spaces toward the goal of sustainable urban development.

Keywords Public spaces · Peri-urban areas · Hanoi · Urbanization · Youth

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1 Introduction

1.1 Context

Public spaces play an important role in a city's social life. Public spaces have been seen as the living room of the city—the place where people come together to enjoy the city and each other (Stanek 2011). The quality of public spaces has a forceful impact on the quality of life for residents in many cities. Public spaces, ranging from grand central plazas and squares to small local neighborhood parks, and street sidewalks make it possible to maintain a high quality of life for the residents. John Ruskin, a leading English art critic from the nineteenth century, noted in his research that "the measure of any great civilization is its cities, and a measure of a city's greatness is to be found in the quality of its public spaces, its parks and squares" (CABE 2005). Public spaces are civic spaces that facilitate social communication and contribute significantly to a high-quality urban environment and the overall liveability of a city (Nguyen et al. 2019a).

Under the impact of rapid urbanization over the past two decades, public spaces have decreased in both quantity and quality in major cities across Vietnam, particularly in Hanoi and Ho Chi Minh City. Hanoi—as the capital city—has seen an explosion of population and a public space as a consequence of the doubling of population size and expanding the city boundary toward the south and southwest of the old Hanoi city after 2011. Some of this expansion follows from the adoption of the city's master development plan through 2030, including an overarching vision toward 2050 (Nguyen et al. 2019a, b; Government of Vietnam 2011).

The statistics from the National Institute of Town and Country Planning in 2017 show that public spaces made up only 0.3% of the total land area of the city, and the public space area per capita was just under 2 m^2, which is just one tenth of the space when compared to the index in developed countries (around 20 m^2 per head) (Tuan 2017). In one recent study, Julie-Anne Boudreau indicated that along with an uneven distribution of public spaces in Hanoi, there was also a shortage of such spaces. Both green areas and bodies of water, as well as both the sports and play facilities, were deemed insufficient. It was recommended that the liveliness and/or attractiveness of public spaces should be improved (Boudreau et al. 2005; Tran 2015). Boudreau et al.'s research also revealed that gender inequality in the use of public spaces could be another problem for Hanoi. In addition, the ownership and management as well as maintenance of public space must also be considered, as they heavily influence the quality of a public space (Ta and Manfredini 2016).

Thoughtful urban development would meet the needs of residents and city officials alike. Residents need more public spaces to do morning exercise, play chess, or have conversations without having to go to any street restaurants or illegally occupied spaces on the sidewalks. With adequate provisions for public spaces, local authorities do not have to block any part of a street to set up a stage for performances on public holidays (Pham 2019). Arguments such as these underscore the high need for public spaces in modern city life (Pham 2015).

In the peri-urban areas of Hanoi, public spaces have also been vigorously transformed over the past two decades under the impact of rapid urbanization (Le 2016; Nguyen et al. 2019a, b). In particular, the spatial and functional transformation and socio-economic changes following the approval of the master plan for Hanoi have significantly affected the quantity and quality of public spaces in some peri-urban areas.

According to the 2017 report of the Vietnam Institute of Urban and Rural Planning (VIUP), in the period from 1995 to 2016, the population of the inner zone of Hanoi increased considerably from 1.28 million to 3.93 million. It is estimated that in 2020, the total population of Hanoi would amount to 7.9 million, including 5 million in urban settlements and 2.9 million in rural areas. Hanoi's agricultural land has been downgraded tremendously over time. In 2009, the total area of agricultural land was 291,000 hectares, but by 2016, it had been reduced to 188,600 hectares. About one third of the agricultural land was converted to built-up areas (Pham et al. 2015). However, the spatial development orientation highlighted in the current master plan of Hanoi, which has been implemented since 2011, focuses more on urban areas (Government of Vietnam 2011). The planning and development of peri-urban areas are only carried out through construction investment projects, without integrating planning in the development programs for the rural and urban construction areas. As a consequence, the rapid urbanization in peri-urban areas has caused many problems including: (1) the massive development of so-called "new towns" or "new urban areas" without establishing a strong link between new urban functional areas and existing infrastructure of traditional villages; (2) a construction boom of industrial zones and clusters in some peri-urban areas without taking into consideration essential social infrastructure investment and the quality of the built environment for the community; and (3) the social segregation that continues to increase under the impact of urbanization in the suburbs.

In line with the rapid peri-urban population growth from 2008 (when the Hanoi master plan was adopted) to the present time, significant changes in land use functions and socio-demographical structure, along with a huge rural/peri-urban migration, a profound transformation of public spaces in terms of quality and quantity have taken place in the outskirts of Hanoi. However, research projects on the quality aspects of public spaces in the periphery of Hanoi are not frequently or properly conducted. Furthermore, the characteristics of space usage, as well as the community's demand for and expectations of those public spaces, have not yet been defined explicitly.

It is noticeable and characteristic in peri-urban wards that there are many immigrants living next to (or together with) local inhabitants. Most of the immigrants are young, aged between 18 and 35: students studying at various universities and colleges, and especially migrant workers working for state-owned factories, joint-venture, or 100% foreign capital enterprises in industrial parks. These residents choose to live near their workplaces or institutions because of the short commute and the low living cost but are facing some problems regarding housing quality. These migrant residents wish to share the existing public spaces with the local community, but the majority of them have no (or almost no) chance of doing so for various reasons, such as having little free time, having low-income, having no self-confidence, or no intention of

social integration (Nguyen et al. 2019a, b). They often cook together on Sunday or go back to visit their families in a village 50–60 km away, either individually or in a small of group of fellow countrymen. They do not seem to be happy about their lives, spiritually speaking. It is therefore worth making further investigations into developing public spaces in peri-urban areas with specific case studies to consolidate the arguments previously proposed.

1.2 Literature Review

Public spaces

Public spaces present openness for the public and connote the idea that these settings are accessible to everyone regardless of age, gender, ethnicity, or other characteristics (Irwin & Erwin 2012). That is to say, they are places where anyone can come, and further, where most events are spontaneous rather than pre-planned and people can mix with others, simply move about, or sit and watch others (Debra, Tran and Pham 2009).

As a specific term, "public space" was first applied in scholarly works in the fields of sociology and political philosophy during the 1950s. Then, at the beginning of the 1960s, the term was applied to urban planning and utilized in the works of other scholars, such as Lewis Mumford in 1960 and Jane Jacobs in 1961 (Xu & Xue 2017).

The interpretation of public space has changed over time. According to Drummond, public space is the space "out there" which belongs to the whole community, although regulated by prevailing social and legal norms (Drummond 2000). In the Western context, public space is recognized as unconstrained space within which political movements can organize and expand into wider arenas (Mitchell 1995). It is a space where a marginalized group can challenge the status quo or dominant order (Duncan 1996), and where "oppositional social movements" can form and operate (Mitchell 1995). According to Edensor's research (1998), the structural ordering of public spaces is culturally specific and not easily transferable from Western to non-Western contexts (Drummond 2000). Pham (2015) argued that public spaces in Asian countries are created, used, assigned, managed, and regenerated due to the socio-political-economic needs of various social institutions, in various spaces and at different times, governed by different political, economic, and social systems. One of the aims of this chapter is to clarify the characteristics of public spaces in the local context of Hanoi's urban development for a proper assessment of the quality of public spaces in the suburbs.

Qualities of public space

For a long time, urban designers, architects, planners, and scholars of urbanism have been concerned with the quality of public space (Mehta 2014). There is a broadness and multiplicity of the characteristics suggested for good public spaces. In his research "The Openness of Open Space" (Lynch 1960) and "Open Space: Freedom and Control" (Carr & Lynch 1981) Lynch addressed concerns of access,

control, and equity along with stimuli and social contact. Carr et al. (1992) put forth a holistic and comprehensive description, suggesting that an ideal public space should be responsive, democratic, and meaningful.

According to the American Planning Association (APA 2017), the characteristics of a great public space should include the following eight elements as follows: (1) promoting human contact and social activities; (2) being safe, welcoming, and accommodating for all users; (3) showing design and architectural features that are visually interesting; (4) promoting community involvement; (5) reflecting the local culture or history; (6) being closely related to bordering uses; (7) being well maintained; (8) having a unique or special character.

By proposing a simple framework to understand the use and sociability of public space in his book *Life Between Buildings*, Gehl (2001) recommended categorizing outdoor activities in three types as follows: necessary, optional, and social. Using the definition put forth by Carr et al. (1992) and the framework suggested by Gehl (2001), Mehta (2014) put forward a theoretical framework to evaluate public spaces. He proposed a Public Space Index (PSI) by adopting five qualities of "inclusiveness," "meaningful activities," "comfort," "safety," and "pleasurability." Measurement methods in the index included expert observation and interviews with users. Mehta's indicators, with a variety of modifications, are utilized by many researchers to evaluate the qualities of public spaces.

Urbanization and public spaces in Hanoi's peri-urban areas

There are many definitions associated with peri-urban areas. The common feature of the many different types of space regarded as "peri-urban" is that they are transitional spaces with some degrees of intermingling urban and rural uses. Peri-urban areas are generally territories affected by strong expansion processes of the city (Antrop 2004). They tend to have a chaotic and fragmented mix of urban and rural functions (Simon et al. 2004).

The emergence of urban development outside designated city boundaries has been a global phenomenon. It occurs at a high level in developing countries, taking place on a large scale and involving rapid change in spatial and socio-demographical structure (Allen et al., 2003; Simon et al. 2004). Peri-urban areas can be classified into three types. First, those areas that have been socio-economically incorporated into the main city are classified as predominant urban areas. Second, semi-urban areas are those dominated by manufacturing and other large land-consuming industrial activities. Finally, potential urban areas are those experiencing early land conversion and residential development (Simon et al. 2004).

Like other cities in Vietnam and in other developing countries, Hanoi is experiencing a large-scale and high-speed transformation in the periphery of the city under the impact of rapid urbanization which has been accelerated since 2008. In recent years, a number of research works conducted by both Vietnamese and international scholars have identified the characteristics and impacts of the peri-urban areas of Hanoi.

More specifically, Thang (2009) highlighted the characteristics of peri-urban areas in terms of economic, social, and cultural factors. Economically, the peri-urban areas

have heterogeneous economic activities which reflect a transformation among the industrial, agricultural, handicraft production, and urban services as well as industries under the strong impact of urbanization. Socially, peri-urban areas reflect a range of occupational, economic, and ethnic diversity of population.

In the peri-urban areas, residents' educational levels and social awareness are better than in rural areas but are not as high as they are downtown. The social relationships in the periphery are multi-dimensional and complex due to the conflicts of interest among different groups of people related to the issues of land use, social services, sanitation, and environmental pollution. Culturally, there is a mixture of rural and urban lifestyles among peri-urban residents because of the diversity of the local communities, in which urban lifestyle is more dominant. Consequently, the attitudes and behavior of the residents toward the environment change accordingly with the different perceptions of values, norms, and culture (Thang 2009).

As per Phong (2006), major impacts of rapid urbanization on the peri-urban areas were reflected in rapid land use changes and socio-economic segregation. While the proportion of agricultural land has been reduced by one third in the past ten years, the number of industrial zones and residential areas keeps rising. Together with the decline of utilizing land for agriculture, the number of local laborers who no longer work in the agricultural sector is also increasing. Apart from those working in factories, many former farmers have now become small traders commuting between their villages and markets in Hanoi.

Regarding the issues of public spaces in peri-urban areas related to urbanization of Hanoi, Le (2016) concentrated on the transformation of public spaces in traditional urbanized villages. In her research, public spaces in traditional peri-urban villages include symbolic spaces (communal houses, temples, pagodas, and shrines) and social spaces (market and road network), reflecting some changes from single-function to multi-function spaces. Public spaces of traditional villages become more important to villagers, especially in the on-going globalization context (Le, 2016). The term of "public space" in the context of Vietnam has always been involved in a negotiation with the government to personalize the public spaces for private use. The urbanization in peri-urban areas is an inevitable process of urban growth when the central districts are overcrowded and densely constructed. Peri-urban villages are mainly located within the radius of 20–40 km from the core of the city, where the highest level of land use transformation can be found. Peri-urban villages show no orderly patterns of urban expansion. A significant change in spatial planning and conceptual rural-to-urban transition should be noted here, including social facilities (upward trend) and open/green spaces (downward tendency) (Kontgis et al., 2014).

1.3 Research Objectives

Public space in the peri-urban areas of Hanoi has become an important component of Hanoi City's overall public space system, especially from the perspective of the rapid urbanization since 2008. This phenomenon has drawn special attention to the

need for an intensive investigation into peri-urban public spaces in order to meet the growing demands of the local people. The major research objectives of this study are as follows: (1) to analyze the characteristics of various typologies of public spaces in three selected peri-urban wards of Hanoi City experiencing the impact of the recent urbanization process; (2) to evaluate the quality of public spaces in peri-urban areas from the standpoint of a Public Space Index in terms of inclusiveness, accessibility, meaningful activities, comfort, and safety; and (3) to identify the most and the least attractive elements of public spaces for the users, especially for the youth, in order to make recommendations for improving the quality of these spaces.

This is followed by the conceptual research framework and methodology (study areas and research parameters), with a presentation and discussion of the research results. Finally, some of the critical issues related to public space planning should be noted, and the limitations of our work are acknowledged.

1.4 Conceptual Framework

The conceptual framework used in this study is established on Gehl's (2010) and Mehta's (2014) theoretical frameworks for evaluating public spaces: A good public space is accessible and open, meaningful in its design and the activities it offers, and brings a sense of safety, physical, and environmental comfort and convenience. In addition, it offers a sense of control and sensory pleasure to the people enjoying the space.

Inclusiveness in public spaces is demonstrated in: (1) publicness and (2) universality (Zamanifard 2018). "Publicness" denotes the right of "everyone" to be in and makes use of public space in a way that does not threaten or compromise the equal rights of others. Some recent research findings signify that spatial design and managing policies ensure accessibility and usability of the space for all members of the society. In the current study, the focus is on the ability of the people who go to the public space and to use it.

Accessibility to public spaces is defined by the nature of the network that links the urban space to its surrounding urban fabric. Essentially, these networks, such as highways or other roads designed exclusively for pedestrian traffic, can determine their role either as links facilitating the exchange process or as obstructions preventing local people from making contact with one another.

Meaningful activities in this context should be the suitability for space to support cultural activity and sociability. To be more specific, the authors are interested in the aspect of "place-meaning" where space becomes meaningful when it is useful, when it supports activities that are symbolically and culturally meaningful to individuals or groups, and when it supports sociability. In Mehta's framework (2014), the Public Space Index (PSI) is designed to measure meaningful activities of a public space by evaluating whether it has space for community gathering. The suitability of the layout and the design of the space supporting activities and behavior as well as allowing

a variety of uses (such as businesses that offer food and drinks) are also included (Mehta 2014).

Comfort in this study only refers to the physical and environmental effects of the public space on human behavior. A number of studies show that comfortable microclimatic conditions, including temperature, sunlight, shade, and wind, are important in supporting outdoor activities in public spaces (Bosselmann et al. 1984). Therefore, the PSI is designed to measure the physiological level of comfort that the public space is able to provide its users.

Safety in the public space is considered on the basis of a person's ability to feel safe from certain social and physical factors, such as crime and traffic. The PSI is designed to measure the safety of public space by rating how safe people feel in the space at different times of the day, the appropriateness of physical conditions and maintenance of the space, and whether the presence of surveillance measures in the public space makes them feel safer or not.

Based on these aspects, a Public Space Evaluation Index (PSEI) incorporating five factors ought to be established and utilized for the study. The details (including variables, weighting, scoring, and measurement criteria) are provided in Box 1.

Box 1: Public Space Evaluation Index (PSEI): variables, weightings, scoring, and measuring criteria

Public space aspect	Variable	Weighting	Scoring criteria	Measuring criteria
Inclusivenes			**20 points**	
1	Presence of different groups of age	2	1 = one group of age 2 = two groups of age 3 = three groups of age 4 = four groups of age	Determined with observation and counting
2	Presence of different genders	1	1 = very limited 2 = low 3 = medium 4 = high	Determined with observation and counting
3	Diversity of activities	1	1 = one activity 2 = two activities 3 = three activities 4 = four or more activities	Determined with observation and counting activities

(continued)

(continued)

Public space aspect	Variable	Weighting	Scoring criteria	Measuring criteria
4	Presence of people of diverse classes	1	1 = very limited 2 = low 3 = medium 4 = high	Determined with observation and interview
Physical accessibility			**20 points**	
1	Lock control at the entrance of the public space	1	4 = no control 3 = low control 2 = medium control 1 = high control	Determined with observation
2	Fence or wall control in the public space	1	4 = no control 3 = low control 2 = medium control 1 = high control	Determined with observation
3	Opening hours of public space	1	1 = less than 10 hours 2 = 10–12 hours 3 = 12h < opening hours < 24h 4 = no restriction at all	Determined with observation and interview
4	Impact of regulations, control to users' access	1	4 = no impact 3 = low impact 2 = medium impact 1 = high impact 0 = very high impact	Questionnaire-based survey of users
5	Users' evaluation of their accessibility	1	4 = very easy 3 = easy 2 = not very easy 1 = difficult 0 = very dificult	Questionnaire-based survey of users
Meaningful activities			**20 points**	
1	Have a place for community gathering (approx. 20 people)	1	4 = yes 0 = no	Determined with observation and interview

(continued)

(continued)

Public space aspect	Variable	Weighting	Scoring criteria	Measuring criteria
2	Presence of space to sell food and drinks for users	1	4 = yes 0 = no	Determined with observation
3	Presence of space to encourage creative activities for youths (graffiti drawing, hip-hop dancing, skating, robot playing, and so on)	2	4 = have space for four or more activities 3 = have space for three activities 2 = have space for two activities 1 = have space for one activity 0 = none	Determined with observation and counting
4	Presence of space for street vendors	1	4 = yes - official space 3 = yes, but non-official 2 = no, with warning boards to restrict street vendors 1 = no, without warning boards to restrict street vendors	Determined with observation and interview
Comfort			**20 points**	
1	Presence of free seating	1	4 = have many seats 3 = have a few seats 2 = have two seats 1= have one seat only 0 = none	Determined with observation and counting
2	Presence of other facilities on the site	1	4 = have four or more facilities 3 = have three facilities 2 = have two facilities 1 = have one facility only 0 = none	Determined with observation and counting

(continued)

(continued)

Public space aspect	Variable	Weighting	Scoring criteria	Measuring criteria
3	Presence of areas in the space that are shaded or covered with overhangs or roof extensions, shade trees	1	4 = 100% of the space is covered or shaded 3 = most of the space (> 80%) 2 = some parts of the space (< 50%) 1 = one part of the space (< 25%) 0 = none	Determined with observation and measuring
4	Presence of equipment or elements for preserving or maintaining the space	1	4 = have four or more elements 3 = have three elements 2 = have two elements 1 = have one element only 0 = none	Determined with observation and counting
5	Level of noise effects on space from outside	1	0 = very high 1 = high 2 = medium 3 = low 4 = not affected at all	Determined with observation, interview and evaluation
Safety			**20 points**	
1	Public space can be recognized from 200 m distance	1	4 = yes 0 = no	Determined with observation
2	Presence of separate connecting lane to public space	1	4 = yes 0 = no	Determined with observation
3	Quality of lighting when it is getting dark	2	0 = no lighting 1 = bad 2 = medium 3 = good 4 = very good	Determined with observation and evaluation

(continued)

(continued)

Public space aspect	Variable	Weighting	Scoring criteria	Measuring criteria
4	Sense of openness	1	0 = very poor 1 = poor 2 = medium 3 = good 4 = very good	Determined with observation and interview
Total Maximum score			**100 points**	

2 Methodology

2.1 Introduction of the Study Areas

The three selected case study wards (My Dinh 1, Sai Dong, and Thuy Phuong) are located in the peri-urban areas of Hanoi City as designated in the master plan of Hanoi City to 2030, vision to 2050 approved by the Prime Minister in July 2011 (Government of Vietnam 2011). The locations of these case study wards are highlighted in Fig. 1. My Dinh 1 ward is a potential urban area experiencing early land conversion and residential development. In My Dinh 1, there are several project-based housing development plans connected with such large-scale urban public buildings at city level and regional level as National Sports Training Centers and My Dinh National Stadium (Figs. 2a, 2b). Thuy Phuong ward and Sai Dong ward can be seen as semi-urban areas dominated by manufacturing enterprises and other large land-consuming industrial activities (Figs. 3a, b, 4a, b). These two wards are becoming more and more populous, with thousands of migrant workers either settling in dormitory buildings or renting village houses (Nguyen et al., 2019a, b).

Table 1 shows some features of the selected case study areas in the peri-urban region of Hanoi City.

2.2 Research Parameters

Acknowledging that a more efficient and precise evaluation of public spaces can only be achieved through a combination of methods that include assessments by experts as well as input from ordinary users (Carmona 2003; Mehta 2014), this research utilized both methods. The research was undertaken in two phases.

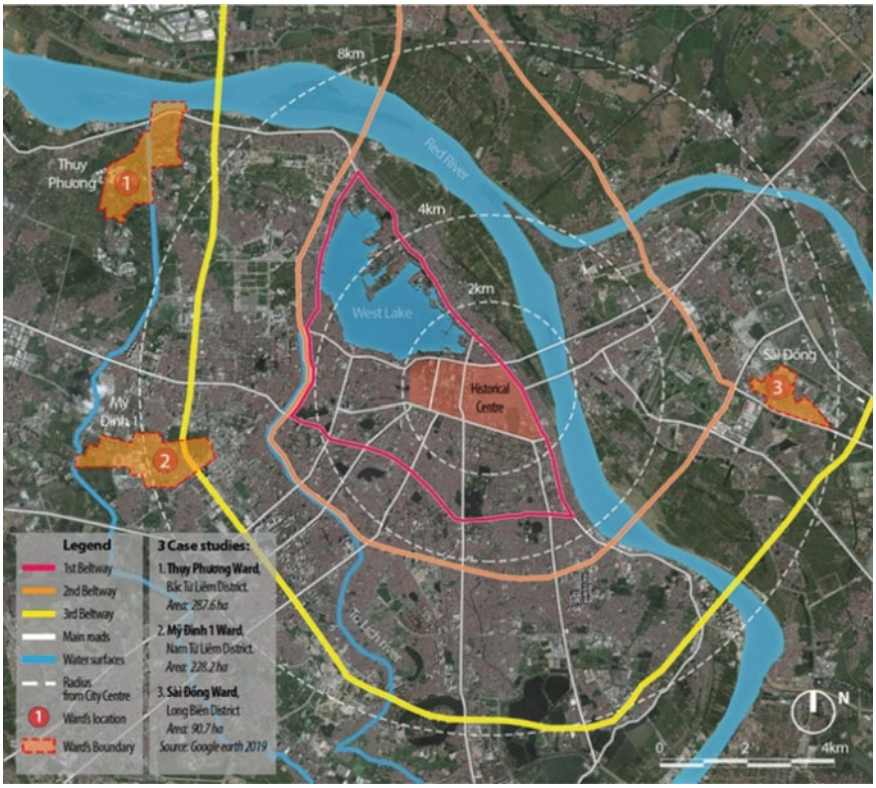


Fig. 1 Locations of three case study wards in the peri-urban areas of Hanoi: (1) Thuy Phuong ward; (2) My Dinh 1 ward; (3) Sai Dong ward

Phase one was conducted with observational surveys of all public spaces in the three selected wards. In total, 48 public spaces were systematically surveyed on one weekday and two weekend days between the end of December 2017 and the first two weeks of January 2018. This phase brought about a general understanding of the typology of public space in the periphery of Hanoi, which was useful for the next phase of the study. The types of public spaces were identified as follows:

Type A: Sidewalk or street with sidewalks and food stalls, tea shops, etc.;

Type B: Official public spaces (public park and gardens, playgrounds);

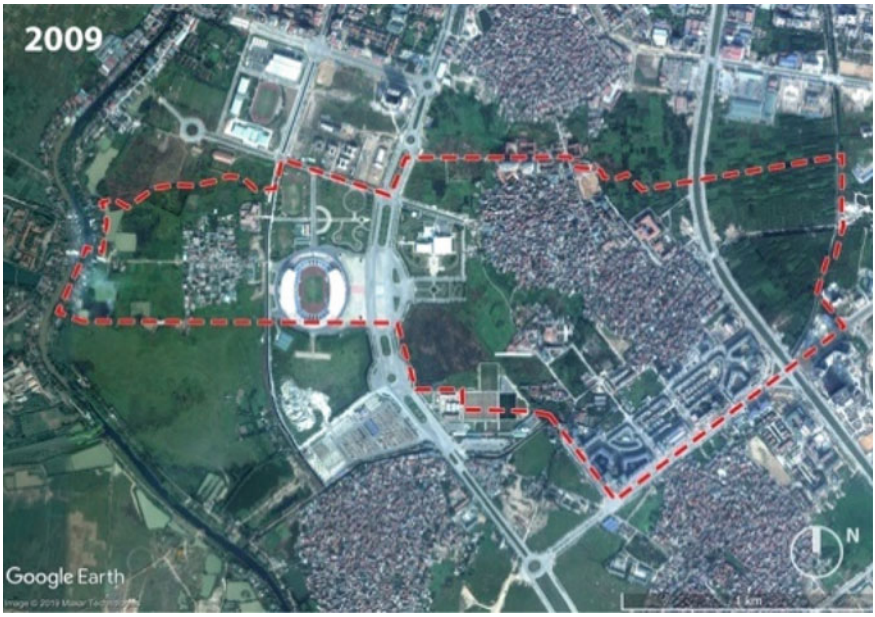
Type C: Yards within religious buildings (temples and pagodas);

Type D: Vacant land plots for other purposes, temporarily used as public spaces;

Type E: Designated recreational/sports space (football, volleyball, tennis, etc.)

Type F: Other (school yards and/or office yards used after 6:00 pm as additional public spaces to the official ones described).

Phase two was carried out on 14 public spaces selected from the 48 public spaces in phase one. The selection of respondents was based on the following criteria: demographic diversity of the users, as well as the typology, management, and ownership



a) In 2009

b) In 2019

Fig. 2 Urbanization of Thuy Phuong ward within 10 years from 2009 to 2019

a) In 2009

b) In 2019

Fig. 3 Urbanization of Thuy Phuong ward within 10 years—from 2009 to 2019

a) In 2009

b) In 2019

Fig. 4 Urbanization of Sai Dong ward within 10 years from 2009 to 2019

Table 1 Features of the selected study areas in the peri-urban region of Hanoi (*Source* Nguyen et al. 2019a)

Ward	My Dinh 1	Thuy Phuong	Sai Dong
Land area (ha)	228.2	287	91
Population (2017)	26,000	15,000	16,000
Population density (residents/ha)	114	52	176
Location	Periphery (ring road No. 3)	Periphery (outside ring road No. 3)	Periphery (between ring road No. 2 and ring road No. 3)
District	South Tu Liem	North Tu Liem	Long Bien
Ward's administrative establishment	2013	2013	2003
Major urban development period	In the 1990s	In the 2000s	In the 2000s
Original status	From three villages	From seven villages	Sai Dong town
Socio-economic characteristics	Public urban/sport services	Medium scale industrial production	Large-scale industrial production
Level of urbanization	High (> 70%)	Medium (50%)	High (> 70%)

status (private, state, community) and mode of use (temporary, permanent) of the public spaces. (Figs. 5, 6, and 7).

The observational surveys were carried out in the mornings and in the afternoons of one weekday and two weekend days. The observational survey form was designed to focus on the five factors for public space evaluation as discussed in Sect. 1.4 (inclusiveness, physical accessibility, comfort, meaningful activities, and safety). Details on the construction parameters for the PSEI incorporating these elements appear in Box 1.

In addition to the focus on the diverse age groups of public space users, the research team paid special attention to young users (aged between 16 and 30) for the questionnaire-based survey. The sampling number followed three rules as follows:

- First, the team aimed to conduct 120 questionnaires to youths in each of the three selected wards, approximately 24 questionnaires per selected site.
- Second, on each research site, the team tried to reach an equal number of male and female respondents.
- Third, the team administered the questionnaires during the two busiest periods of public space usage in Hanoi: weekday morning (5:30 to 10:30 am), weekday afternoon (5:00 to 8:30 pm), weekend morning (6:00 to 11:00 am), and weekend afternoon (4:00 to 8:00 pm).

All questionnaires were self-conducted on paper with the support of one well-trained research assistant during multiple site visits in September 2019. A total of 363 youth users were surveyed in the phase two. The questionnaires given to young

Fig. 5 Location of surveyed public spaces in My Dinh ward, phase two

Fig. 6 Location of surveyed public spaces in Thuy Phuong ward, phase two

Fig. 7 Location of surveyed public spaces in Sai Dong ward, phase two

users documented: (i) user characteristics (including their gender, original hometown, occupation, transportation mode used and travel time required to access the site, and visit frequency); (ii) activities practiced in the public spaces; (iii) respondent assessment of the site based on specific factors, such as accessibility to the site, openness of the site, potential to communicate or interact with other individuals or groups on the site, the most and least attractive elements of the site, and their overall expectations of public spaces for the youths.

Table 2 shows the number of public spaces investigated in two phases of the surveys conducted in the three peri-urban wards of Hanoi. The number of public spaces selected for phase two in each ward corresponded with the number of questionnaires to ensure accuracy and equivalence during the assessment.

Table 3 refers to the different types and quantities of surveyed public spaces in each ward for a comparative purpose.

Table 2 Data on three selected case study wards for phase one and phase two

Ward	My Dinh 1	Thuy Phuong	Sai Dong
Number of public spacessurveyed in phase one	18	18	12
Number of public spaces surveyed in phase two	5	5	4
Number of young users' questionnaire surveys in phase two	124	118	119

Table 3 Types of public spaces surveyed in phase one and phase two

Ward	My Dinh 1		Thuy Phuong		Sai Dong	
Types of public space	Phase one	Phase two	Phase one	Phase two	Phase one	Phase two
A: Sidewalk or street with pavements	5	2	6	1	2	2
B: Official public spaces(public park and gardens, playgrounds)	4	1	4	2	6	2
C: Yards within religious buildings (temples and pagodas)	3	–	2	–	–	–
D: Vacant land plots for other purposes temporarily used as public spaces	1		–	–	–	–
E: Designated recreational/sports spaces (football, volleyball, tennis, etc.)	4	1	2	2	–	–
F: Other (school yards and office yards) used after 6:00 pm as additional public spaces	1	1	4	-	4	–

3 Results

3.1 Significant Findings

Diversity

Public space users are quite diverse in terms of age groups: children, youngsters, middle-aged, and senior people all share the space. Among them, youngsters (aged 16 to 30) make up the largest part, particularly in My Dinh 1 ward. They are the majority group (95 out of 160—equal to 59.3% on one weekday and 161 out of 289—equal to 55.7% on one weekend day). In the other two wards studied, Thuy Phuong and Sai Dong, a similar situation can also be found (in Thuy Phuong: 30 out of 48—equal to 62.5% on one weekday and 45 out of 78—equal to 57.7% on one weekend day, and in Sai Dong: 60 out of 158—equal to 38% on weekday and 45 out of 111—equal to 40.5% on one weekend day).

It is notable that the number of young public space users on one weekend day in Sai Dong is lower than on one weekday, while it increases in the other two wards (My Dinh 1 and Thuy Phuong). Especially in My Dinh 1, a significant augmentation (62.1%) has been noted. The likely reason for a decrease in the case of Sai Dong ward is that many migrant workers from the neighboring provinces spend two weekend days visiting their families in their home villages. (See Figs. 8, 9).

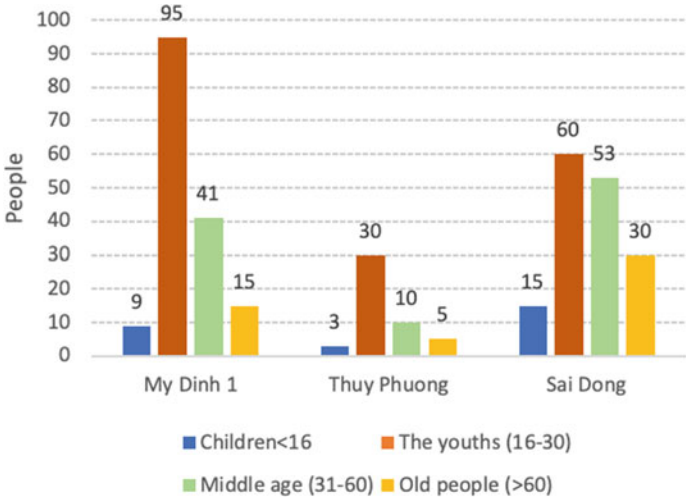


Fig. 8 Public space use by age: weekday

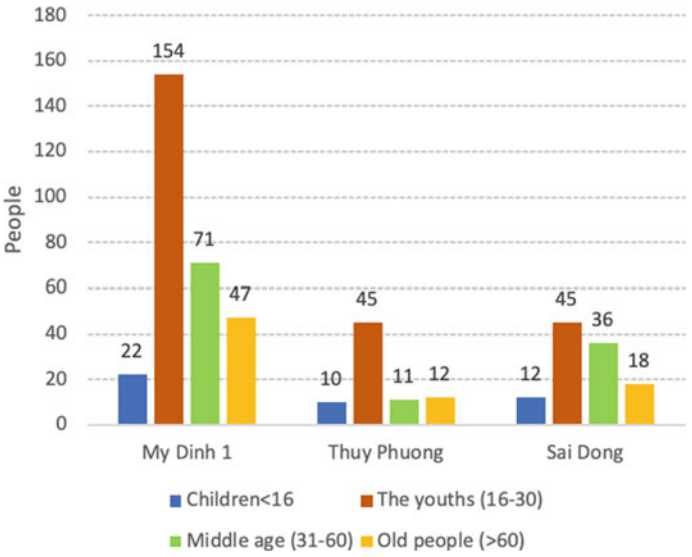
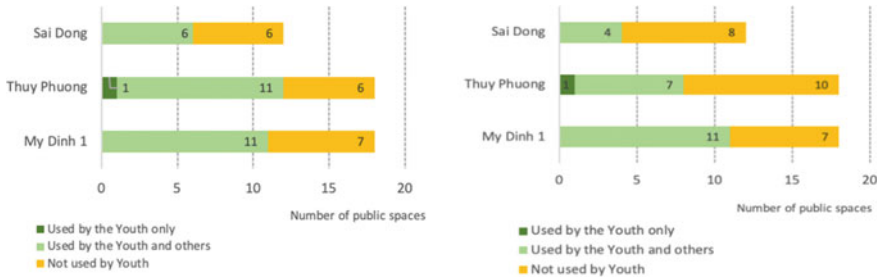


Fig. 9 Public space use by age: weekend days

Very few public spaces are targeted to the youth

The number of public spaces oriented toward young users is extremely low: one space in Thuy Phuong only. Most of the public spaces in use are shared by young users and other groups which may not be very convenient to them, because they cannot do whatever they want in respect of the other people, especially seniors. Furthermore,



a) Weekday b) Weekend day

Fig. 10 Patterns of public space use in three wards regarding young users

many other public spaces are available to but not used by youngsters because they find those places unattractive or inaccessible. In Thuy Phuong ward, for example, there are 11 shared public spaces and 11 others not used by youngsters (See Figs. 10a, b).

Types of activities

In total, 13 types of activities take place in public spaces in the three wards, ranked in decreasing order of the number of users. Sitting and relaxing (190), talking and chatting (179), eating and drinking (172), using smart devices (93), sports playing (75), doing exercise (49), doing creative activities (34), baby-sitting (17), shopping (7), selling goods (5), reading/self-studying (4), chess and card playing (0) (See Fig. 11). The most popular activities, according to the statistics, are the easiest things to do, not requiring any special conditions for designing a space or organizing the activities. For example, people can sit anywhere they want, on the sidewalks, on park benches, or even on grass. They can chat and talk with anyone, not only their close friends, starting with the simple greetings and continuing on to various topics that interest them all. Pavement iced tea shops and finger food stalls can be seen everywhere, especially in overcrowded places. Local people provide those services and find them to be a stable source of income.

Time of use and types of public space

The average time of using public spaces among youngsters is 55.6 min. However, it depends largely on the types of public space. Young users spend most of their time—76.9 min—playing sports and enjoying a certain kind of entertainment. The most popular sports include badminton, football, and tennis. Due to the lack of real public spaces planned in the neighborhood, some unofficial open spaces (such as inner yards of office buildings located inside the neighborhood) can be used after 6:00 pm for the local people to play sports. Some so-called official public spaces like parks, flower gardens, and wide sidewalks do not keep people occupied for a long time,

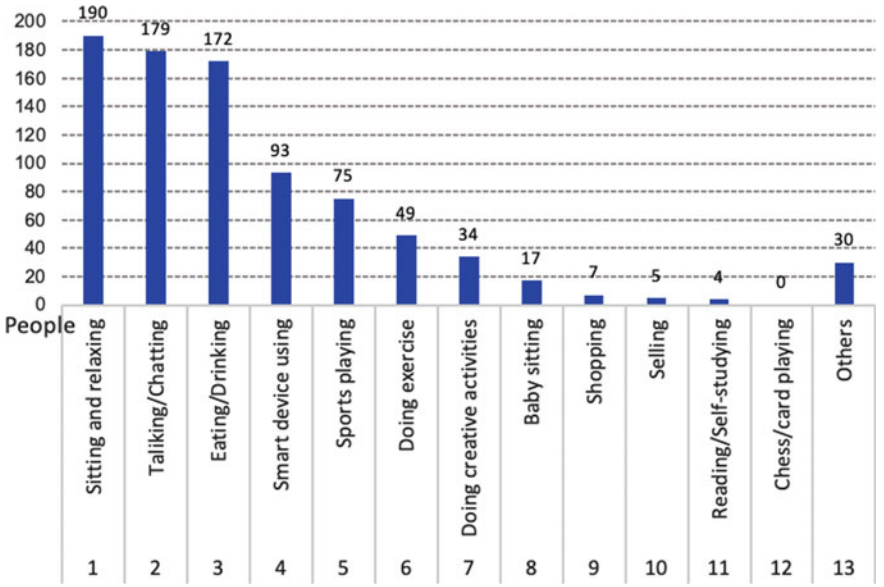


Fig. 11 Different type of activities in the public spaces

probably because they may feel uncomfortable or unsafe after a prolonged period, or the spaces do not meet the public's demand for design quality and/or sanitation (See Fig. 12).

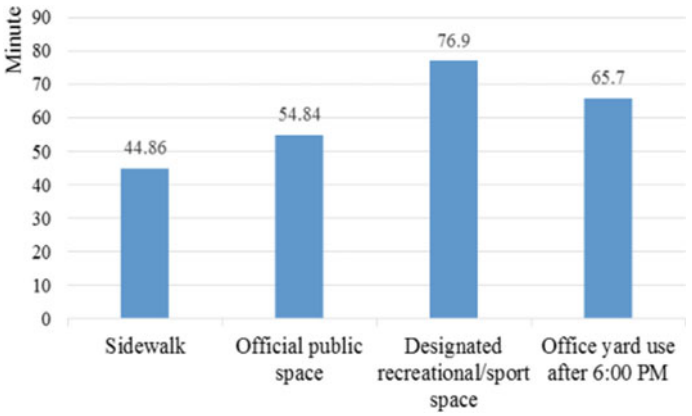


Fig. 12 Average duration of time spent at different types of public spaces

3.2 Evaluation Results of Public Space Quality Based on Public Space Evaluation Index - PSEI

Table 4 and Figs. 13 and 14 show the evaluation results of public space quality in three selected wards on one weekday and two weekend days based on five key aspects and twenty-two criteria as demonstrated in Box 1.

It is extraordinary that public spaces in My Dinh ward are evaluated as "better quality" in all five aspects when compared to the two other wards. The qualities of public spaces in Thuy Phuong and Sai Dong are much lower.

The aspects of accessibility in all three wards could be evaluated at the highest score in comparison with other aspects. Some aspects were given low scores by users, such as the lack of suitable spaces for meaningful activities and the lack of inclusivity for certain groups of users, especially young migrant females. In Sai Dong ward, public spaces do not offer many meaningful activities for young users on both weekdays and weekend days. In Thuy Phuong wards, inclusiveness is evaluated with the lowest score for the public spaces available.

3.3 Critical Issues

The gender imbalance of public space users, especially among the youths

In all three peri-urban wards, on one weekday and two weekend days, the number of young male users far exceeds the number of young female users. The results from in-depth interviews of young females reveal some reasons why they did not want to stay in public spaces: They have little time for relaxing or entertainment after work since they have to do a great deal of housework and take care of their children; there are very few public spaces near their living places that are easily accessible; and most of the public spaces are not suitable or comfortable for migrant females to use (Fig. 15).

Public spaces are not well planned or designed to facilitate physical and mental activities and can therefore hardly enhance social interactions among young people.

Most of the activities performed in the public spaces in peri-urban areas are simple and easy, for instance, eating or drinking in street cafes or tea shops, or sitting and using smart devices. There are not many interesting activities organized for different groups of users. A lack of comfortable spaces for relaxing, reading books, or playing chess, as well as creative games was noted in the survey results. Moreover, a need for interactive spaces for different age groups that allow individuals to come together (i.e.: places for meeting, chatting, and/or playing together) must be taken into account in future planning.

Less attractive elements of public spaces

According to the questionnaire survey results, there are 10 elements that make the public spaces in the three peri-urban wards less attractive, six of which were given in

Table 4 Results of the Public Space Evaluation Index (PSEI) for 14 public spaces in three wards: My Dinh 1, Thuy Phuong, and Sai Dong, in the peri-urban areas of Hanoi

Surveyed ward	Public space typology	Inclusiveness		Perceived accessibility		Meaningful activities		Comfort		Safety	
		WD	WE	WD	WE	WD	WE	WD	WE	WD	WE
My Dinh 1	Official public space	10.5	14.0	16.0	16.0	11.0	13.3	9.5	8.8	10.0	10.0
My Dinh 1	Designated recreational/sports space	4.5	11.3	14.0	14.0	11.0	11.3	13.0	12.5	12.0	12.0
My Dinh 1	Sidewalk	10.5	14.8	10.0	10.0	11.0	11.3	11.0	11.0	14.0	14.0
My Dinh 1	Sidewalk	10.5	13.3	15.0	15.0	11.0	11.3	11.0	11.0	14.0	14.0
My Dinh 1	Office yard use after 6:00 pm	6.0	2.5	10.0	10.0	8.0	8.0	8.5	9.5	6.0	6.0
Sai Dong	Official public space(Public park)	10.5	12.8	13.0	13.0	4.0	3.0	9.0	8.5	13.0	13.0
Sai Dong	Official public space	6.5	9.3	13.0	13.0	4.0	4.0	11.0	11.0	9.0	9.0
Sai Dong	Sidewalk	11.0	13.8	16.0	16.0	5.0	5.3	4.0	4.0	4.0	4.0
Sai Dong	Sidewalk	11.0	13.3	13.0	13.0	11.0	11.3	7.0	6.8	10.0	10.0
Thuy Phuong	Official public space(Public park)	7.0	13.8	16.0	16.0	19.0	19.3	11.0	11.0	10.0	10.0
Thuy Phuong	Official public space (Public park)	12.0	10.3	13.0	13.0	4.0	4.0	6.5	7.0	9.0	9.0
Thuy Phuong	Designated recreational/sports space	3.5	5.0	13.0	13.0	8.0	11.3	6.0	6.0	8.0	8.0
Thuy Phuong	Designated recreational/sports space	2.5	4.8	14.0	14.0	7.0	7.3	4.5	4.5	11.0	11.0
Thuy Phuong	Sidewalk	6.0	11.5	11.0	11.0	11.0	11.3	9.0	9.0	12.0	12.0

Note: WD: Weekday, WE: Weekend

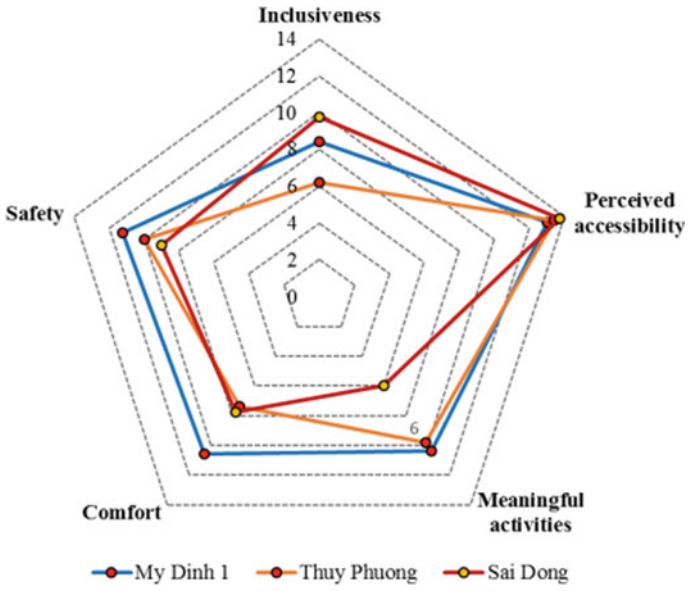


Fig. 13 Quality evaluation of public spaces in three wards on one weekday

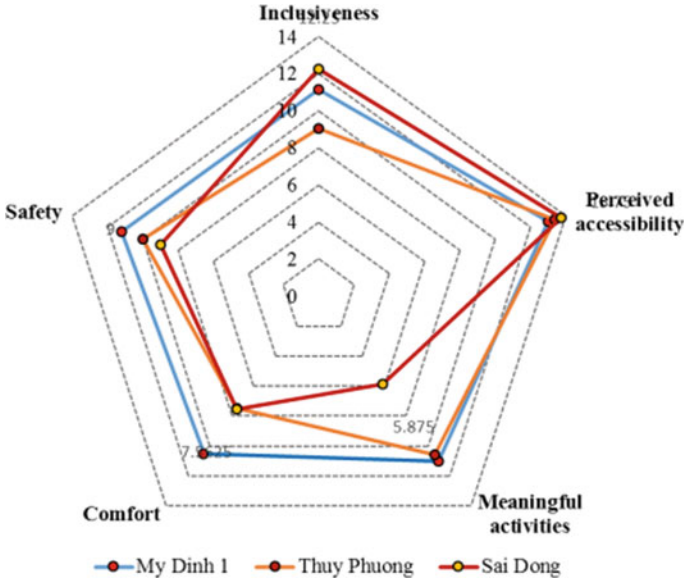
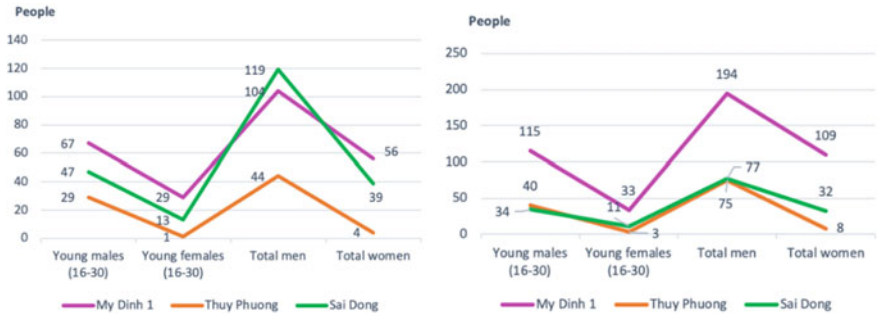


Fig. 14 Quality evaluation of public spaces in three wards on two weekend days



a) Weekday b) Weekend days

Fig. 15 Public spaces use by gender

the form of complaints by most of the users: the lack of meaningful and interesting activities, poor landscape design, lack of equipped facilities, boring spaces, poor ventilation and polluted environment, and public spaces that are only accessible through a fee. Resolving all of these issues should be seen as critical to the future success of the public spaces and should guide improvements to secure a better quality space and higher level of attractiveness to the users.

4 Discussion and Recommendations

4.1 Discussion

In peri-urban areas of Hanoi city, as analyzed in three typical case studies of three typical living quarters, it is apparent that public spaces have not yet met the local people's demands for both space and activity. With regard to migrant workers, as found in Sai Dong ward, the problem becomes even more critical. In all the three wards, young people (aged from 16 to 30) are the majority group of users, but the public spaces available currently fail to meet their needs, either because of the poor design (not attractive enough) or the activities (not so many or not as frequently organized as expected). In addition, some social and psychological issues have to be taken into account, as some migrant workers have not yet been regarded as real residents, and they are not invited or encouraged to share the public spaces with the local people. In some areas, the local people are open, but the migrant workers close their minds and feel hesitant to join the activities. In all the three wards, many places have the potential to be developed into attractive public spaces, but they are currently largely ignored. That situation can be called "potential but insufficient on spot." Quantitatively, the public spaces in each ward should be re-considered and re-developed in order to meet future demand, when the population grows and more migrants come to live and work, either temporarily or permanently.

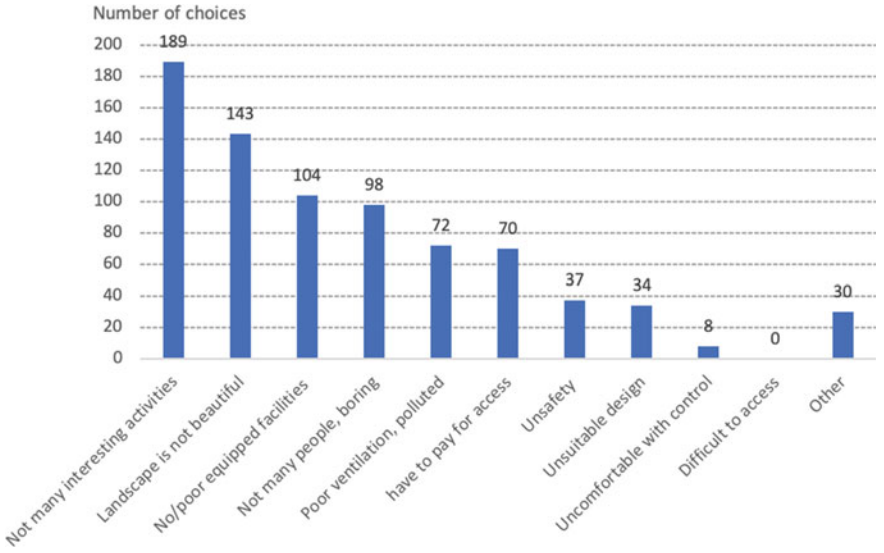


Fig. 16 Reasons why public spaces are unattractive to the public in three wards: My Dinh 1, Thuy Phuong and Sai Dong

The quality of design for public spaces is another crucial point. To date, only a few public spaces developed by private investors (and users, therefore, have to pay for access) are properly designed, meaning that they include sports centers (with tennis courts) or entertainment houses. It is obvious that these spaces are indoor or half-outdoor. The other public spaces (real outdoor ones) are still poor in terms of design as a consequence of inadequate investment in both concept and finance, as well as in management and maintenance. As demonstrated in Fig. 16, the low quality of public space design is responsible for the fact that many people feel unsatisfied and would rather stay at home or go somewhere else, when poor landscape (143 respondents), no facilities (104 respondents), and unsuitable design (34 respondents) are combined.

Public spaces offer good opportunities for people to get to know one another (as the first step), to join hands in common activities, and then to reach a common goal (at the highest level). When residents know one another well enough or meet up quite often, at least once a week, they will be ready to share thoughts, feelings, and experiences; to exchange ideas and information; and eventually to discuss some issues together and to cooperate with one another on some community-based projects. Public spaces will also enable social integration, which Internet-based networks can never replace.

Should unofficial public space be accepted as "real" public space in Hanoi? This is a question that needs to be raised and re-considered. In fact, those public spaces are used daily, and somehow they enhance their own values in the eyes of the local people, especially those living in quarters with a high building density. For example, the inner yards of local people's committee offices or schools may be open in the early morning (until 6 am) and late in the afternoon (after 6 pm—until 9 or even 10 pm),

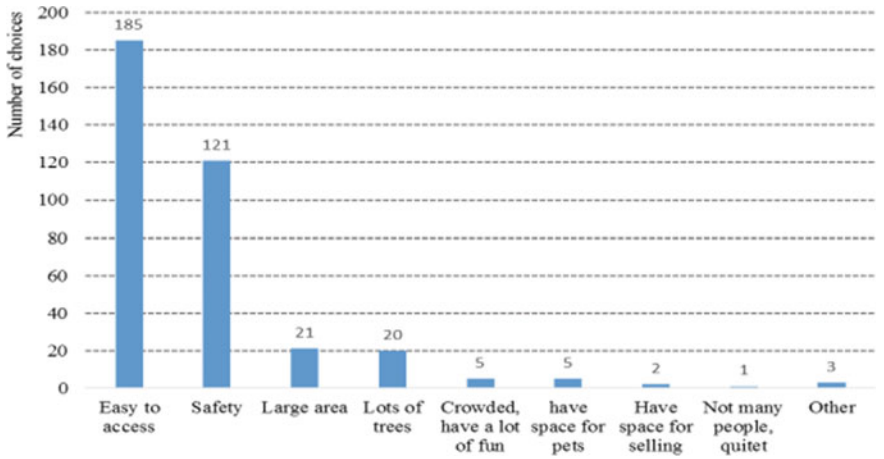


Fig. 17 Users' expectation of the qualities that a public space should offer them

so that local people can exercise, play sports, and simply go for a walk. This can be done by means of a negotiation between the authority and the community, and the community should make and keep a commitment to upkeep in using those unofficial public spaces. Another case of unofficial public spaces is vacant land plots between blocks of houses; if they are still not used for farming or another specific purpose, they can be developed into playgrounds or living quarter mini-parks, in addition to the official public spaces as planned. In this case, the authorities may let local people manage those places, giving the local people's committee the responsibility of monitoring the landscape, equipment, and especially the activities in those public spaces from afar (Fig. 17).

4.2 Recommendations

All the potential places that have been unused or not properly used so far should first be re-developed by the local authorities and professionals along with the local residents themselves to serve the local people, including immigrants. Furthermore, illegally occupied public places being restricted for private use must be reclaimed or re-acquired and then turned into well-designed (in view of space) and well-organized (in terms of activities) public places. Still on top of quantity, the networking of public spaces should be a key point of focus. Many medium-sized or small-sized but well-connected public spaces (either in a chain or in a network) are better than one large public space, even when it is centrally located.

In order to improve the quality of public spaces and fix the problem regarding the irrational use of public spaces so that public spaces can serve the people as best as possible, there should be a change in mindset and particularly in design

thinking. As the survey outcomes have already pointed out, the diverse needs of the groups of people who use public spaces and their activities, there can be regarded as important input of the whole design process. In Sai Dong ward and Thuy Phuong ward (adjacent to Nam Thang Long Industrial Park and Sai Dong Industrial Park, respectively), there is a large community of young migrant workers in each place. They need social integration and interaction. Without well-designed public spaces and well-organized common activities, they might never become an integrated part of the local community.

Public spaces do not only exist in physical spaces with intentionally designed specific functions but also take the form of spaces created and designed by users, as Koh (2007) already emphasized. In this regard, it is necessary to change the current perceptions and approach methods to make full use of the social significance, diversity, flexibility, and sustainability of urban public spaces, especially the those in suburban areas where the development is dynamic and potential for systematic urban development can be found. Place making should be integrated into spatial planning and design. Existing public places need to be renovated and upgraded to satisfy many groups of young and elderly people. It is recommended to offer them attractive spaces which are expected to encourage creativity and strengthen social interaction and cohesion. Then, all the social sources available for the public space will be mobilized. Apart from financing, good ideas and concepts from the community (not only from professionals) can be put into practice along with their responsibility for, commitment to, and attachment to the spaces.

5 Conclusions

The research analyzes the characteristics of various types of public spaces in three selected peri-urban wards of Hanoi City experiencing the impact of the rapid urbanization process. By using observational and questionnaire surveys, the research shows some significant findings, such as the diversity of users and the fact that youngsters make up the largest group of users; that very few public spaces are targeted to youths; that the diversity of activities in the public spaces has not yet been considered; and that the most popular activities performed in the public spaces could be better organized. The research also highlights the relation between time of use and types of public spaces. By using PSEI as an effective tool, the research evaluates the quality of public spaces in three selected wards on five major aspects (inclusiveness, accessibility, meaningful activities, and comfort and safety). Generally, the quality of peri-urban public spaces is assessed at an average level, in which accessibility is given the highest score from the users in all the three wards. However, meaningful activities and inclusiveness are not so well rated by users in Thuy Phuong ward and Sai Dong ward. The critical issues are explored from the research as follows: the gender imbalance among users when males are dominant in the peri-urban public spaces, the poor design quality of public spaces, and the lack of equipment as well as facilities that has led to another lack of suitable spaces for various meaningful

activities. Additionally, there are some attributes of the current public spaces in the peri-urban area that make them less attractive to users, such as the lack of interesting activities for target groups, inadequate landscape design, the lack of equipment, boring spaces, poor ventilation, unsafety, and entrance fees. The four factors that users expect from public spaces in order to increase its attractiveness are given as follows: 1. Public spaces should be accessible and close to resident settlement areas; 2. public spaces need to be safe, especially for women and children; 3. public spaces should be large enough for many more facilities to be installed and used; and 4. public spaces should have more shade trees to improve comfort conditions.

The research results also consolidate some principles for future planning and development of public spaces in peri-urban areas. Firstly, public spaces should be planned and developed so that they are close to existing residential areas and industrial workers' apartments, within a short distance so that people can walk there quickly and easily, and to ensure safety whenever anybody wants to go to these public spaces. Secondly, public spaces should be carefully investigated and designed to bring physical comfort to users in hot and cold weather. Thirdly, public spaces should be organized to provide more spaces for meaningful activities that attract a larger number of people, especially young people, to enhance social interactions among different age groups.

Like other developing countries in Asia, under the impact of urbanization, a vast amount of land in peri-urban areas of mega-cities in Vietnam has been changed into new urban development areas or industrial zones while the land demand for public spaces is not regarded by local authorities, investors, and planners. In some new urban development areas, the land plots initially planned for public space are not developed or changed for other purposes. Meanwhile, with the population growth and the increase of young migrant workers, the need for public spaces is becoming increasingly urgent. Therefore, this research also raises a critical question for local authorities and investors: Should they invest in urban planners who pay more attention to the planning and development of urban public spaces to ensure quality design and maximize user satisfaction?

Some limitations are worth mentioning in this research. The survey sample and sites do not represent all groups of users, nor all public space in the peri-urban areas of Hanoi. In addition, the team did not survey in detail all types of public spaces in each ward because of limited funding and time for observations and questionnaire surveys. Moreover, the seasonal and holiday variations in the use of public spaces could be an obstacle to accurate observation. For example, the religious buildings are opened publicly during festival seasons (which coincided with the phase one survey), but they were closed during the phase two survey. Another key point is that activities in public spaces depend on the weather. Under the extremely hot weather of the survey time in phase two, some activities did not take place at all.

Despite such limitations, the first findings of this research make an important contribution to depicting an image of public spaces in the peri-urban areas of Hanoi. This research is regarded as the first bold step to further studies, which will help improve the quality of public spaces to better serve the needs of local communities.

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Land Commodification and the Changing Landscape of Peri-Urban Villages in Hanoi, Vietnam

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Abstract Under the processes of urbanization, globalization, and marketization after economic reform, peri-urban villages in Hanoi are now "becoming urban" and witnessing significant changes in their spatial organizational structure. With the inflow of new migrants and the transactional activities of space, the spatial density and population in the peri-urban villages are rapidly increasing. This process witnesses the transformation from living spaces associated with agricultural livelihoods toward a new type of urban housing. At the same time, traditional and locally significant public spaces have been gradually reduced and invaded. We argue that the disorder in the landscape is being created by a rapidly changing market and urbanization dynamics in the production of space. Furthermore, the regulations which maintain the order of space have evolved from informal institutions, such as "the village's rules," to the new logic of land commodification in the Doi Moi era. Our fieldwork for this project reveals a fierce competition for limited land resources, a lack of clarity in the boundaries of property rights, and the inability of the local government to maintain spatial order in peri-urban villages. A case study of Trieu Khuc Village in Hanoi shows this transformational process of spatial production and reveals the challenges for future planning and urban management in Vietnam.

Keywords Land commodification · Production of space · Peri-urban village · Value of space · Property rights · Hanoi

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1 The Context of Spatial Development in Peri-Urban Villages in Vietnam

Traditional villages in Vietnamese society once embodied economic independence and self-governance, constituted by a society associated with agricultural production (Pham 2000). Under the rapid urbanization process, the peri-urban landscape has witnessed a social and spatial transformation from traditional villages to urbanized villages. The concepts of "villages in the city" or "urbanized villages" have frequently appeared in academic publications in Vietnam to describe the spatial phenomenon in peri-urban areas, where the villages were passively assimilated into the urban structure derived from the expansion of the cities. The creation of a "village in the city" is the process of rural settlements becoming part of the city as open communities with urban economic, cultural, and governing attributes. This open-type model is very different than the enclosed-type of traditional villages. The spatial structure of the peri-urban village is continuously changing, increasing in both construction and population densities, which has caused many issues in the quality of the living environment and challenges when it comes to governance.

The pace of urbanization in Vietnamese cities has been driven by processes of industrialization and marketization, which have influenced the flow of labor and migration into the cities. At the same time, the land transactions and development activities are happening in both a top-down and bottom-up manner. The peri-urban area, with abundant land resources, has become an attractive destination for large-scale urban projects such as industrial parks, new urban areas, and infrastructure development, which are led by a growth coalition between government and developers. The process of urban development has led to a sharp reduction in agricultural land in peri-urban areas, which have been converted into urban and industrial spaces. According to the Hanoi general statistical Yearbook, the total area of agricultural land has decreased from 192,720 ha (57.6% total urban area) in 2008 to 174,429 ha in 2020 (51.9% total urban area).

Traditional villages in the peri-urban areas, once associated with agricultural society, are now facing a large amount of land loss caused by the development of the surrounding area, and many villages have been surrounded by new urban patterns that include new urban areas, shopping centers, or industrial clusters. With a long-standing culture of rural communities, traditional villages represent a popular residential settlement phenomenon. Under land redevelopment in the peri-urban area, the villages haven't been demolished or relocated by the state and developers, but, in general, their spatial structure is rapidly transforming toward a high-density built environment. Population density in the urbanizing villages is also rapidly increasing from approximately 150 persons/ha to 300–500 persons/ha, about 2.5 to 3 times higher than the original density of the village (Pham 2000). Moreover, the social structures of these peri-urban villages are also transforming from the closed social relations between intimate neighbors to a more open system that integrates social groups, including old villagers, migrants, farmers, blue-collar and white-collar workers, and students.

Recent studies in Vietnam have discussed some of the spatial issues in peri-urban villages, such as the destruction of traditional village space, the disorder caused by new construction, and the impacts of increasing density. Taken together, these factors are negatively impacting the quality of life and the living environment of the residents. Some scholars have pointed out that governance issues, such as failure to control spatial development in the peri-urban villages, have been caused by informal land development (Nguyen 2016; Nguyen et al 2018). Other researchers have analyzed the relationship between spatial development and living quality in these villages (Fanchette 2016; Ngo and Yun 2018). The mechanism of spatial transformation and uncoordinated development in peri-urban villages continues to attract research attention. Scholars from both inside and outside of Vietnam have adopted different perspectives to explain the mechanism of these spatial effects. For instance, it has been argued that the passive transformation of livelihood caused by agricultural land loss has affected people's opinions regarding construction behavior (Fanchette 2016; Labbé 2011). Besides, the housing need for migrants is considered to be a major driving force for the informal land market in peri-urban areas where villages have provided affordable housing. On the other hand, the income from land trading and rental housing have become new sources of livelihood for indigenous households (Hoang et al. 2018; Fanchette 2016). Under the lens of urban governance, the weak capacity of the local government has led to widespread illegal construction and violations of spatial development control in peri-urban areas. Nguyen Van Suu observed that the mistakes of local authorities lead the residents to spontaneous actions such as encroaching upon public spaces for housing purposes (Nguyen 2007). Danielle Labbe also pointed out the contradictions in self-management of traditional communities with the new regulations of the local state, which have led to conflicts in the production of space (Labbé 2011). From the aspect of social relations, Pham Hung Cuong proposed the concept of "Porous Urban" (*Đô thị xốp*), referring to the typical phenomenon of the Vietnamese urban village, which endures complex social relations and spatial components (Pham 2000). Alternatively, spatial transformation of the peri-urban villages is also influenced by the construction activities of the migrants, who do not share the local culture of the communities and tend to maximize their benefit from development and transactions while failing to protect traditional values. However, due to low capital investment and poor construction techniques, many informal buildings do not meet basic architectural standards, causing a chaotic village landscape (Ngo and Yun 2018).

2 Land Commodification and Changes in the Value of Space

Overall, previous studies have analyzed the changing landscape of peri-urban villages from various angles and have pointed out the disorderly effects of spatial development in these areas. However, they have inadequately examined the relationship between

land market formation and the changing value of space. Moreover, they have failed to question how these changes impact the production of space in peri-urban villages. This chapter undertakes an in-depth analysis of the changing mechanism of spatial production from traditional rural villages to urbanizing villages. It also argues that the mechanism to maintain the order of space in traditional villages, *Hương ư´ơc*, which can be translated in English to "The Village's Rules," has now been replaced by the new rules of spatial production and transaction in the market economy. In short, land and space have become tradable commodities and their exchange value has surpassed their use-value.

During the planned economy period from 1976 to 1986, Vietnam's land-use system was built on a foundation of collective ownership. The land was freely allocated to users by the state, while transactional activities were strictly controlled by the government; the land market did not exist during this time. People could have access to land in the form of family inheritance, and they were also allocated land by the state or agricultural cooperatives without paying land-use fees. In both urban and rural areas, the value of land was only attached to its use-value as a means of production or a space for daily life. The state used its administrative power to restrain the formation of the land market. As a result, the exchange value of land had been suppressed, and surplus value from land rent could not be realized.

Although, in the planned economy period, the exchange value of land could not be realized due to the control of the state, the hidden potential of exchange value existed. In the conditions of underdeveloped infrastructure and transport systems, urban land values were also impacted by the location of projects and surrounding infrastructures. Although the state allocated land to state units without levy land-use fees, the state units were required to apply for land-use allocation, and they had to compete to be able to access land plots with better infrastructure and location. In rural areas, the hidden potential of the exchange value of land was lower than those in urban areas. There were still value gaps between rural and urban land, but the difference in land rent could not be exploited through transactional activities.

Since the Doi Moi reform in 1986, along with the recognition of the state's role in the market economy, the land-use institutions in Vietnam entered the reform process, and the state had also recognized trading rights of land-use and housing. Since then, the exchange value of the land has been realized through transactions on the market. The competitive rules of the market also reflect the gaps in rent values between different land types and different locations. Besides, the differential rent between urban and rural areas creates enormous profits in the land conversion process, which significantly benefits the government, developers, and landholders. The hidden potential of land value in peri-urban areas has been realized, making this area the space for capital flows, accumulation, and spatial expansion generating the surplus value. This value is the driving force behind top-down urbanization and land redevelopment in peri-urban areas.

Land development and transaction activities in peri-urban villages are excellent examples of land commodification and the changing value of space. In traditional rural villages, the production of space was associated with agricultural livelihood while the spatial order was controlled under the village's rules. Contrarily, in the

urbanized village, market logic and housing needs have deeply changed the value of space; the exchange value of space is promoted, contributing to the income of the landholders. The process of spatial transformation in peri-urban villages will be discussed below.

3 The Use-Value of Space and the Village's Rules in Traditional Villages

Traditional villages had long been communities for Vietnamese farmers with special values of landscapes, societal organizations, and folk regulations. During the feudal times, when the state could not intervene in every community, the rural villages were always autonomous and self-governed. The social and spatial orders of each village were maintained through the rules and regulations called "the village's rules" (*Hương ước*). An old folk saying, "Village's customs rule the law" (*Phép vua thua lệ làng*) has been used as evidence for the self-governance of traditional villages. The village's rules regulated many aspects of the village's activities, such as social organizations, religious activities, and the responsibilities of its members to preserve the public landscapes and temples. The construction activities of the village's members were observed by other members, and the conflicts between villagers were usually resolved by the village council, not the local government.

Traditionally, the spatial organization of a village is formed around a symbolic landscape or architectural feature, agricultural activities, and folk beliefs connected to the land. These spatial factors are governed and maintained through "the village's rules," which are informal institutions that the community's members must follow in order to recognize and protect the whole village. It is an honor for each individual to be "a villager," and the production of space is based upon a complex system of social relationships.

For example, visually, a traditional village is attached to its architectural elements; each village is a closed community surrounded by a bamboo hedge, which becomes a strong wall and protects the village from aggression, wild animals, and invaders. The village's center is usually a public space such as a communal hall (*Đình làng)* and the entrance to the village often has a gate (*Cổng làng*). Symbolic elements pervade the villages, such as the pagoda (*Mái Đình*), the Banyan tree (*Cây Đa*), and the village pond (*Ao làng*). The village's rules regulate that the young men in the village are responsible for protecting the properties and the safety of the whole village.

The organization of the village's space is closely related to agricultural production, which is reflected in both private and public spaces. Given that rural areas were often sparsely populated, private housing was often low-rise, consisting of single- or two-story structures with large yards. A typical combination of housing in rural villages normally includes a leading house, auxiliary house, drying yard, gardens, ponds, and wells. This model of housing has a common characteristic that combines the functions for living and production, such as a yard for drying agricultural products,

poultry-yard, and fishponds. The village's rules also emphasize the importance of "farm work as a root" (*Việc nhà nông là cái gốc l´ơn*) and thus the need to protect the land used for agricultural production and enforce its regulations on the space. For example, the village's rules of Quynh Doi Village in Nghe An province, regulate that: "The village does not allow fruit-planting areas in the field to be abandoned and those who let the field become idle land must be fined."

4 The Exchange Value of Space and Spatial Activities in Peri-Urban Villages

The rapid urbanization process in Vietnamese cities has made a profound impact on both the spatial and social structures in peri-urban areas. Traditional villages previously associated with agricultural production and handicraft industries have now been absorbed into the emerging urban structure. Along with the development of industrial parks and new urban areas, a large amount of agricultural land has been converted for urban uses, resulting in the loss of the means of production that directly affects the long-term livelihoods of local farmers. This development process has destroyed the traditional spatial forms that were based on the productive nature of an agricultural society. In its place, a new landscape pattern has emerged in the villages of the peri-urban areas. This new pattern is based on the new social structure and the logic of land commodification. New interest groups have emerged and actively participate in activities that bring about new spatial patterns. Among them, two interest groups that play active roles in the production of the informal spaces include: (1) indigenous farmers and residents who have lost their agricultural livelihoods but still own residential and other land; and (2) migrants, who move into the villages looking for local employment and housing opportunities.

The first interest group of indigenous residents is an important player in the spatial production process because they have the double advantage of occupying most of the local land, as well as maintaining pre-established, complex social relationships with other members of the community. Because the current regulations of land conversion and compensation do not allow the farmers (who have lost land) to share the profits from land development with the state and investors, it is hard to satisfy them; they have lost their agricultural livelihoods.

However, the urbanization process also creates new economic opportunities for the indigenous people, as they can find new jobs and new sources of income in the informal economic sector.[1] In addition, construction activities and land transactions also serve as a great source of income. Along with the agricultural land, the villagers also hold garden land, homestead land, and private farming land (*Đất phần trăm*). Ownership of these lands can be their prime capital when entering into a post-agricultural life and becoming the privileged group participating in the inland

[1] Such as jobs in industrial parks and new urban areas or sidewalk food services, grocery stores, maids, etc.

construction and transaction activities. As a consequence of the flow of migrants into peri-urban areas, the construction activities and transactions of land pieces and housing have created a vibrant housing market in peri-urban villages in parallel with the formal housing market dominated by real-estate developers. The indigenous villagers rely on their land resources for these construction activities, business transactions, and rental housing for migrants. Utilizing the advantages of the previously occupied land, the indigenous villagers thus obtain profits from the production of space through construction, operation, and transactions based on land ownership.

The migrants, on the other hand, get directly involved in the construction, transaction, and consumption of space in peri-urban villages. This interest group is composed of diverse social components, including low-income and middle-income households, migrant workers, farmers, and students. Their arrival raises the demand for local housing, but because of their limited economic capacities, renting or buying houses from the local people is often impossible. Moreover, while some migrants agree to buy undocumented housing (or land plots) to reduce costs, others get involved in illegal housing activities, such as illegally occupying, building on, or selling houses involving land. In practice, many migrants are not only the tenants and consumers of space owned by indigenous people, but they also get directly involved in the occupation and transaction of the space.

Spontaneous activities in spatial production and transaction are part of the commodification process under the formation of the land market. For indigenous groups, these activities are also spatial strategies to maximize profit or gains from urbanization. Although land acquisition for urban development has caused agricultural land loss and taken away certain traditional livelihoods, the urbanization process has stimulated the value of land and created new sources of income. The advantages of previously owning local land and space have placed the local farmers in a preferable position compared to the migrants in the production of space. When a traditionally enclosed society, associated with agricultural production, has been replaced by a more open and urbanizing one, the spatial forms of villages and housing in peri-urban villages are also quickly transformed. The value of space is not limited by its use-value; on the contrary, the exchange value of space brings a direct source of income that gradually dominates the logic of spatial production. The phenomena of land subdivision, the construction of multi-story buildings, illegal occupation, transaction, and rental spaces have reflected these fundamental changes in the value of space. The peri-urban land is quickly occupied by people and divided, maximizing construction density and thus setting up a process of transformation for the landscapes within the peri-urban regions.

5 A Case of Spatial Development in Trieu Khuc Village

Trieu Khuc Village, formerly belonging to the Tan Trieu commune in Thanh Tri District, Hanoi, is currently a ward of Thanh Xuan District, Hanoi (Fig. 1). During the French colonial era, this village was the "most important center of the textile

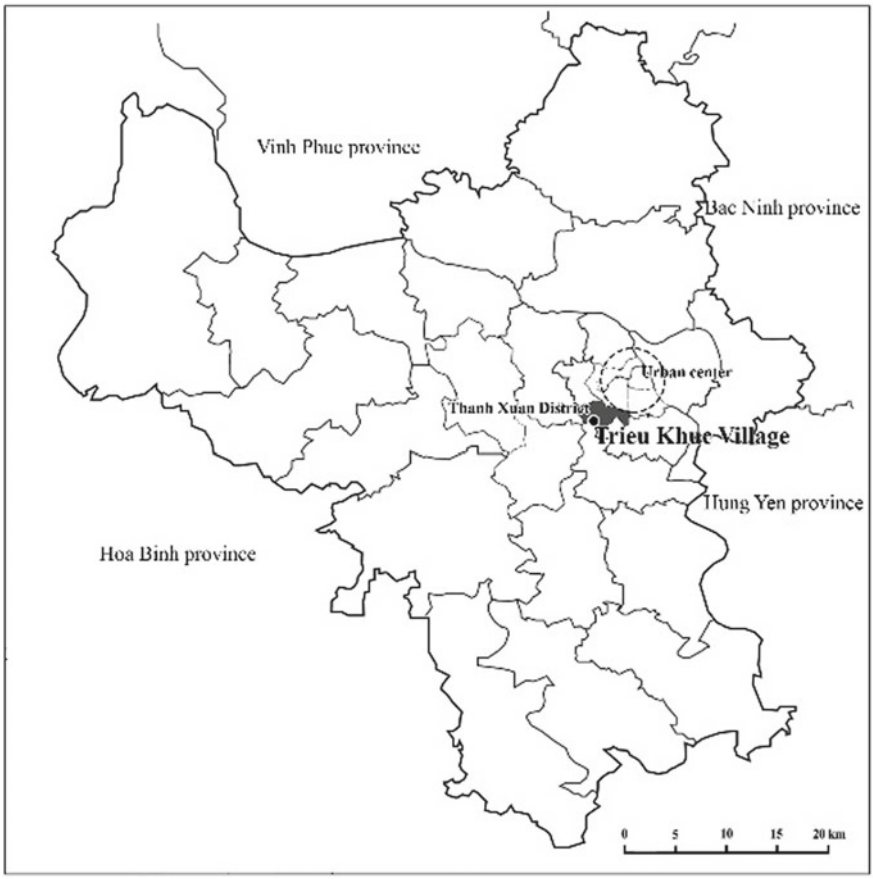

Fig. 1 Location of Trieu Khuc Village on Ha Noi map

industry in the Northern Delta of Vietnam (*B´ăc Kỳ*)" and was mentioned by Gourou in the book *The Farmers in Bac Ky Delta* (*Ngu`ơi nông dân châu thổ B´ăc Kỳ*) [10]. After nearly ten years from the expansion of Hanoi in 2009, the traditional village of Trieu Khuc, which is associated with textile industries and agricultural livelihood, has been dramatically changed under the rapid process of urbanization and marketization (Fig. 2).

5.1 Changes in Social Structure and the Landscape

During the urbanization process, the structure of the population in Trieu Khuc underwent significant changes, increasing from 820 households with a total of 4220 people in 1992 to 1552 households with 8380 people in 1999. By 2011, according to data

Fig. 2 Satellite images of Trieu Khuc Village in 2002 **a** and 2018 **b** (*Source* Google map)

from the Commune People's Committee of Tan Trieu, Trieu Khuc Village had 3651 households (about 18,357 people), with a density of 9178 people/km^2 (4.5 times higher than the average density of the Hanoi City in 2011) (Tran, 2015). The population increased to 26,000 people in 2015, approximately 11,000 of which were migrants, comprised mostly of students and workers (Tran, 2015).

Agricultural production and handicraft industries, such as producing recycled plastic products and making feathers and brocade weaving, were the main sources of livelihood for the indigenous villagers. Since 2000, in addition to weaving and dying, local people have started to work on collecting and recycling plastic products. Urbanization and large-scale land development cost many households their traditional jobs, forcing them to look for new resources for livelihood. With the advantage of its location close to the city center and the universities, Trieu Khuc Village became a long- and short-term destination for migrants. Recognizing the opportunities for generating income by renting their homes, many households arbitrarily divided their land to small plots or added floors to their building to trade or rent (Fig. 3). According to data from the police department of Tan Trieu Commune in Trieu Khuc, 480 households (with an estimated number of about 3500 people) are renting, and approximately 11,521 people rented a boarding house (*nhà trọ*) in 2012, an increase of 329% compared with 2009 [1]. Approximately 60 percent of households in the village have rooms for rent, and many households have more than five rooms, with the rental income around $172 to $215 per month. Some households with larger land plots have 20–30 rooms with a rental income of up to $1287 per month. Because most of the tenants are low-income people who can only pay about $43 to $86 for monthly rent, these boarding houses are normally underinvested; therefore, they are of poor aesthetic quality and their construction standards do not meet the technical requirements for fire prevention and ventilation.

Parallel with the changes in social structure, the spatial form of Trieu Khuc Village has transformed rapidly. A village once famous for a rich architectural tradition and harmonious landscapes is now rapidly urbanizing. The public spaces are compromised and encroached upon by commercial development. Both public and

(a) Motel (*Nhà trọ*)

(b) Small business establishments

Fig. 3 High-density area and livelihood (*Source* Author, 2019)

private gardens are disappearing with increased and denser construction of boarding houses, small shops, and factories. Many ponds inside Trieu Khuc have been filled for construction uses, and at present, the village has only two wells in Le hamlet and Dinh hamlet, both of which are surrounded by residential encroachment. Peaks, pagodas, and other aesthetic landmarks and spaces have also been negatively impacted (Figs. 4 and 5).

5.2 The Issues of Land Commodification Without Effective Governance

The land-use pattern in Trieu Khuc Village is rapidly changing over time, characterized by a sharp decrease in agricultural land. In the 1990s, the total land area of Trieu Khuc was 150 hectares, 72% of which was agricultural land, while 28% was used otherwise. By 2000, the total area of agricultural land was reduced to 104 hectares as a large amount of land in Trieu Khuc was converted for new urban projects. From 2010 to 2015, urban projects have acquired an additional 52 hectares of land. That means that Trieu Khuc has only 50 hectares of its original agricultural land, at present. However, the urbanization process has raised the value of land in Trieu Khuc and the surrounding areas. According to the residents, the price of land in general has increased rapidly since the early 2000s, with a concurrent increase in the price of residential land. According to the market land price information on the Batdongsan real-estate website (https://batdongsan.com.vn) [11] in 2019, land prices can vary between \$1716 to \$6435/m^2. Therefore, many households have split their land for sale or divided it for their children, to set them up for a new life (Tran 2015).

(a) Public space of the Communal House

(b) The village pond and temple

(c) Temporary factories

(d) Land-Plot division and new-built housing

(e) Narrow alley with newly-built architecture

(f) Newly-built house

Fig. 4 Current space of Trieu Khuc Village (*Source* Author, 2019)

Fig. 5 Phenomenon of pond filling and new residential land lot in Trieu Khuc Village (Source: Author)

As a result of increasing population density, developable land resources have rapidly become scarce. To develop a sustainable living environment, the state's role in governing the market activities and maintaining the order is essential. The state should use more instruments such as planning, regulations, and tax provisions to effectively manage land development. When the land has become a special commodity and its exchange value has increased local incomes, then the landholders in Trieu Khuc can realize profits through maximizing their construction footprint and adding additional stories to their buildings. Many new constructions have occupied the public land, or divided vacant land into small plots, which are traded on the market. The local government, however, has not always been consistent in preventing illegal occupation, construction, and transaction activities, which has caused confusion and disorder as well as serious externalities of land development in the village.

In addition, the ambiguity of the land property rights has led to many disputes among villagers around their rights to use space. Villagers filled the village ponds, and built and occupied housing due to the ambiguous distinction between public and private land. Additionally, the ambiguity between various types of private land uses

such as garden land, homestead land, and "family agricultural land" has contributed to illegal construction and land disputes. The disputes over property rights between households are often due to the lack of detailed property maps. Additionally, villagers lack knowledge about land laws and tend to negotiate among each other to solve conflicts, rarely seeking assistance in court or from local government. As local officials and those involved in grassroots government are also villagers, they too participate in land cover and "under the table" negotiation. According to the official data, in 2010, Tan Trieu Commune People's Committee announced 60 cases of illegal construction with a total area of 2753.5 m^2. By 2013, local authorities spotted 47 cases of illegal construction, in which the Commune People's Committee engaged in coercion in 38 cases. There were 9 cases of illegal construction in the village that were suspended and enforced (Tran 2015).

6 Conclusion

The case of Trieu Khuc Village is a typical example that shows how marketization and urbanization cause changes in livelihood, social organization, and the value of space, thereby affecting construction behavior and the order of space. The spatial order in traditional villages, which was maintained by the use-value of space along with the villages' rules, has been gradually replaced by the exchange value associated with the land commodification process. It should be emphasized that, under the rapid development of peri-urban villages, the property boundaries between various land types and the property rights of landholders remain ambiguous. Additionally, the management capacities of local governments are very limited, and land development and transaction activities in peri-urban villages are booming without effective planning controls or regulations. As a result, development activities get out of control quickly, and spatial development is dominated by speculative urbanism.

Our research emphasizes the important role of local government in managing and governing the development of urbanizing villages. Urban transformation within the peri-urban regions, as witnessed in Trieu Khuc Village, reveals the disorderly effects of spatial production. Rooted deeply in the changing values of space and the social structure, they require the presence of the state to provide public goods and civil order. The old communities practicing high levels of self-governance relied on local customs and social hierarchy to maintain order. Now these same areas are rapidly opening up to migrants and the investment of capital from the outside world. Hence, government intervention by means of planning and regulations is especially important here and now. This intervention should not be misinterpreted as the dominance of the socialist state over market activities and civil society, but as a necessary method of protecting public spaces and ensuring fair use of land resources. To do this, the government must clarify the boundaries of land property rights and have stronger sanctions to suppress illegal occupation and construction behaviors. More specifically, the government should strengthen its capacity through greater use of both traditional and new planning instruments, such as maps of land

plots, regulations, a land registration mechanism, and detailed planning for peri-urban villages, along with having a long-term strategy requiring the essential changes in the housing supply structure of the cities and sufficient provisions for affordable housing to accommodate low- and middle-income residents.

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Establishing Legal Norms in Vietnam for Compulsory Land Acquisition for Purposes of Economic Development: The Balancing of Public and Private Interests

Hien Trung Phan

Abstract According to the Constitution of Vietnam, the State can exert compulsory land use rights for national defense and security, and for socioeconomic development for public interests. However, Vietnamese law has no specific guidance for the definition or interpretation of "socioeconomic development for public interests." As a result, some provincial governments abuse their power to acquire land for development that is not genuinely intended for public purposes, causing difficulties for the livelihoods of the land users. In some extreme cases, there are conflicts between the land users and the provincial governments. This situation evokes a need to review the theoretical background about keeping a balance between public and private interests in cases of compulsory land acquisition Phan (Phan HT (2009) In: Phan HT, The law of compulsory acquisition of land—striking a balance between public and private interests in the United Kingdom and Viet Nam. VDM Verlag Dr. Müller, Germany, p 106–107). In reviewing the existing literature, first, an examination is made of comparative legal philosophies in western countries. Various legal concepts and traditions related to property rights are considered. Second, some practical cases of compulsory land acquisition are considered. Given the discussion, a solution on how to more appropriately balance the rights of land users against the interests of the State is presented. Thus, land law as it relates to compulsory acquisition may be improved in a manner that respects democratic principles of land management in Vietnam and enables sustainable development.

Keywords Land acquisition · Land law · Compulsory purchase · Public–Private interests

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1 Introduction

After gaining independence in 1975, the Vietnamese government established a subsidized economy. Land was considered national property [1] and only the State had the right to allocate land to individuals, households, and organizations, while the Land Law of 1987 prohibited land sales and leases between/among any individuals and/or organizations [2]. An overview of the evolution of Vietnamese land laws pertaining to compulsory land acquisition is offered in Table 1.

The Constitution of 1992 was the first Vietnamese Constitution to recognize a market economy. Despite "entire-people ownership" of land, under the "unified management" of the State [3], the Land Law of 1993 enabled land users (individuals and organizations) to transfer, lease, mortgage, and inherit their land use rights [4]. On that basis, compulsory land acquisition *with compensation* was allowed with the incorporation of Land Law 1993. However, at that time, the Vietnamese Land Law did not specify criteria for "land acquisition for economic purpose," although Decree 22/1998/NĐ-CP did record some cases of land acquisition, the determining criteria for which were very similar to "economic purposes." [5].

In fact, the legal term, "compulsory land acquisition for economic purposes" was first introduced in the Land Law of 2003 (Article 41). At this time, the government, through various decrees, kept expanding cases of "compulsory land acquisition for economic development." [6] As a result, it was very difficult to determine the scope of "compulsory land acquisition for economic development."

The Constitution of 2013 was the first Vietnamese Constitution to record compulsory land acquisition (Phan, Constitutional Basis for Public Land Acquisition in Vietnam, 2008), including land acquisition for "economic development". [7] On that basis, Articles 61 and 62 of the Land Law of 2013 listed all the cases of compulsory land acquisition. This meant that from then on, the National Assembly, the highest

[1] Articles 19 and 20, Constitution 1980.

[2] Article 53, Land Law 1987.

[3] Article 17 and 18 Constitution 1992.

[4] Articles 2 and 3 Land Law 1993.

[5] "Land used for development projects of new urban areas, concentrated residential areas and other residential areas already decided by competent State agencies" (Item 2a, Article 1, Decree 22/1998/NĐ-CP dated April 24th, 1998, of the Government on compensation for losses when the State recovers land for use in national defense and security purposes, national interests and public interests).

[6] See Clause 2, Article 36, Decree 181/2004/NĐ-CP, dated October 29th, 2004, of the Government on detailing the implementation of a number of articles of the Land Law; Clause 3, Article 2, Decree 17/2006/NĐ-CP, dated January 27th, 2006, of the Government on amending and supplementing a number of articles of decrees guiding the implementation of the Land Law; Article 34—40 Decree 84/2007/NĐ-CP, dated May 25th, 2007, of the Government providing additional regulations on issuance of land use right certificates, land acquisition, implementation of land use rights, order and procedures for compensation, support and resettlement when the State acquires land and resolves complaints about land.

[7] Clause 3, Article 54, Constitution 2013.

Table 1 Evolution of Vietnamese legal documents related to compulsory land acquisition

Period	Time	Legal document	Issue concerned
P1	1980	**Constitution 1980** (Articles 19 & 20)	Land considered as *national property*, land could only be allocated by the State
	1987	**Land Law 1987** (Article 53)	Land *sales and leases prohibited* between/among individuals/organizations (allocated by the State only); *no compensations allowed* in case of compulsory land acquisition
P2	1992	**Constitution 1992** (Articles 17 & 18)	Land considered as *entire-people's property*, under the "unified managed" of the State
	1993	**Land Law 1993** (Articles 2 & 3)	Land use rights *could be transferred, leased, mortgaged, and inherited* between / among land users (individuals / organizations) Compulsory land acquisition with *compensation was first allowed*, *without clear criteria specified*
	1998	**Decree 22/1998/NĐ-CP** (Article 1)	*Some criteria specified* for compulsory land acquisition, for purposes which were very similar to "economic" ones; *no legal term defined*
P3	2003	**Land Law 2003** (Article 41)	*First introduction* of the legal term "compulsory land acquisition for economic purposes" *into a law*
	2004	**Decree 181/2004/NĐ-CP** (Article 36)	*Expansions of cases* of "compulsory land acquisition for economic development" *The scope* of "compulsory land acquisition for economic development" was *very difficult to determine*
	2006	**Decree 17/2006/NĐ-CP** (Article 2)	
	2007	**Decree 84/2007/NĐ-CP** (Articles 34—40)	
P4	2013	**Constitution 2013** (Article 54)	*First introduction* of the legal term "compulsory land acquisition for economic purposes" *into the constitution*
	2013	**Land Law 2013** (Article 62 & 63)	*All cases* of compulsory land acquisition listed; *The responsibilities to regulate* "compulsory land acquisition for economic development" *transferred* from the Government to the National Assembly

State authority in Vietnam, had the power to regulate the scope and the government, therefore, no longer had any responsibilities to regulate "compulsory land acquisition for economic development."

Despite the National Assembly's efforts, debates on "compulsory land acquisition for economic development" have continued. Thus, it is necessary to review and discuss legal concepts and theories on how best to balance public and private interests. This review and discussion will inform a more discerning and concrete implementation of the broader principles set forth in the Constitution of Vietnam and in the Land Law of 2013. That is, that the general idea of "compulsory land acquisition for economic development for national and public interests" can be applied with greater specificity, clarity, and administrative and legal guidance. What follows is an in-depth consideration of these legal concepts and theories. There are three major components to this review and discussion: (1) a consideration of the ideology of public and private interests; (2) the requirements to ensure a balance between these interests; and (3) the practice of compulsory land acquisition in Vietnam.

2 Land Acquisition in the Ideologies of Public and Private Interests

In daily life, people need food, accommodation, and other amenities to satisfy their demands. Because of the necessity of acquiring either full ownership or at least use rights of property, private property systems overwhelmingly predominate across the globe (Soto, 2000, p. 226); there is a connection between the development of private property and the development of society. However, the underlying ideology is not necessarily uniform across countries, but may be more rightly interpreted as spanning a continuum. In theory, three prevailing ideologies can be distinguished.

2.1 The Ideology of Private Interests

At one extreme, private ownership is recognized as a natural and absolute right. The protection of private property within this framework was recognized quite early in history. John Locke, one of the most important thinkers of the seventeenth century, dedicated his thoughts to individual liberty and the protection of individual property rights against governments that endanger the right of citizens. In conjunction with Robert Boyle, John Locke introduced the "natural philosophy" called "Natural Law" (Locke, 1986a, b, c) in which every individual can enjoy their natural rights to land and other properties. He claimed: "The great and chief end, therefore, of men uniting into commonwealths, and putting themselves under government, is the preservation of their property; to which in the State of Nature there are many things wanting" (Locke, 1986a, b, c, p. 70). As with John Locke, Sir William Blackstone saw the

right to property as natural, stating, "So great moreover is the regard of the law for private property, that it will not authorise the least violation of it; no, not even for the general good of the whole community" (Blackstone, 2016, p. 94).

The subject of private property, and how and why private property must be strictly respected, may be seen from different perspectives within the works of the authors above. However, all of them assert some significant and common principles within their views of private property.

- First, private ownership is a natural right. The inference that it is natural is because it obviously arises from the natural order of life. In other words, when human beings became aware of the role of property, they knew how to acquire, keep, and dispose of it. The right to possess property, therefore, is closely related to human nature (Finnis 1980).
- Second, it is an absolute right and inviolable: "so great moreover is the regard of the law for private property, that it will not authorize the least violation of it; no, not even for the general good of the whole community" (Blackstone 2016, p. 94).

Of course, recognizing the right to private property and establishing it in law has been achieved by human beings over a long period of time (Soto 2000, p. 226). However, an overemphasis on private ownership might cause some difficulties for society in economic, social, and political terms. In particular, should development be needed in the public interest, the government would face difficulties in persuading the owners to make use of their private property even with fair compensation. The sensitivity of this matter explains why the right to property was taken out of the European Convention on Human Rights prior to its signing in Rome in 1950. It later appears as Article 1 Protocol 1 (Marston 1993, pp. 796–826).

2.2 The Ideology of Public (Collective) Interests

At the other extreme, there is the ideology based on the "harmfulness of private property" (Marx 2000, p. 95). Karl Marx is the most influential proponent of this ideology based on public (or collective) interests. Marx asserted that: "Further development of productive forces would lead to the disappearance of private capitalist ownership and appearance of collective socialist ownership" (Djilas 1969, pp. 99–100).

A contemporary of Marx of a different political persuasion, also well-known for supporting the public interest in the early nineteenth century, is Jeremy Bentham, founder of utilitarianism. He objected to the Lockean ideology of "natural right to property" because according to him, property rights cannot exist in a State of nature. They can only exist under a government. He proclaimed that: "The interest of the community is one of the most general expressions that can occur in the phraseology of morals: no wonder that the meaning of it is often lost. The community is a fictitious body, composed of the individual persons who are considered as constituting as it were its members. The interest of the community then is what?—The sum of the interests of the several members who compose it" (Bentham, 1948, p. 3).

Even though Marx and Bentham came to the subject of "property" from very different perspectives, one can see their common viewpoint about public and private interests quite clearly. One could see the views of Marx and Bentham as follows:

- Public interests are indispensable in a community and a society (Bentham 1948).
- Collective ownership must be the main ownership in a society—socialist ownership (Marx 2000). Preferably, a State has the full authority to acquire land from the private property as far as that is for the public need.

Of course, there are a few ways to understand and implement the viewpoints of Marx and Bentham. In some socialist countries, it was first understood that all main properties, which are productive materials, must belong to the State [8]. Certainly, besides its advantages, the domination of "public property" may carry disadvantages as well. In describing property in many developing countries or former communist States, de Soto characterizes the following as a common situation: "Imagine a country where nobody can identify who owns what, addresses cannot be easily verified, people cannot be made to pay their debts, resources cannot conveniently be turned into money, ownership cannot be divided into shares, descriptions of assets are not standardised vary from neighborhood to neighborhood or even from street to street" (Soto 2000, p. 15). From a critical perspective, Hernando De Soto commented that: "It is a world where ownership of assets is difficult to trace and validate and governed by no legally recognizable set of rules; where the assets' potentially useful economic attributes have not been described or organised; where they cannot be used to obtain surplus value etc." (Soto 2000, p. 32). At least to de Soto, this concept of public (collective) interests is not seen as practicable, from either perspective.

2.3 The Ideology of Striking the Right Balance

The theme of "compulsory acquisition" can cover many issues, such as paying reasonable compensation or provision of fair resettlement for those displaced. However, the main issue remains: "For which reasons may the State acquire land compulsorily?"

Certainly, the State needs land for public purposes. One can imagine that, without compulsory acquisition, we could not meet public demands for public infrastructure and capital facilities, such as roads, governmental offices, and the like. At the same time, individual citizens also require land to settle their lives and to satisfy their human needs. The dilemma is how to reconcile the two; without care and respect for individuals' properties, the public facilities and projects (e.g., airports and motorways) and the issue of compulsory land acquisition necessitated by such projects to serve public need, do not make any sense. It is necessary, then, to strike the right balance between public needs and private interests.

In fact, it can be argued that the "balance between public interests and private property," or "public and private interests," or "interests" in general, involves an

[8] The constitutions of 1980, 1992, and 2013 of Vietnam.

artificial and contextual definition, which can be accepted in a certain way at a certain time, and is not absolute. Like laws, "balance" is an ideal State that governments want to (but never can) make perfect.

Life is always changing: it requires adjustments in its different elements for different circumstances at different times. As an inevitable consequence, when practicing the ideology of striking the "right balance" between public and private interests, a researcher should bear in mind the following points:

(i) Be aware of the element of flexibility in any consideration of the *right* balance. The right balance should be flexible, i.e., spreading along a certain "scale" or "spectrum," because it must respect all customs, cultural values, legal jurisdictions, ideologies, and policies, as well as the specific societal characteristics of each country. Therefore, in general, conceptualization and implementation of the "right balance" should be expected to vary from one country to another.
(ii) Even within the same country, certain variations in this "spectrum" of the "right balance" should be expected due to varied internal geographies.
(iii) The *applicable range* of the right balance spectrum should also be variable and contextual. Results from national, and cross-national, research studies, if done well, could provide useful information and help set these upper and lower ends of this spectrum.

However, despite arguments in favor of contextuality and flexibility in the formulation and application of the "right balance," it stands to reason that there must be some standards that are logically acceptable to every country.

3 Some Requirements to Ensure the Proper Purposes of Land Acquisition

In order to maintain balance between public and private interests while acquiring land for "economic development," some standards could be set as follows:

First, land acquisition for "economic development" must be specified in the Constitution and prescribed in law. For example, in the constitutions of France, as well as of other capitalist countries, laws specify that private ownership, including land ownership, is sacred and inviolable. No one may dispossess anyone of his/her ownership, except for the cases of public need, and then only with full compensation paid in advance (National Assembly Office of Vietnam, 2012a, b, c, p. 4).

Second, the concept of "economic development" must be reconciled with the idea of public need. In other words, compulsory land acquisition is only allowable when there is or are social, economic, or environmental purposes that serve public, and perhaps national, needs. "Land governance is the only regime to ensure that the process of compulsory land acquisition is directed towards all three economic, social and environmental objectives" (Dang, Institutional Innovation in Land Management and Enforcement of Land Governance in Vietnam, 2016, p. 26).

Third, the projects for which land is acquired must be approved by higher authorities, in order to ensure that these "economic development" projects are actually intended to meet a specific public need. For instance, in Singapore, compulsory land acquisition is only applied if: (i) it is necessary for public purposes; (ii) the project, for which the compulsory land acquisition is necessary, is accepted by the Prime Minister; and (iii) the process of compulsory land acquisition is strictly adhered to, including notification of the impending compulsory purchase 2 to 3 years in advance of said purchase (National Assembly Office of Vietnam, 2012a, b, c, p. 5).

Fourth, the people who are affected by the plans of any compulsory land acquisition must have the right to participate in the planning process. Concurrently, the local government must have the accountability to ensure the conditions that would enable people to practice their rights. Moreover, the affected people must have the right to be heard by a court in case of a dispute over fairness or other issues in the local government's acquisition of their land plots for "economic purposes."

In many developed countries, the government can delegate the task of compulsory land acquisition to the local authorities. In the event of conflict, court hearings are set. With local autonomy, however, comes responsibility. For example, in the UK, land could be compulsorily acquired with the purpose of "regeneration, development, redevelopment, and improvement." [9] In some cases, the purposes could be "extensive redevelopment" (Chesterfield Properties Plc v. Secretary of State for Environment; Secretary of State for Transport and Stockton-On-Tees Borough Council, 1998). However, due to the need to clearly define the purposes of development, redevelopment, etc., the UK Parliament enacted the Planning Compulsory Purchase Act of 2004 to amend section 226 of the 1990 Act. This amendment defines the responsibilities of the acquiring authority in deciding if the purposes are legitimate or not. Particularly, there is the limitation that if "the development, redevelopment or improvement is not likely to contribute to the achievement" of the public goal, then it cannot satisfy the compulsory purchase purposes. [10] In this way, the provision strengthens the local authority's responsibility to define clearly the purpose of compulsory acquisition of land (Phan, 2009, pp. 106–107).

Comparative considerations of the legal arguments made in other contexts is important. Compulsory land acquisition in Vietnam does not happen in a vacuum, and there is already a legal history surrounding the issue that needs to be considered.

4 The Practice of Compulsory Land Acquisition in Vietnam

Article 62 of the Land Law 2013 States three cases of land acquisition for socioeconomic development for national and public interests. Each of these has its own advantages and disadvantages as follows:

[9] *Town and Country Planning Act*, 1990. c. 8, s. 226(1a).

[10] *Housing Act*, 2004. c. 34, s. 99(1).

(i) Important national projects as designated by the National Assembly: Currently, the term "important national project" is not stipulated in Land Law. Furthermore, there is no criteria or provision in the current Land Law and its guiding documents as to how the National Assembly determines what is considered an "important national project."
(ii) Other national projects approved by the Prime Minister: The regulations on investment decisions that require land acquisition in Clause 2, Article 62, Land Law 2013 are different than those in other laws. For example, the Bidding Law 2013 and Land Law 2013 do not have specific regulations on project bidding for land use, so it is liable to have a negative impact on land management, wasting land resources. According to land experts, "Investment projects that use land are a type of project that depends not only on financial and technological factors, but also on the methods of land use" (Dang, 2017, p. 29).
(iii) Provincial projects approved by the provincial People's Council: The scope of projects included in the list of areas for land acquisition approved by the provincial People's Council is often widely formulated and unclear, making it difficult to understand and apply, and is often easily abused by the provincial government.

The lack of specific guidance may allow for overly broader interpretations and enable inappropriate cases of compulsory land acquisition that are beyond the intention of the law.

Neither the concept of "urban embellishment" [11] nor other concepts relating to "economic purposes" are clearly stated in the Land Law and other legal documents in Vietnam. Similarly, various land use classifications, including cemeteries, graveyards, funeral homes, cremation houses, new urban areas, rural residential areas, concentrated production and processing areas of agricultural, forest and aquatic products and seafood, among others, are not defined. Therefore, the scope of land acquisition remains unclear or ill-defined.

In addition, Land Law stipulates that when implementing well-planned infrastructure projects [12], the State can proactively acquire land, including land for the construction of the infrastructure, as well as the surrounding land. However, there is still a lack of detailed guidelines on such land acquisition, especially from the standpoint of the purpose and scope of the project, that complicates the issue. [13] In fact, it has been argued that when the State acquires land, whether for socioeconomic development or not, economic benefits will still accrue. "The emergence of economic factors makes it much more difficult to assess the public benefits. The State conducts land acquisition compulsorily, then transfers the land to investors. After being invested and built up, the value of the land is increased and traded on the real estate market. So, first of all, the benefits are in the hands of the investors" (Dinh 2016).

[11] Clause 1, Article 146, Land Law Land Law, 2013.
[12] Clause 3, Article 146, Land Law Land Law, 2013.
[13] Clause1, Article 16, Law Law 2013.

In some cases, "land acquisition for the purpose of socio-economic development" [14] shares the same benefits as "transferring land to implement production and business projects". [15] In fact, the determination of these goals is also a difficult problem to solve when it comes to satisfying both the economic and social aspects of development (*Kelo v. New London,* n.d.). For example, projects of high-tech zones and economic zones are new urban areas intended to serve a public purpose (such as the creation of jobs), but could also generate bigger profits for the investors. "Therefore, the purposes of land acquisition must be for the community, and the State should consider carefully whether or not to expand these purposes, especially for the cases of commercial purposes, such as urban areas, because urban areas can serve commercial purposes more than they do for public purposes" (Nguyen 2016, p. 75). According to some experts, the scope of application of land acquisition methods in Vietnam is too wide, and many projects are difficult to prove as beneficial to national or public interests (Tien Long 2017).

Second, Vietnamese laws do not guarantee public participation in the planning processes. As envisioned in law, the draft of land use plans at provincial and district levels must be shared with the public to solicit people's opinions. However, people's comments are often bypassed because of a lack of detailed procedures to hold local authorities accountable to public inputs (Ngoc Ha, 2014). In short, people cannot effectively participate in the planning process where provincial governments decide to undertake land acquisition for economic development.

In the absence of clear guidelines, it is rather difficult to determine the purpose of land acquisition as being of a social, economic, or combined socioeconomic nature. In some instances, local government agencies arbitrarily acquire land for the general purpose of "socioeconomic development" that may take many forms. There are still localities that view land acquisition for "ecotourism urban areas" a type of land acquisition for socioeconomic development (Xuan Hung, 2016). In fact, the construction of eco-urban areas is usually a profitable business investment project that shows little public benefit to the community. On the other hand, there are projects where the planning area for social housing and resettlement accounts for less than 10% of the project area, while more than 90% of the planning area is for commercially marketed housing, typically including condominiums and garden villas. Some localities do consider such development and interpret the use of compulsory acquisition in these cases to be appropriate (Lanh and Duong 2017).

Additionally, Vietnam lacks regulations (or formal procedures) to evaluate the effectiveness of a development project after land acquisition. For example, enterprises or entrepreneurs often prepare the initial project plans so as to develop the economy, thus serving the national and public interests, and then submit them to be ratified by the authorities. However, as some local communities have reported, "as soon as clean land is recovered," requests are made to change the purpose of the project from "public" to "economic" (e.g., commercial and service), which considerably

[14] Article 62, Land Law Land Law, 2013.

[15] Article 73, Land Law Land Law, 2013 indicates that civil law is applied in the case of needing land for production and business projects, not applied for compulsory land acquisition

increases the land value; "there are 1390 projects with plans adjusted from 1 to 6 times in the whole country" (Nguyet Minh 2019). This increase in profitability does not extend to the original owners of the land, because they had previously received compensation based on much lower land prices, as decided by the local authorities. This causes "discontent for the people" and "particularly serious losses to the State budget" (Phan 2017).

Last, legal recourse is limited in Vietnam. According to current Vietnamese law [16], land users can only complain about concrete administrative decisions. In fact, the complaint-settling agency, as well as the administrative court in Vietnam, does not accept the cases of land use planning and plans, although the planning and plans actually determine the purposes of land acquisition (whether they are for economic development or not).[17] Moreover, courts in Vietnam do not accept cases related to land price, because they do not have the authority to decide the price. In fact, they can only refer to the prices determined by the relevant people's committees. According to the guidance of the Chief Justice of the Supreme People's Court: in cases where the people petition against administrative decisions in favor of compulsory land acquisition by the State, the courts must not conduct any revaluations of the land use rights, and can only refer to the existing dossiers (planning, plans, purposes of land acquisition, land prices, etc.) previously determined by relevant authorities at the time when they requested the land acquisition. [18]

5 Concluding Thoughts

I conclude with a few recommendations for the legislative, executive, and judicial authorities on how to make compulsory land acquisition more reasonable and fair for the public who must part with their land.

Legislative authorities should clearly define all the parameters of the concept of "land acquisition for socioeconomic development for national and public interests" in order to mitigate the current murkiness around the scope of compulsory land acquisition and the abuse of power issues, as discussed above. When making a list of land acquisition by purpose, it is necessary to explain the concepts in that list clearly, to ensure proper and uniform understanding among all the stakeholders. Urban concepts

[16] Article 2, Law on Complaints 2011, and Article 3, Law on Administrative Proceedings 2015.

[17] This shows that there are still major differences between Vietnamese laws and the laws of advanced countries elsewhere in the world. For instance, there was the Kelo U.S. Supreme Court case in the USA in 2005, where the people sued the local government because they assumed the purposes of land acquisition was for "a commercial project", which was unfair to them (*Kelo v. New London*, n.d.). Although the people eventually lost the case, at least they were heard in several courts. This lawsuit also "tolled the warning bells" to experts and scientists worldwide on the situation of people's land being taken for private enterprises.

[18] Subsection 13, Answer No. 02/GĐ-TANDTC dated September 19th, 2016, of the Chief Justice of the Supreme People's Court on answering a number of issues of administrative procedures and civil procedures.

(and land use types) such as urban embellishment, rural residential areas, new urban areas, and so on, should have specific definitional criteria embedded in the concepts of "socioeconomic development," and "national" "public" and "private" interests. In addition, it is necessary to develop the criteria to determine the cases of compulsory land acquisition.

The executive authorities should ensure that the purposes of the projects for which compulsory land acquisition is implemented strictly adhere to the original comprehensive plans, and not allow for the constant revision of the original plans, which violates the affected people's legitimate benefits. It is also important to ensure that the land acquisition process follows the comprehensive land use planning regulations, that cases of local land acquisition are tightened, and that clearly defined criteria are used as a basis for competent State agencies to select and approve projects requiring land acquisition. Moreover, it is necessary to guarantee public participation in the planning process. Finally, the Government should improve the effectiveness of land management, and strengthen the inspection, supervision, and handling of violations in land acquisition.

The judicial authorities should guarantee democracy and transparency along the planning process of the projects involving compulsory land acquisition, as well as the affected people's rights to be heard in courts. Vietnamese law should expand the scope of subjects suing administrative cases. At that time, the decision to approve the district's annual use plan—which defines the purpose of land acquisition for economic development—was also the object of the complaint or lawsuit. On the other hand, the regulation of administrative courts has the authority to re-determine land prices to compensate people according to the principles of fairness and equality, and correctly reflect market prices when the State acquires land compulsorily for the purpose of economic development.

A resolution of these issues surrounding compulsory acquisition will help establish a balance of interests between, on one hand, the needs of the State to provide land for infrastructure, capital facilities, and other projects with a public purpose, with the rights of property owners and users. Such a resolution will allow stakeholders to know the principles of the law and provide due process in their execution. Furthermore, clarity will create a more efficient property market by eliminating uncertainties surrounding planning activities and property rights.

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Issues with Transformations in Land Management: Ho Chi Minh City, Vietnam

Phan Hai Ho

Abstract In the nearly five decades since *Doi Moi* (economic reform) in Vietnam, there has been rapid social-economic transformation accompanied by rapid urbanization and dramatic changes in land use. Equally, dramatic has been the changing legal landscape related to land use planning, land use law, and the evolution of property rights. This chapter reviews changes in property rights, land use law, land use management, and planning policy in Vietnam, particularly in Ho Chi Minh City. Contentious issues related to the assessment of property values, ownership rights, and regulations, and other planning issues are discussed and analyzed. From the analysis, a set of policy considerations is offered.

Keywords Property rights · Land use law · Property assessment

1 Introduction

Since 1986, Vietnam has undergone a dramatic socioeconomic transformation known as *Doi Moi* (economic reform). In this process, the country's development model has shifted from a central management system to a model of "market-oriented socialist economy under state guidance," leading to a transformation in the land management system (Beresford 2008). In 1988, the central government enacted a land law, which permitted granting land use rights to individuals and organizations, although the state remained the sole administrator of land on behalf of the citizens. Within five years, in 1993, the central government introduced a new law on land which specified five different rights of the land users: (i) right to transfer, (ii) right to exchange, (iii) right to lease, (iv) right to inherit, and (v) right to mortgage. Nevertheless, the 1993 land law still affirmed that land was owned by the government. In 2003, a new law on land was released which simplified administrative procedures surrounding land use. The 2003 land law also provided the legal foundation on land management for the opening of land and the real estate market by framing provisions on land use rights in

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the market for immovable property, land pricing, and financial issues related to land (Nguyen et al. 2016). In 2013, the government enacted the latest land law, which includes some improvements on land transactions and land prices. It also provided a decision-making procedure on land acquisitions and upgrading the rights of foreign investors. Accordingly, land is classified as agricultural land, non-agricultural land, and unused land, which forms the basis for land use designation and planning. In order to change the land use classification, land users are required to obtain the approval of the provincial government.

Socioeconomic changes induced by the *Doi Moi* paved the way for a period of impressive economic achievements. Vietnam's poverty rate decreased from nearly half of the population to just under 2% during the 1990–2018 period while its GDP rose at 6.8% annually (Nguyen and Kim 2020). Similar to other developing countries in Asia, economic reform in Vietnam had a profound effect on urbanization, as its urban built-up area expanded almost nine times during the period between 1992 and 2010 (Ouyang et al. 2016). As McGee (1991) observed, cities are major hubs of increasing investment and development, which are represented by high population densities, high population mobility, a mixture of land uses, and a reduction in agricultural production. Ho Chi Minh City (HCMC), a prime example of a fast-growing Asian metropolis displaying similar characteristics, faces many of the associated land management and land use issues. Following a general overview of some of these issues and related problems in the following sections, HCMC will be used to contextualize the current land management dynamics in Vietnam.

2 Land Management in the Context of Urbanization in Vietnam

2.1 Legal Valuation of Land and Land Use Rights

Urbanization has created high demand for Vietnam's scare resource—land (Collier and Venables 2017). The Vietnamese government recognizes three key rights to land but they are not universal. While "ownership rights" (*Quyền sở h˜ưu*) are in the hands of the entire people, the "controlling rights" (*quyền quản lý)* are managed by the government, and the "use rights" *(quyền sử dụng)* are allocated to individuals, households, and organizations for a certain period of time. Government holds the lawful right to recover or requisition land for broadly defined purposes, including national defense, security, and public interest (Article 16, Land law 2013). Legal valuation of land is understood as the valuation of "land use rights," which is determined by the government. As per Article 18, Land Law 2013, the government prescribes the principles and the methods for land valuation, promulgates the land price brackets and the government-set framework, and decides on specific land prices.

In addition to the complexities pertaining to land rights, the nature of changing land use purposes in urban land management regulations is unclear in Vietnam's

legal documents. According to Article 2, Land Law 2013, state agencies exercise the powers and perform the responsibilities as the representatives of the entire people and perform the tasks of unified state management over land. However, Land Law 2013 and related legal documents did not provide regulations on land price, which is integral to the intended purpose of land use and reflected in differences between agricultural land prices in urban and rural areas. The inequality in agricultural land prices between cities and countryside is viewed as a form of administrative decision-making.

When the state issues a decision on a territorial administrative unit designated as a *ward, town, district,* or *city* (including land, rivers, bridges, roads, etc.), that unit is recognized as a municipality or the municipal government. As a result, the land within the administrative unit is recognized as *urban* land. Thus, when the state conducts activities related to land use rights, the legal value of urban land as reflected in land rent, land use fees, etc., should be recalculated. Under the current law, when the state implements a land policy such as compensation and site preparation, the value of land use rights is substantially increased, and the state has to compensate and relocate displaced land users in accordance with urban land prices, not the prices of agricultural land.

2.2 The Economic Value of Agricultural Land in Areas Designated Urban

In Vietnam, the allocation of land uses is in the hands of the local municipal officials, who are under pressure to promote the dual goals of economic development and farmland preservation. The government holds the right to decide on master plans, land use purposes, land recovery, and land requisition, as well as land prices and financial policies on land (Article 13, Land Law 2013). Land prices are regulated in an annual government-set framework in accordance with the type of land and administrative unit. However, in practice, when the government makes a decision on matters such as compensation, site clearance, transfer of land use rights, and investment, problems arise related to the use of agricultural land in metropolitan areas.

Irrespective of location, agricultural lands in the cities and the countryside are treated as the same, namely *agricultural land,* and are priced at their use value. This is the case even as it is obvious that agricultural lands in urban areas have dramatically higher speculative value. Regulations on urban land are enacted by the state in the following manner: While the value of urban land increases, that of the agricultural land decreases. In metropolitan areas, legal valuation of the compensation price of agricultural land is considered more as symbolic, as it is significantly below the prevailing market rates for land when the government decides on land recovery or requisition. Farmers in cities are obligated to transfer land use rights according to the

will of the state and with the same price structure as agricultural land in the countryside. In addition, for governmental decision-making purposes of compensation, site clearance, transfer, investment, and so on, the price of agricultural land is set at the lowest level, as compared to other types of land. For instance, in Hoc Mon district, a square meter of *farmland* in residential areas is compensated around 1.1–2 million dong (around $50–$100), while the same amount of *residential land* in the same area is compensated at around 20 million (nearly 1000 dollars) by the local government (Hoa 2019).

Furthermore, agricultural land conversion for urban development and industrial purposes cannot be reversed once an administrative decision is made. Agricultural land is a vital part of agricultural production and food security. Therefore, it can be argued that the value of farmland should be considered the highest among other types of land rather than the other way around, as it reduces the detrimental effects of urbanization on farmers and their livelihoods.

2.3 Urban Land Management Tools

Currently, the State of Vietnam is carrying out land management in general and urban land management in particular, including the creation of new policies, institutions, laws (on urban planning), and land use plans. However, some of the important details surrounding these legal tools, such as effective utilization of the so-called "natural management tools," management of issues affecting urban development trends, and urbanization and regulation of land price and land ownership have not been duly recognized or clarified in the legal system.

Natural management: The state and the land users automatically recognize and implement jurisdictional boundaries and soil types as natural management tools. For example, whereas alluvial soil is used for rice production, saline soil is used for aquaculture. Similarly, development of residential areas, as well as real estate and infrastructural development projects, takes place within the designated boundaries of urban land.

Management of issues affecting urban development: Despite the availability of multiple management tools, urban land management in Vietnam continues to lag behind urban development and remains impacted by land law violations, lack of transparency, and accountability. For example, the local government in Ho Chi Minh city enacted 179 decisions to sanction administrative land violations in the first quarter of 2020, amounting to around two decisions daily (Ha 2020). Similarly, transparency and accountability have emerged as significant issues in urban land management. Ideally, the state should promote transparency in land use planning and administrative decisions regarding the land use master plan, and land policies and mechanisms should be referenced or consulted by the people to ensure accountability. However, this was not clearly defined in the land laws of 1993 and 2003.

Regulating urban land's price according to market value: The core value of urban land is higher than other types of land in the real estate market (Ministry of Finance

2017). However, the land use system lacks a legal mechanism to manage the core values of urban land. For example, before expanding urban roads, the state should calculate and agree upon the economic value of the land plot with the land users in accordance with the market value. Then, when opening a new road, the value of the land should be divided equally between the state and land users. If this is regulated in the land law, compensation and site clearance will be easier, and complaints and lawsuits will be reduced.

Legality of ownership regulations: The granting of a certificate does not currently guarantee the value of the land. Land in general, and urban land in particular, does not conform to the ownership regime as prescribed. Ownership includes three rights as follows: possession, use, and disposition. However, according to the provisions of the 2013 Constitution, land owned by the people can be appropriated for the country's development. However, in terms of ensuring the legal value of the ownership right, it is inappropriate and does not fully protect the rights of land users. For example, the term "certificate of land use rights" as used on a land use certificate is not comprehensive; land users do not have all three rights mentioned above. There must be a way to set up and name this certificate so that the land users have the right to dispose of and possess land to the extent permitted by law (e.g., right to possession, scope, level of authority, etc.).

Land management in the urban transformational process in Vietnam is impacted by many issues related to the somewhat ambiguous nature of the state's land laws and legal documents, as reflected in current land valuations, land rights, management tools, transparency, and other aspects of the land management system. The rest of the chapter explores Ho Chi Minh City as an example to revisit some of the practical aspects of these issues, such as the legal valuation of urban land, land management tools, transparency, and violations of legal requirements. The chapter will conclude with some suggestions or recommendations to improve the situation.

3 Managing Urban Land in Ho Chi Minh City

Ho Chi Minh City (formerly Saigon), located in the southern part of Vietnam, is Vietnam's largest urban agglomeration, contributing over 9.3% of the population and 22% of the GDP of Vietnam in 2019. It covers about 2061 km (796 square miles), with 494.01 km^2 in urbanized area consisting of 19 districts and counties, and a rural area comprising 5 sub-districts. Despite accounting for only 0.6% of the country's land, Ho Chi Minh City is a major hub for industries in Vietnam, with the highest contribution in commercial services (33.3%) followed by industry/construction (15%). Each of these grew rapidly between 1999 and 2009, with annual growth rates of 8.4% and 11.7%, respectively (Cira 2011). Ho Chi Minh City's favorable economic conditions have attracted migrants from other parts of Vietnam. The mega city, with a density of 3937 people/km^2, is home to nearly 8 million residents (GSO 2015). In nearly 20 years, the number of residents doubled from around 4 million in 2000 to more than 8 million in 2018 (UN 2019).

In the last three decades, Ho Chi Minh City experienced a substantial expansion, leading to rapid industrialization and peri-urbanization with the emergence of a large number of industrial zones (Nguyen and Kim 2019). Beginning with the Tan Thuan export processing zone in 1991, several large-scale or mega projects, including the construction of the Nhieu Loc-Thi Nghe Canal, the Vo Van Kiet highway, mixed-use high-rise buildings, the Phu My Hung New Town, and four bridges to the Thu Thiem, Hiep Phuoc, and Cat Lai seaports, have been completed during this period (Nguyen et al. 2016). In view of this rapid expansion, the current land management practices in the city are posing many problems related to construction density, traffic congestion, water supply, drainage, social security, and beyond. The city has also faced an increased population density in the city center, a mixture of residential and commercial land use patterns, and a limited capability of local government to manage the land. Furthermore, because of its rapid urbanization, Ho Chi Minh city's agricultural land, accounting for 55% of its total area at 114,000 ha, is expected to undergo an annual reduction of 500 ha. Agricultural land conversion for urban development without proper management has led to violations of the land use plan, increased population density, and a heavy burden on the transportation infrastructure. As Nguyen et al. (2016) observed, it is the local government that is confronting the problems of urban management at the intersection of public intervention and market economy. Some of the previously discussed land management issues confronting Ho Chi Minh City are noted below.

According to the available land-related legal documents, Ho Chi Minh City's government has enacted numerous regulations on the legal valuation of urban land, such as issuing the city's land price framework, calculated according to the central government's land pricing structure. However, due to a limited budget, the city has to manage the land price in a manner of increasing urban value (both inner city and suburban land when urbanizing) and reducing the value of agricultural land. Consequently, the compensation for agricultural land is the lowest compared with any other type of land. Therefore, conflicts about compensation arise between the government and residents, especially in suburban areas.

Moreover, with the requirements of urban development, the city has changed the land use purpose by implementing central administrative decisions and issuing local administrative decisions. When a development plan is in place, some suburban districts become urban administrative units. However, the value of the land use rights and land use purposes remains the same, because the original designation as agricultural land does not automatically change. Subsequently, the value of land use rights in these areas is applied according to the agricultural land price list. The above-mentioned method of calculating the legal value of agricultural land and applying agricultural land prices has resulted in protracted complaints, which delay completion of the city's projects. Management of urban land is carried out in piecemeal fashion under different administrative jurisdictions, which holistically consider a variety of related elements in the urbanization process such as the land's function, urban infrastructure, and population growth rate. Furthermore, without the benefit of a reliable forecast or projection for future growth, the city's urban land management continues to lag behind its development. Current land policies and mechanisms have

not made provisions for public participation or consultation, and the accountability of managers and officials is still unclear. Therefore, violations on land use plans and land-related regulation of land users still occur with frequency. The phenomenon of illegal residential construction on agricultural land, violating the city's land use master plan, is a common example. From 2016 to 2020, there were 11,000 cases of construction violations (Vu 2021). The local government has to deal with these illegal activities, which include not only construction violations, but also self-conversion of land use purposes, or the transferal of land use rights without approval.

Some of the inadequacies and pitfalls of land management in context of Ho Chi Minh City, as discussed above, are apparent in the following examples:

(i) When a new road is completed, the surrounding apartment projects are licensed prematurely, despite the absence of public infrastructural facilities such as parks, schools, and hospitals. In addition to its many obvious shortcomings, this phenomenon gets to be burdensome for the traffic systems and public service delivery.

(ii) Conflicts between the central and local governmental authorities get in the way of effective urban land management. Several areas (such as military-purposed land and the headquarters of central government agencies) are under the administration of the central government, which prevents the city government from exercising its management rights to implement the land use plan. Sometimes, these land user rights are transferred to private stakeholders to develop real estate projects such as Vinhome Tân Cảng and the Ba Son area.

(iii) Despite regulations on the preservation and protection of historical areas in need of improvement, such as the historic French villas and Chinese-influenced architecture, the number of historical and architecturally significant buildings is declining (Dong 2019).

(iv) Problems in land management, as discussed above, are also manifested in some of the new urban projects in Ho Chi Minh City, where a lack of transparency in land use planning and land use conversion and the violation of land-related regulations have had a negative social-economic impact. For example, the city of Thu Theim has cleared almost the entire peninsula in District 2. Ninety-nine percent of the land in this area, covering 382 ha of land for housing and 334 ha of commercial development, has been compensated for clearance. It is expected that when the project is completed, Thu Thiem will be home to 150,000 residents, attracting 220,000 workers. To reiterate, there are several issues, such as the planning and construction of underground transport systems, the relocation of various city administrative offices, and the development of a new commercial and financial area, that have remained unresolved.

4 Concluding Thoughts

I conclude with the following recommendations:

First, when the state recovers land, it is necessary to abide by the provisions of the land legislation laws. Violations must be handled in a strict and timely fashion, ensuring compliance with retrospective regulations and personal responsibility regulations.

Second, land improvement should be conducted in a manner that acknowledges rural-agricultural land as the most valuable type of land and protects the rights of farmers. Additionally, land price framework should only be applied for fulfillment of land financial obligations, not in case of state land acquisition.

Third, future urban land policies should consider the core value of urban land, as well as the land's market value. For example, if the land is cleared for development, the land value will increase many times in comparison with the early land value. The increase should be taken into the compensation value.

Fourth, zoning and planning of urban land should happen in accordance with the master land use plan.

Fifth, transparency in the implementation of urban land management mechanisms and policies should be ensured, so that residents can have easy access to land use planning-related information.

Sixth, the current organizational structure of the land management agencies should also be re-considered in terms of streamlining and clarifying the respective management authorities at different jurisdictional levels.

Seventh, urban land management should not be undertaken in isolation but should follow the regional development strategy, in order to reduce pressure on urban land in the core urban areas.

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Urban Growth and Multi-seasonal Land Cover Classification of Dhaka, Bangladesh: An Approach Using Google Earth Engine

S. M. Shihab Nur and Chandana Mitra

Abstract Land cover change strongly influences environmental change and local climate variability and therefore can tamper with improvements in local, regional, and global policies. Cities of the world with rapid land cover and demographic change require strong adaptation and mitigation policies to maintain a healthy environment. One such global city is Dhaka, the capital of Bangladesh and the third most densely populated city in the world. Dhaka has grown uncontrollably, creating many economic, logistic, and environmental challenges. To quantify the growth of Dhaka city and assess the impact of land cover changes on the environment, the popular and traditional method of overlaying anniversary remotely sensed images was implemented. Twenty-four Landsat images for each year were overlaid, covering ten years from 2008 to 2018 with a 5-year interval (2008, 2013, 2018) using the Google Earth Engine tool, to assess and quantify the land use and land cover changes of Dhaka. The classification and regression tree (CART) algorithm was used to classify the land cover. The study highlighted that except for urban built-up, which had a 16% steady increase over the ten years, all other categories showed dips and rises. The ten-year expansion pattern shows that initially, the growth was close to Buriganga River, but gradually, the city expanded to the north and east, away from the river. We believe that our research approach provides better insight into a multi-seasonal land cover classification for planners and policymakers to utilize in city improvements.

Keywords Land cover · Multi-seasonal classification · Google Earth Engine

1 Introduction

The formation and spatial expansion of megacities in many Asian countries have inflicted immense pressure on the infrastructure and environment of the urban core as well as the peripheries of cities. Demand for land to expand industrial, commercial, and institutional activities not only affects the associated land covers and land uses

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(LCLU), resulting in urban sprawl, but also impacts the urban ecosystem (Aguilar et al. 2003). Suburban and peri-urban areas lose natural landscapes, protected areas, flood zone areas, agricultural areas, and water bodies. Loss of this LCLU may have tangible short-term economic benefits, but in the long run, these transformations take a massive toll on habitats as they cease to work as a protection from natural hazards and calamities (Yuan et al. 2005). The loss of suburban agricultural lands disrupts the food supply chain, which traditionally fed the increasing population of the growing city (Lopez et al. 2001), eventually increasing the food-supplying catchment area of the city (Haregeweyn et al. 2012). The atmosphere above the city experiences a decrease in air quality and an increase in urban heat, affecting human health (Kalnay and Cai 2003).

This study focused on Dhaka city, the capital of Bangladesh and the 3rd most densely populated city in the world, according to Wright (2020). To understand the present LCLU pattern of Dhaka city, it is important to know how the city grew through the centuries from a small town to the 3rd largest city in the world.

1.1 Historical Urban Growth of Dhaka

Land use and land cover changes in a city largely depend on its urban policy, plan, and historical pattern of growth and development. Analyzing the historical urban growth of a city explains the growth pattern, land cover change directions, and local factors behind land use and land cover change. Dhaka has been under several political regimes in its history, which always left an impact on the city's form and growth.

Dhaka gained prominence when in 1608, Islam Khan became the subedar (administrator) of the city, appointed by the Mughal emperor. Thus, 1608 marks the inception year of Dhaka (Kabir and Parolin 2012). Islam Khan, the then subedar of Bengal, made Dhaka the capital of Bengal in 1610. After the Mughal period ended in 1700, Dhaka entered the British period and lost its importance as well as its pace of development. The Geddes Master Plan developed by Sir Patrick Geddes in 1917 laid out development steps during the British period (Kabir and Parolin 2012).

After becoming the capital of East Pakistan in 1947, Dhaka experienced rapid change. The city started to expand to the north, referred to as New Dhaka. Dhaka Improvement Trust (DIT) was established in 1956 to develop a plan for the city. DIT planned and developed four new major city sections, Gulshan Model town, Banani, Uttara, and Baridhara Model town, the northern part of the city (Kabir and Parolin 2012). Before the northern part was developed, the major built zone was in the southwestern part of the city along the Buriganga River, also known as the old town of Dhaka. The northern section was mostly fallow or agricultural land. In addition to the DIT initiative, the city had a few other planning projects and reports that have helped developed the city since the nineteenth century, including Dacca Town Planning Report (1917), East Pakistan Planning Sub-committee (1948), and Dacca Master Plan (1959). The City Development Authority of Dhaka, named RAJUK (Rajdhani Unnayan Kartipakkha), initiated some projects within the city.

The first one, Dhaka Metropolitan Area Integrated Urban Development Project, came in 1981. Then, RAJUK launched the Dhaka Metropolitan Development Plan in 1995. In 2015, RAJUK started the detail area plan (DAP) project, including the suburban areas of the city (Kabir, and Parolin 2012). This project expanded the jurisdictional area of Dhaka city, gradually including nearby suburban districts (Dhaka Structure Plan 2016–2035). It also defined land uses and designed policies and plans to address future demand and environmental conservation (Dhaka Structure Plan 2016–2035). All these projects led to the embryonic expansion of Dhaka from a southern old town to a megacity. The urban planning history explains the concentration of urban activities and their significance in present land cover change.

The urban plan of 1959 had no plan for land use control while the plan of 1995 categorized the main flood flow area, sub flood flow area, retention pond, water body, and public facility area as conservation areas. Despite categorization, there was no action for land use control, and the city expanded beyond the territory of the plan. The recent Dhaka Structure Plan 2016–2035 has a subsection, named urban control area (UCA), which designates flood flow zones, water retention areas, national and regional parks, forest areas, large-scale heritage sites, rivers, and canals as conservation areas and suggests limited physical development in those areas. Most of those conservation areas lie in the east, west, and periphery of the city (Nahrin 2019). These plans and policies and defined land cover help this research to hypothesize the reasons behind some specific changing patterns of land cover (e.g., changing waterbodies and wetlands into built-up areas).

1.2 The Present State of Land Cover of Dhaka City

Dhaka is one of the six South Asian megacities with a population of over 16 million, according to a 2010 housing survey (Moniruzzaman et al. 2021). Figure 1 shows Dhaka within Bangladesh territory and Dhaka Metropolitan Area (DMA) in Bangladesh. DMA is the study area of this research, with an area of 304 sq. km (75,311 acres).

Bangladesh's economy, education, commerce, and industry are highly centralized in Dhaka (Siddiqui et al. 2016). To accommodate an increasing number of people, a large portion of land gets converted to residential areas, with over 40% of land used as informal settlements (Dewan and Yamaguchi 2009). Moreover, establishments have been built for commercial and industrial purposes to fulfill the employment needs of the migrant population. From 1975 to 2003, waterbodies (2.3%), wetland (9.7%), cultivable land (8.6%), and vegetation (6.2%) all have been significantly reduced in the city. The two increasing land cover types by percentage are built-up and barren land (Dewan and Yamaguchi 2009). With this rate of decrement, vegetation and waterbody were not expected to cover more than 4 and 5%, respectively, by 2020, whereas the built-up area was expected occupy 46% of the total Dhaka city land (Islam and Ahmed 2012). With this prediction, it is time to thoroughly identify and

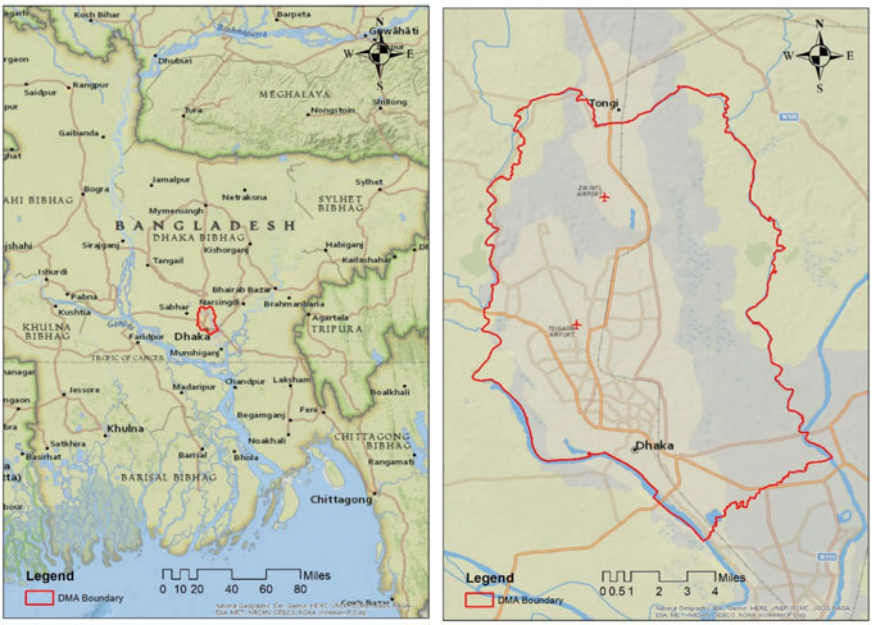

Fig. 1 Map of Bangladesh and Dhaka Metropolitan Area (DMA) (*Source* ESRI)

implement LCLU policies and mitigation measures to ensure that Dhaka city never reaches extreme environmental degradation and health challenges.

2 Data and Methods

Multi-temporal LCLU classification in a remote sensing platform is a popular method for land cover classification (Kantakumar and Neelamsetti 2015). For the city of Dhaka, several studies have been conducted using the single image post-classification method, most of which selected only four classes of land cover, waterbody, vegetation, built-up area, and barren land. Wetlands and agricultural lands also constitute a major part of the landscape of Dhaka city, although these two land covers are decreasing dramatically (Ahmed et al. 2013). These land covers are generally merged with other land covers such as water bodies, vegetation, and barren land, making identification of these land covers challenging and time-consuming. To the author's knowledge, this study is the first to use Google Earth Engine (GEE) to quantify the LULC of Dhaka with six significant classes, waterbody, vegetation, built-up, barren land, wetland, and agriculture.

Images from multiple seasons were stacked to efficiently distinguish the land covers that have similar reflectance in all seasons. This required the processing of numerous high-resolution images simultaneously, which was performed through the

GEE platform. GEE is enriched with a ready-to-use high-resolution data catalog with high-performance computing functions (Gorelick et al. 2017) providing the opportunity to process a large number of satellite data layers, such as Landsat and Sentinel (Oliphant et al. 2019), without downloading. Queries such as cropland mapping, tree cover change detection due to natural disasters, the spread of plant diseases, ecosystem mapping for both land and aquatic environment, along with others, can be performed easily using the GEE tool (Shelestov et al. 2017). The platform more specifically provides an internet-accessible application programming interface (API) and an associated Web-based interactive development environment (IDE) for efficient satellite image processing with the opportunity for prototyping and fast visualization of results (Gorelick et al. 2017).

2.1 The Present State of Land Cover of Dhaka City

For this study, the city boundary shapefile for Dhaka has been collected and extracted from the digital database of the United Nations Office for the Coordination of Humanitarian Affairs (https://data.humdata.org/dataset/administrative-boundaries-of-bangladesh-as-of-2015) and from Development Design Consultant (DDC), based on the Draft Dhaka Structure Plan Report (2016–2035) of the city development authority, RAJUK of Dhaka city, Bangladesh (RAJUK 2015). Then, the city boundary was projected to the World Geographic System 1984, a standard geographic projection system.

2.2 The Present State of Land Cover of Dhaka City

Landsat 5 Thematic Mapper (TM) and Landsat 8 Operational Land Imager (OLI) 30 m time-series images available through GEE were used for land cover classification. Images have been collected for the last 15 years (2008, 2013, and 2018) with a 5-year time gap. For this analysis, a median image was first made for each season from the images of that season. Then, median images of each season were used to train sample data collection. The temporal median values of each band were then computed to produce the resulting image (Gorelick et al. 2017). As median images can distinguish seasonal differences more efficiently, they were used in this research. (Gorelick et al. 2017).

The Landsat satellite series launched by the National Aeronautics and Space Administration (NASA) and the U.S. Geological Survey (USGS) produces high-quality imagery consistently. The blue, green, red, near-infrared (NIR), short-wave infrared 1(SWIR1), and short-wave infrared 2 (SWIR2) bands were used for classification. Table 1 shows the selected bands for this research and their resolution from Landsat 5 and Landsat 8. The temporal resolution of Landsat images is 16 days.

Table 1 Characteristics of multi-temporal Landsat 5 and Landsat 8 data (Oliphant et al. 2019)

Band name	Landsat 8 OLI spectral range	Landsat 5 TM + spectral range
Blue	0.45–0.51	0.45–0.52
Green	0.53–0.59	0.52–0.60
Red	0.64–0.67	0.63–0.69
NIR	0.85–0.88	0.76–0.90
SWIR1	1.57–1.65	1.55–1.75
SWIR2	2.11–2.29	2.09–2.35

2.3 Classification and Training Sample

There are two types of classification: supervised and unsupervised. With supervised classification, a user can select sample pixels from an image representing a specific class, and the image processing software uses those to classify the image. Training sites are selected based on the knowledge of the user. Software processes the image using maximum likelihood and minimum distance, based on statistical analysis (Aldoski et al. 2013). With unsupervised classification, the user has no prior ground information. The computer decides which classes are related and shows them to the user. The user must define the classes and the number of classes. Using specific statistical criteria, the pixels having the same or nearly the same spectral characteristics are grouped in the same class (Wang and Cheng 2010).

To assess the LCLU of Dhaka city, a supervised classification method was applied within GEE. There are a number of supervised classification algorithms, such as Bayes CART, random forest, SVM, perceptron, and Mahalanobis. CART, random forest, and SVM were used on a trial-and-error basis in this research and reviewed. Among them, random forest produced the best result (Gorelick et al. 2017). Random forest is a machine learning algorithm that can do regression and classification using discrete or continuous data. It computes the algorithm analyzing the complex relationships within the predictor variables (Mutanga et al. 2012).

In this study, the images have been classified into 6 classes. These are waterbody, vegetation, built-up, barren land, wetland, and agriculture. The definition and the area of interest for each class were derived from Moniruzzaman et al. (2021), which is provided in Fig. 2. To classify these selected classes, training samples have been determined using secondary data including historical images, Google Earth view, and authors' knowledge. For 2018–19 imagery, Google Earth and Google Maps were selected as a reference. Comparison of both true-color and false-color images was used to differentiate and select training sample data (Shihab 2020).

Wetlands have less depth and become more visible during the rainy season, whereas waterbodies have greater depth and exist all year round. Agricultural land looks green during the cropping season, and some low-lying agricultural lands get flooded during the rainy season. As a result, in the rainy season, wetlands, water bodies, and agricultural land look similar and are difficult to distinguish. This is

Class Name	Description
Agriculture	Land used for agriculture, crop fields, paddy field, fallow lands, and vegetable lands, fruits, and other cultivated lands
Built-Up	All residential, commercial, and industrial areas, isolated and clustered settlements, transportation, roads, services, mixed urban, and other urban areas considered impervious in the present study
Wetland	Permanent and seasonal wetlands, low-lying areas, marshy land, rills, gully, and swamps
Open Land	Barren land, bare and exposed soils, abandoned land, open space, landfill sites, earth and sand in-fillings, brickfields, areas of active excavation, uncultivated land, and construction sites
Green Spaces	Deciduous forest, mixed forest land, palms, orchard, herbs, climbers, gardens, inner-city recreational areas, parks and playgrounds, grassland and vegetable, conifer, scrub, and others
Water Bodies	River, permanent open water, lakes, ponds, and reservoirs

Fig. 2 Description of LULC classes (adapted from Moniruzzaman et al. 2021)

where the advantage of GEE comes in, because we can stack all available images to identify wetland, waterbody, vegetation, and agricultural lands separately and properly.

Training samples for water bodies were selected from winter and summer seasonal images. The wetland training sites were selected from the rainy season, differentiating the wetlands from waterbodies when they showed up only in the winter. Training samples for agricultural lands were selected from winter and summer images, considering the winter (rabi) crop season stretches from November to April in Bangladesh (Mohsenipour et al. 2018). The shape was the distinguishing element when natural vegetation and agricultural land were considered. Agricultural land had regular shapes, natural vegetation irregular. The selection of training samples for barren land was quite challenging. Agricultural land looks like barren land after crops are harvested. Dried wetland and barren land also have the same spectral signatures. Thus, to avoid these confusions, training samples for barren land were selected from the rainy season when the higher flat land not submerged by water was considered to be barren land. Training sites for built-up areas were selected from all seasons' images, as it is not mutually exclusive from other land covers (Shihab 2020). Often, cloud-free and clear images were not available during monsoon periods, which was the season considered to highlight the land cover differences. This was one of the challenges of good classification of the images.

Identifying the agricultural parcels is challenging, although they have unique shapes and scales. More sophisticated methods such as the multiresolution segmentation (MRS) algorithm (Baatz and Schape 2000) and sequential model-based optimization (SMBO) (Bergstra et al. 2011) can predict and delineate agricultural grids more efficiently, but with time and resource constraints, visual inspection of satellite images and google earth images was used to pinpoint the regular forms of agricultural

images. Training samples were taken from predominantly agricultural land to minimize the chance of over-segmentation (Tetteh et al. 2020; Beaubien 1986; Vogels et al. 2019).

As monsoon images were also taken into consideration, there were issues regarding clouds and masking the cloud cover. However, training samples were taken from monsoon images only for wetlands that exist predominantly during the monsoon season (Quamar 2019; Clark and Csiro 1988), and images and training samples were taken from places visually free from clouds to reduce the effect of clouds. In addition, composite images were filtered with pixel_qa band (bits used were 3 and 5) to mask out the cloudy pixels.

In this study, three seasons were considered, producing three images for each year, putting together all available images in GEE (Shihab 2020). The three dominant seasons of Bangladesh are as follows: (1) the dry winter season from November to February (November 16th to February 15th), (2) the pre-monsoon hot summer season from March to May (March 16th to May 15th), and (3) the rainy monsoon season from June to October (June 16th to October 15th) (Shahid 2011).

Using the ".addBands" function, the three images from each year were merged, bringing all bands together. Then, training samples were selected from the merged three images of 2008, 2013, and 2018, and image classification was performed. The uniqueness of this classification was the consideration of all bands, representing all the seasons throughout the year.

2.4 Accuracy Assessment

Classification accuracy was validated using the error matrix method in Table 2. For accuracy assessment, reference points were selected based on secondary data (historical images of Dhaka during selected periods). Most accurate points were selected as reference points. For each class, 7 points were selected. Average accuracy was 94%. Users' accuracy ranges from 91 to 95%. Producers' accuracy ranges from 91 to 95%. For both users' and producers' accuracy, waterbody and wetland resulted in lower accuracy. Commission error ranged from 0 to 73%. Omission error ranged from 0 to 62% (Ukrainski 2016).

Table 2 Results of accuracy assessment of classified output (Conditional Kappa (K^) Statistics)

Category	Years		
	2008	2013	2018
Overall accuracy (%)	95	94	95
Kappa value	0.95	0.93	0.94
Producer's accuracy (%)	93	91	95
Users accuracy (%)	95	96	91

2.5 Limitations of the Study

The study used 30-m resolution Landsat images, which often cannot adequately distinguish classes with very narrow differences. Again, the selection of training samples was performed using Google Earth temporal images, historical images, and the authors' knowledge, without any primary survey because of time and resource constraints. The study used monsoon images for better delineation, but high-intensity cloud covers consistent all through the monsoon periods may affect delineation and classification as well, despite cloud masking.

3 Results and Discussion

Dhaka city, administratively known as Dhaka Metropolitan Area (DMA), has been established with the Buriganga River bordering the southwestern part of the city somewhat restricting the growth of Dhaka (Fig. 3).

3.1 LCLU Change

Over the ten years of Dhaka's growth, it is evident that a lot of land cover land use change occurred between 2008 and 2018 (Fig. 3). The urban built-up concentration was in the southwestern part, alongside the Buriganga River in 2008. The northern part was mostly green and barren land; vegetation and waterbody were on the eastern part of the city. By 2013, the urban built-up area had increased, spreading through the northern part of the city. It further increased from 2013 to 2018. This is not a surprise as Dhaka is the third most densely populated city in the world (Wright 2020). The ten-year expansion pattern shows that the growth near the Buriganga River faded out, and gradually Dhaka expanded to the north and east, away from the river.

Over the years, barren land significantly transformed into the urban built-up area. Water bodies in the northeastern and western areas transformed into green spaces. Some water bodies still exist in the center and north-western part of the city. Specifically, in 2018, the urban built-up area expanded to the southeast and central part of the city. A large green area in the eastern part has transformed into barren land. Water bodies in the central part have narrowed and changed into barren land and impervious surfaces.

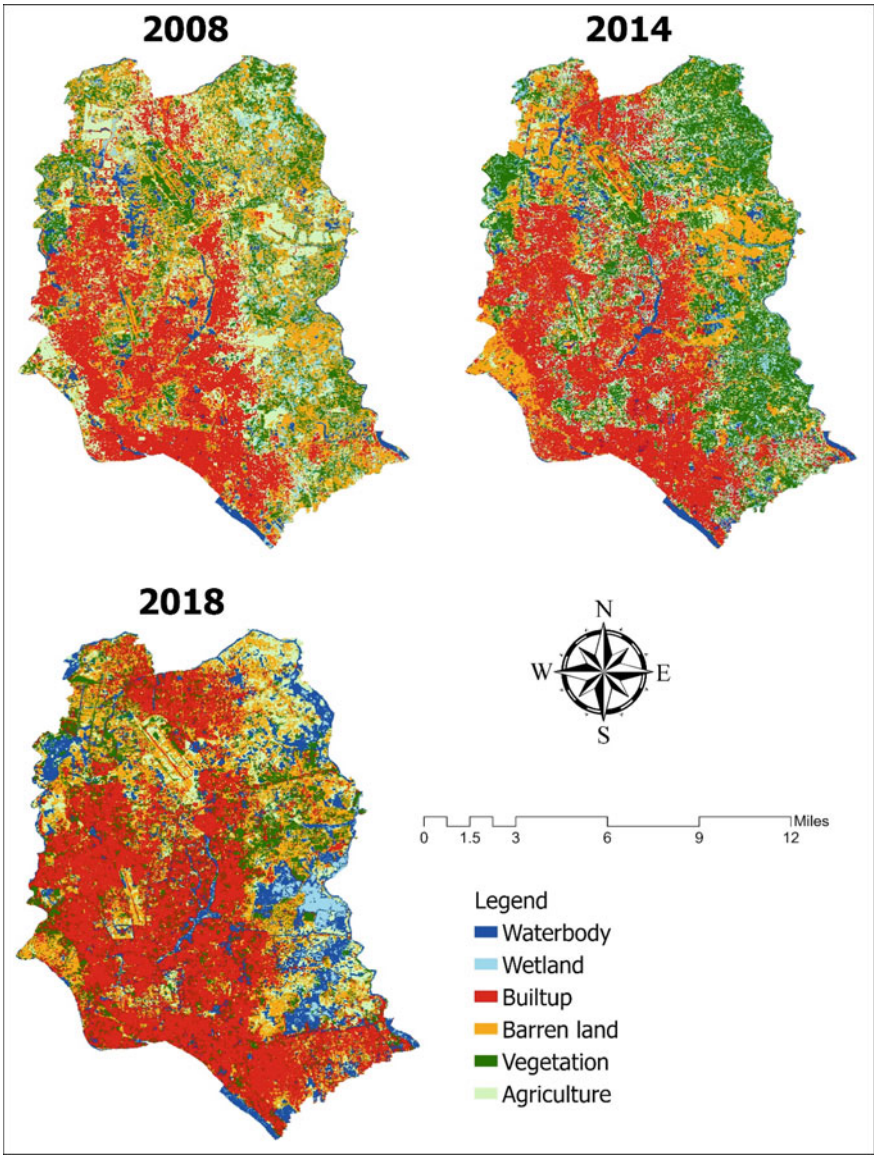

Fig. 3 Land cover changes of Dhaka Metropolitan Area (DMA) in 2008, 2013, and 2018. (A section of the Buriganga River is visible in blue in the southwest of the three images)

3.2 Statistical Change

The LCLU changes in Dhaka reveal some interesting patterns (Table 3). Waterbody changes show consistent growth, which is promising from a sustainability point of view. From 2008 to 2018, water bodies have decreased slightly and then increased as some lakes were revitalized by the government. In this time, wetlands have decreased significantly, but water bodies have increased. As this research tries to delineate water bodies from wetlands, there may have been some land characterized as water bodies in prior literature but attributed as wetlands here. This could be the reason for an increased percentage of water bodies in this study. Combined, the change of water bodies and wetlands is negligible in this study, which confirms the findings from prior literature (Kafy et al. 2021; Moniruzzaman et al. 2021). Vegetation has shown different patterns in these two periods. From 2008 to 2013, vegetation increased by 44%, but then between 2013 and 2018, almost 50% of vegetation cover was lost, and the total amount remains unchanged after 10 years. This decrease could be attributed to population increase and thus increase in demand for land. This study tries to differentiate vegetation from agricultural lands and tries to classify agricultural lands in the domain of sparse vegetation. An increase in vegetation cover from 2007 to 2014 might have come because it was classified as agricultural lands in prior literature. Again, visual analysis of these images from Fig. 3 reveals that most of the increase happened in the eastern part of the city and mostly converted from wetlands or sparse vegetation like agriculture. It could be because the eastern fringe of the city has flood flow zones, water retention areas, national and regional parks, forest areas, and other open spaces. In a comprehensive study on urban planning and environmental area conservation of Dhaka, Nahrin (2019) found that, in the last 10 years, a lot of those lands were purchased by individuals and land developers, who usually transform them into different land uses, wait for few years and sell when the price increases. Often there is earth filling and planting of new trees to hold authority in those lands before transferring them to more profitable land covers such as residential or commercial plots. Within this time, those lands might exist as vegetation if the land grabbers grow some plants to keep ownership and authority. Here, vegetation and agricultural land use often overlap. Jointly, the changes of vegetation and agricultural areas are aligned with the prior literature working with higher resolution images like rapid eye (Kafy et al. 2021; Moniruzzaman et al. 2021).

The only category that consistently showed an increase was built-up, a 16% increase between 2008 and 2018. Barren land over these ten years increased consistently, with a slight dip between 2013 and 2018. Wetlands have decreased in coverage, which is expected as more land is needed to cater to the growth of the city. Agriculture also showed some consistent decrease by 2018. These land cover changes are also consistent with prior literature classifying wetlands and agricultural lands for the same study area (Moniruzzaman et al. 2021).

This unique element of Dhaka LCLU found in this study is the fluctuations in land cover distribution over a short period of ten years. Almost all land covers increased and decreased within five years, depicting randomness in the pattern of LCLU change.

Table 3 Statistical table of land cover of Dhaka from 2008 to 2018

Land cover type	Land cover area acres (in percentage)		
	Land cover in 2008	Land cover in 2013	Land cover in 2018
Waterbody	3765 (5)	2259 (3)	9790 (13)
Wetland	6778 (9)	6025 (8)	1506 (2)
Built-up	18,827 (25)	22,593 (30)	29,371 (39)
Barren land	21,087 (28)	12,803 (17)	15,815 (21)
Vegetation	11,297 (15)	19,581 (26)	11,297 (15)
Agriculture	12,803 (17)	12,050 (16)	7531 (10)

The common pattern is, first agricultural land changes to vegetative land, then to the barren land and finally gets converted to built-up. This fluctuation can be attributed to a real estate scam of leaving the land barren for few years before reclaiming the land to build high rises.

In 2008, there were significant wetland and agricultural lands in the northeast and northwest part of Dhaka. Gradually, these wetland and agricultural lands got converted to barren land by 2013. There could be two reasons for that. One is the increase in the extent of the flooded area during the monsoon season. With extensive encroachment of built-up onto the flood zones, the area getting flooded during the monsoon season also has increased (Rahman and Islam 2019), thus gradually converting productive land to unproductive barren land. The interesting fluctuations of vegetation and agricultural land reveal that agricultural areas are more susceptible to conversion into barren land and eventually to built-up areas. The other reason is real estate investments, as mentioned earlier in the paper. The water bodies have been filled with soil, and vegetation is cut down and transformed into crop fields, left abandoned for a while before beginning to build on it. Not only real estate agents but also landowners themselves fill waterbodies and demolish vegetation to grow crops and profit from them. Eventually, they also transform into urban development.

4 Conclusion

This study restates the importance of GEE, in which several satellite images can be stacked, allowing us to distinguish between abandoned agricultural land with floating green aquatic plants and water bodies with a vegetated cover. Without image stacking in Google Earth Engine, these agricultural lands would be mistakenly identified as vegetation. Image stacking and training samples of each land cover from their best representative seasonal image have made it possible to delineate each land cover exclusively.

LCLU of Dhaka city has been changing since its declaration as a capital city post-Bangladesh's independence in 1971. Demand for land has increased due to the

consistent increase in population. In a city like Dhaka, where growth happens organically, the repercussion is on the urban environment, and the overall wellbeing of the city is compromised. Unplanned and unsustainable growth leaves a long and consistent impact on the economy and the progress of the city, which is not uncommon in the developing megacities of the world. Dhaka LCLU has seen a lot of temporary and permanent transformations in its land cover types in the ten years (2008–2018) chosen for this study. Some of the conversions were deliberate and eventually transformed into built-up. These strategic land cover changes were responsible for the loss of water bodies, vegetation, and other natural landscapes of the city. Generally, these man-made and strategic land cover changes decrease the natural landscape share of the city gradually but have yet to get attention from government agencies and conservation environmental groups. Thus, a thorough change analysis of Dhaka city's LCLU will give a better understanding of the conversion pattern and help determine the next steps to a healthier and more sustainable future for the city.

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Beating the Traffic: Civil Society Participation in Transport Reforms and Innovations in Metro Manila, Philippines

Gina Rocafort Gatarin

Abstract Traffic congestion is synonymous with Metro Manila, the capital of the Philippines. With a population of almost 13 million people, travel usually takes a grueling amount of time as they traverse the gridlocked roads and cram into the very limited supply of public transport modes. Meanwhile, cars reign supreme in occupying much of this metropolis's hardly expanding road networks. While the government, foreign creditors, and big corporations plan for new and expensive transport infrastructure and public utility vehicle modernization as ways to solve the traffic problem, they tend to focus only on increasing economic gains and prioritizing technocratic expertise in transport planning and decision-making. They tend to marginalize the meaningful participation of civil society in co-creating transport solutions. This is why this research provides examples of good practices of collaborative initiatives to address traffic problems. Through my interviews with government transport agencies, private sector representatives, and civil society, as well as my auto-ethnographic account navigating around Metro Manila's complicated transport system, I present two examples of civil society-led transport reform initiatives in Pasig City. These examples contribute to reconstituting urban transport as a project of "shared responsibility" among the diverse constituents of the transport system. It builds upon a post-development discourse and the urbanism of Jane Jacobs in understanding modernity and urban development. In this way, the research contributes to how meaningful collaboration in transport reforms and innovations can make possible sustainable and less interventionist solutions to the transport problems of metropolitan cities in the Global South.

Keywords Civil society · Metro manila · Philippines · Traffic · Urban transport

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1 Introduction

Traffic is the top concern of daily urban life among Filipinos (DOTr and GIZ 2016: 1). This is particularly true in the country's capital, Metro Manila. Its roads transform into giant parking lots, called "carmageddon", especially during rush hours. With 13 million people, its fragmented transport system cannot accommodate the increasing demand for mobility. Factors that contribute to its worsening congestion include population growth, poorly maintained rail and road infrastructure, increased private vehicle usage, limited spaces for non-motorized transport, and lack of coherent and clear transport policies and plans, (see Regidor and Aloc 2017; Napalang and Regidor 2015; Manasan and Mercado 1999).

In 2014, a Japan International Cooperation Agency (JICA) study estimated that traffic congestion costs Metro Manila a daily net loss of Php 2.4 billion (US$52 million) and might increase to Php 6 billion (US$130 million) if no significant measures are taken by 2030 (JICA 2014). Another commissioned study by the ride-sharing scheme *Uber* in 2017 ranked Metro Manila as having the third-worst traffic in Southeast Asia with commuters stuck for an average of 66 min per day (Rappler 2017). Also, in 2017, the country was ranked in the Driver Satisfaction Index of the traffic and navigation application *Waze* as the worst place to drive among the 39 countries studied (Camus 2017).

There have been many plans over the past 40 to 50 years for Metro Manila's urban transport system, mainly through studies initiated by international development institutions (see Regidor and Aloc 2017; Napalang and Regidor 2015; Rimmer 1986). Their usual emphases are infrastructure's contribution to economic growth and global competitiveness that can foster development. They mainly focus on the construction of transport infrastructure and the implementation of technological solutions targeted to improve mobility through faster vehicular movement and increased road capacity. However, their implementation has been very difficult to sustain.

These are top-down solutions championed by foreign creditors, large corporations, and government administrations, which change every six years. With these numerous stakeholders involved, "fragmented responsibility "(Rimmer 1986) in transport governance became the norm. The overlapping roles of institutions tend to evade transparency and accountability. Furthermore, the voices of transport providers, such as the drivers and operators of public utility vehicles and car manufacturers and associations, are more amplified in transport decision-making. Meanwhile, the heterogeneous "public", those who commute through public and active transport (i.e., walking and cycling), have very limited spaces for meaningful participation (see Cariño 2007; Fischer 2000).

For these reasons, I argue that for urban transport challenges to be addressed sustainably, the economic domain must not be the sole focus of solutions. The urban transport development agenda must acknowledge the political and cultural domains, alongside rethinking of the economic and ecological domains. To develop

this agenda, transport reforms and innovations must involve meaningful collaboration with the vibrant civil society environment in the Philippines and optimize local innovations.

From this viewpoint, the study is a modest contribution in understanding the role of meaningful participation of civil society in making complex transport decisions (Fischer 2000: xi). To contextualize the spaces and role of civil society participation, I shall discuss in the next section how it evolved in the governance and development landscape in the Philippines. This is followed by two illustrations of civil society-led transport reforms and innovations in Pasig City, Metro Manila. Pasig City presents a rich context as it spans over 34.32 square kilometers or 3432 hectares with a population of 755,300 in 2015 (Pasig City 2018). It has been suffering from severe traffic congestion and air pollution for many years.

I draw the Pasig City illustrations from an auto-ethnographic account on Metro Manila's urban transport system and 20 qualitative interviews with representatives of government transport agencies, the private sector, and civil society. These interviews encompass a wide range of pertinent stakeholders providing rich insights in solving Metro Manila's transport problems. The illustrations from Pasig describe a paradigm shift from the regime of top-down governance and fragmented responsibility toward a "shared responsibility (Young 2006). Drawing inspiration from post-development theory, I challenge the myopic government transport agenda that only sees transport solutions as a way to achieve economic growth and global competitiveness, with people's quality of life as an afterthought. I want to move beyond solutions that tend to be embedded in the development experience and practices in the West (Escobar, 1995), as well as the geopolitical ambitions of China and Japan (see Wu and Chong 2018; Potter 1997). With this at hand, the study provides some watersheds of hope, which may inspire more positive engagements in the cities of the Global South in tackling urban mobility challenges.

2 Civil Society Participation in the Philippines

Civil society in the Philippines is a major player in the development process both at the national and the local levels. Representative stakeholder groups come in many forms: "grassroots organizations, cause-oriented and sectoral groups, mass movements, and non-government organizations" (Mojares 2006: 35). Their participation in reforming state policies and ensuring community participation evolved in ways that make their involvement one of the most vibrant and advanced in the world (ADB 2013: 2).

The socio-political context for civil society participation in the Philippines is a major product of the struggle against the authoritarianism of the Marcos era (1965–1986). Emerging from the 1987 Constitution, the provisions for "people power" in governance became tenets of the democratic government that followed the Marcos period (Cariño 2007: 95). According to van Naerssen (2001: 680), such democratic government, which is open to a participatory character of civil society, is a major precondition for their existence and success.

Participation by civil society in governance is reinforced also by decentralization as mandated by the *Local Government Code of 1991* and the introduction of President Fidel Ramos' administration (1992–1998) of the party list system in 1998. Dennis Rondinelli (in Cariño 2007: 93) argues that decentralization has been a key feature of the post-authoritarian period in the Philippines, which institutionalizes "citizen participation in development planning and management". Meanwhile, the party list system allots to marginalized groups 20% of the total number of seats at the House of Representatives, filled through proportional representation (Lewis 2013: 38). This addresses concerns of marginalized populations as politicians from elite backgrounds, who dominate elected positions, tend to be Janus-faced in supporting reforms (Swyngedouw 2005).

According to Shatkin (2000: 2358–2359), two justifications for decentralization and participation are as follows: (1) a *neoliberal view* of reducing the power of the national government for a more cost-effective and efficient service delivery and (2) a *political economy premise* that community groups deliver more sustainable and appropriate development outcomes to fill local needs. In the first view, it is noteworthy that institutions like the World Bank, which was a "gatekeeper" of orthodox modernization driven by a centralized state, prescribe these principles of democracy to attain development using the apolitical term "governance" (Cariño 2007: 92). The second view also has its complexities since participation of civil society is prone to corruption, as illustrated by controversies around pork barrel funds. Right or wrong, there is a perception that by channeling government funds to deliver services, certain politicians have connived with some fly-by-night or dummy non-government organizations (NGOs), to steal from the public coffers.

In relation to transport issues, civil society usually plays the role of watchdog to reduce corruption, project delays, and clientelism prevalent in infrastructural projects such as road construction (see Dañguilan Vitug 1998). Here lie the shaky grounds of civil society participation. Even though the state enables spaces for participation, it also needs policing. Some interesting illustrations are seen around the adoption of civil society participation in open government initiatives, such as bottom-up budgeting (Bu B) and undertaking citizens' participatory audits (Open Government Partnership 2015 in Cruz et al. 2019: 11). This situation has then created a pressing dilemma for civil society on "whether or not, and to what degree, to cooperate with government agencies" (van Naerssen 2001: 678).

3 Civil Society Initiatives in Transport Reforms and Innovations

Despite the Philippines having one of the most vibrant environments for civil society participation around the world, organized groups that engage with transport issues tend to be exclusive to transport providers. However, a growing number of concerned

individuals in recent years have started to establish informal groups to find solutions to the worsening transport situation. They are mostly volunteers who have worked or are still engaged with government and international development institutions. Others have a background in information technology, engineering, urban planning, project management, law, community organizing, and environmental protection. Their engagement is primarily motivated by the perception that the millions of people who experience the daily Carmageddon and endure the sacrifice of being a "warrior" to survive public transport commuting are not given the voice they deserve.

Many of the civil society groups that I encountered during my field research attempt to form coalitions with like-minded individuals and organizations to engage with government, academia, and the private sector. Examples of their engagements include the crafting of policy papers and proposals that will help government agencies. To illustrate such engagements, I shall share two examples of civil society-led transport reform and innovation in the busy Ortigas central business district (CBD), Pasig City. These are the *Bayanihan sa Daan* initiative, adopted in the implementation of carless weekend along the F. Ortigas Jr. Road (formerly Emerald Avenue), and the walkable Pearl Drive initiative.

3.1 Bayanihan sa Daan *Through Carless Weekends*

Bayanihan sa Daan (Collective Heroism on the Road) is a civil society-led road-sharing movement convened by the Filipino environmental lawyer Antonio "Tony" Oposa, Jr.[1] through the Share the Road Movement. *Bayanihan sa Daan* espouses a 50–50 road-sharing principle—50% of the road will be allocated to sidewalks, bicycle lanes, and urban gardens while the other 50% will be for the organized transport system (public utility vehicles and private vehicles) (Walkability Asia 2014). In February 2014, the Share the Road Movement, together with civil society groups (National Bicycle Organization, Clean Air Asia, and Partnership for Clean Air), ordinary citizens, and Filipino senators (Loren Legarda, Paolo Benigno "Bam" Aquino IV, and Edgardo "Sonny" Angara, Jr.) filed a petition for a *writ of kalikasan*[2] and mandamus to the Supreme Court of the Philippines to bring back urban sanity on the roads (Ayalin 2014).

Applying the Filipino tradition of *bayanihan*, wherein community members help each other, usually in lifting a nipa house from one location to another, *Bayanihan sa Daan* claims to work through a sandwich approach to achieving positive change

[1] Tony Oposa is a Ramon Magsaysay Awardee, Asia's highest public service award or the Nobel Peace Prize of Asia. He championed the principle of intergenerational responsibility in the landmark case *Minors Oposa v. Factoran, 1993*. He filed petitions to the Philippine Supreme Court on behalf of children and the future generations to take legal action to protect the environment and sued government agencies for their inaction on cleaning Manila Bay. I spoke personally to Oposa, who referred me to the Pasig City local government on the implementation of *Bayanihan sa Daan.*

[2] The *writ of kalikasan* (nature) is a legal remedy that guarantees "the constitutional right to a balanced and healthful ecology" (Republic of the Philippines Supreme Court 2010).

in society. The sandwich or *bibingka*[3] approach utilizes a bottom-up or grassroots movement of civil society, catalyzing the needed change, as well as a top-down approach wherein the government initiates change (Interview with Oposa in Walkability Asia 2014). With only 2% of the Philippine population owning private motor vehicles but with such vehicles occupying most of the road space, *Bayanihan sa Daan* invokes the protection of the law for the remaining 98%, discriminated against through the lack of proper sidewalks, bicycle lanes, and a good public transport system (Interview with Oposa in Walkability Asia 2014). It claims that roads are not just for cars but also for people.

In its radical sense, it advocates for a "road diet". It attempted to demonstrate the road-sharing principle in one of Metro Manila's major thoroughfares, the Epifanio delos Santos Avenue (EDSA), in 2015. It showed the public the intensity of the traffic crisis since EDSA has exceeded its capacity. According to the Metropolitan Manila Development Authority (MMDA), EDSA can accommodate 160,000 vehicles per direction per day, but it reaches as many as 260,000 vehicles per direction in car volume daily (Clean Air Asia 2015).

Subsequently, the Pasig City local government was inspired and made the *Bayanihan sa Daan* principle its policy. The Pasig City local government first learned about the *Bayanihan sa Daan* initiative through the nationwide conference of environment and natural resources office (ENRO). Pasig's representative to the conference spoke to Oposa and made adjustments to the concept for local application. It became the basis for implementation of carless weekend along F. Ortigas Jr. Road in the Ortigas CBD.

Since Pasig City instituted its *Green City Program* in 2009, *Bayanihan sa Daan* found stable grounds for practice. The *Pasig Green City* is a flagship program of former mayor Robert "Bobby" Eusebio and the City Environment and Natural Resources Office (CENRO) for the strengthening of the Pasig Command Communications and Control (C3) Center (Porio 2012: 21). The Pasig C3 serves as the "nerve center" for traffic, emergency, and disaster situations (Porio 2012: 21).

During my interview with the Pasig CENRO representative, she emphasized that the *Pasig Green City* is part of the "mayor's vision" on environmental protection in the next 50 years. The Pasig CENRO representative is referring to former mayor Bobby Eusebio, whose family ruled Pasig for 27 years (1992–2019). It is interesting to note then that Pasig's successful implementation of the *Bayanihan sa Daan* rests on the leadership of a local chief executive from a political dynasty who has perpetuated control and power through advancing good local governance (see Porio 2012).

The *Bayanihan sa Daan* adaptation started with carless Sundays with an aim to curb the growing number of smoke-belching vehicles added to Metro Manila's roads, which contribute to 60% of the air pollution (Pasig City Ordinance No. 13, Series of 2011). Figure 1 shows F. Ortigas Jr. Road during a weekday. But, apart from cutting down on emissions, it provided a space for family and community activities, promoted pedestrianization, and contributed to decongestion of the city.

[3] *Bibingka* is a Filipino rice cake that is traditionally cooked in a clay pot. Preheated coals are placed at the top and bottom of the pot to cook it.

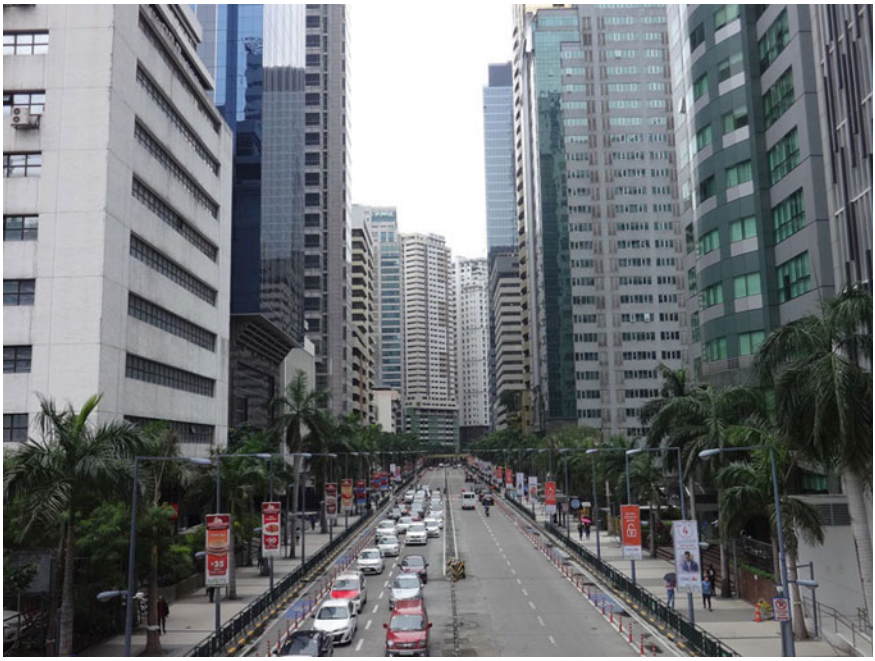

Fig. 1 F. Ortigas Jr. Road on a weekday (*Source* Roque 2019)

The carless road (see Fig. 2) compensated for insufficient public parks (Pasig CENRO Representative, Personal Communication, March 06, 2019). Initially, some business establishments along Emerald Avenue became concerned about closing the road to motorized transport as it might lead to loss in revenue. However, the people who have patronized the carless Emerald Avenue demanded more hours with roads closed to vehicles and subsequently it changed to two days in 2017. As the CENRO representative (Personal Communication, March 06, 2019) shared, "[f]irst, around June, it was just 8AM, 6AM to 12 noon. Then, when the people clamored, they want it to be 6AM to 6PM around October. Then, in December 2017, they agitated for the program to be expanded to two days."

In the same year, *Bayanihan sa Daan* was awarded the Galing Pook Award in recognition of this sustainable transport initiative as an excellent innovation in local governance. By 2018, the Pasig City local government decided to create its own transport office, the City Transportation Development and Management Office (CTDMO). The latter used to be only an ad hoc committee in the Pasig City council. This office was created through a joint initiative with mayor Bobby Eusebio, which continued during the term of his wife, mayor Maribel Eusebio (2013–2016) and through the lobbying of senior citizens and people with disabilities (PWD) (Pasig CTDMO Representative, Personal Communication, February 22, 2019).

CTDMO's creation as a standalone transport office is a distinct move since most Philippine cities and municipalities focus only on traffic management. CTDMO

Fig. 2 Carless weekend at F. Ortigas Jr. Road

holds the mandate to accommodate the growing transport services and sustainable transport initiatives of the city. It has an active social media presence that announces bus schedules and shares articles on inclusive and sustainable mobility. The carless weekend project was delegated then from the CENRO to CTDMO. From F. Ortigas Jr. Road, it has multiplied in many places around the city. The most recent one is along Pearl Drive, which will be discussed in the next section.

3.2 Walkable Pearl Drive Initiative

Pearl Drive is another busy road in Pasig City's Ortigas CBD. Most of the road space is occupied by motorized vehicles and parking areas. Even its sidewalks have become extensions for parking, which forces people to walk on the road. According to a representative of the network Move, Move, Move People (3MP), the walkable Pearl Drive initiative started when members of the University of Asia and the Pacific (UA&P) community attended a discussion about Implementing Rules and Regulations (IRR) of the National Transport Policy (3MP Representative, Personal Communication, January 14, 2019). These UA&P members identified Pearl Drive to be a major project, so they launched an online petition in 2018 on the Web site Change.org and gathered more than 6,000 signatures.

A group called Friends of Pearl Drive initiated the online signature campaign. It is composed of residents and office workers of Barangay San Antonio (the village where Pearl Drive is located) and the faculty, staff, and students of UA&P, who urged the Pasig City local government, Barangay San Antonio officials, Ortigas & Company, and Ortigas Center Association, Inc. to make Pearl Drive walkable. This would be accomplished by constructing a linear park along the road's creek side and reclaiming the sidewalk spaces that had been converted to parking spaces by local business establishments (Reysio-Cruz 2019).

By early 2019, petitioners were successful in closing Pearl Drive every third weekend from January to March. The Friends of Pearl Drive, led by Philip Peckson, were eventually supported by the officials of Barangay Antonio and the Pasig CTDMO. A 200-m portion of the road became off-limits to vehicles to give space to people (Reysio-Cruz 2019). Food stalls became available, and people were able to savor community life in the road through the provision of a safe environment for bicycles and pedestrians. MMDA traffic enforcers were also present to redirect the flow of traffic. Like the carless weekend at F. Ortigas Jr. Road, the Pasig CTDMO views the Pearl Drive initiative as a way to provide a de facto park amidst the "Ortigas jungle of steel and concrete" (as cited in Reysio-Cruz 2019).

Most of the activities related to the Pearl Drive initiative are advertised through social media, including Facebook. The latter became an active platform for the circulation of information, such as the advertisement in Fig. 3. It was supplemented by the launch of a photo contest open to the public called Click Your Byahe (Click Your Travel). The subjects of photo entries included four categories: (1) overcoming mobility challenges; (2) using public transport; (3) using non-motorized transport; and (4) transport's environmental impact. The photo exhibit was opened to the public on January 17, 2019. With the media and public attention it received, plans have surfaced from concerned individuals on how Walkable Pearl Drive will continue.

4 Beating the Traffic with Creativity

The worsening traffic situation in Metro Manila has massive impacts to all domains of life—political, economic, cultural, and ecological (see James 2015). Its impact on the political domain became prominent during the 2016 presidential campaign of current Philippine President Rodrigo Duterte, who promised to seek emergency powers from Congress to tackle the traffic problem. He wanted to appoint a national traffic tsar to centralize the authority in managing Metro Manila's chaotic transport system (Peel and Ramos 2016). Such is his platform to address the fragmented responsibility that characterize the governance structure of the urban transport system. However, Congress did not approve his plan. In 2019, Duterte claimed that this campaign promise is the only one he was not able to fulfill. This is despite the rollout of the ambitious Build, Build, Build (BBB) program that promises a "golden age of infrastructure" in the Philippines and the Public Utility Vehicle Modernization Program (PUVMP).

Fig. 3 Advertisement for the Walkable Pearl Drive Initiative (*Source* Peckson 2019)

These programs of the Duterte administration view infrastructural and technological solutions to Metro Manila's transport issues as means to achieve economic growth and global competitiveness. The BBB program, for example, has targeted infrastructure spending of Php 8–9 trillion (US$160–180 billion) from 2017 to 2022 (NEDA et al. 2017). It aims to build urban railways, urban mass transport, and airports and seaports within three to five years of Duterte's term in office (NEDA et al. 2017) and further develop Clark, in the north of Manila, to decongest the capital. Meanwhile, the PUVMP is the largest non-infrastructural program of the Duterte administration. It formulates solutions to the dreadful traffic situation and transport system around route rationalization, fleet consolidation, and vehicle modernization.

Many aspects of the BBB Program have been criticized, including the shifting in financing toward greater debt-taking, causing macroeconomic drawbacks on trade balance and exchange rates, and its particular interest toward Chinese financing (Cruz et al. 2019: 3). In a similar vein, some groups of drivers and operators of public utility vehicles, such as the jeepney, criticize the PUVMP as being "anti-poor and profit-oriented" (San Mateo in Westerman 2018). New units of modern vehicles are too expensive for ordinary drivers and operators, thus are criticized as only a façade for the corporatization of the transport sector.

In such a complex landscape of the traffic situation and transport issues, people are left on their own to find ways to meet their mobility needs. The rising middle class

highly favors purchasing cars and motorcycles. These private motorized vehicles have become the private solution to the public problem of the lack of a safe, reliable, and efficient public transport system, aggravated by the hostility of the roads to pedestrians and cyclists (see Murphy and Hogan 2012). NEDA's study called AmBisyon Natin 2040, for example, shows that 77% of middle class Filipinos prefer to own a car (NEDA n.d: 11).

With the addition of more motorized vehicles comes the impact to the ecological domain, particularly indicated by worsening air pollution in the metropolis. 88% of the air pollution around Manila comes from mobile sources (DENR-EMB n.d: 6). Greenpeace Southeast Asia estimates that there were as many as 27,000 premature deaths in the Philippines in 2018 due to fossil fuel air pollution (Farrow et al. 2020: 16).

Lastly, there is the impact on the cultural domain because even though millions of people are affected and are complaining about the situation, their engagement to change the situation is limited. This is despite conditions of openness to civil society that enable greater political participation the Philippines, as noted earlier. Thus, the intention of this research is to demonstrate how such civil society-led transport reforms and innovations can provide creative ways of utilizing various platforms to achieve positive change.

The *Bayanihan sa Daan* and walkable Pearl Drive initiatives in Pasig City illustrate that civil society can mobilize support within its sector, as well as from the government and the private sector. These examples of civil society-led transport initiatives are crucial to tame the magnitude of influence of technocrats (or what is popularly known as "economic managers") in government, foreign creditors, and large corporations who dominate transport decision-making. They tend to be blind to the impact of the massive upheaval caused by these solutions leading to displacement in housing, livelihood, and sense of security, especially of the urban poor (see Senate of the Philippines 2018; IBON Media 2017).

These examples illustrate the possibilities for a more collaborative approach to address the conflicts that arise whenever transport plans are implemented and calls on "a change in approach from all interests" (Booth and Richardson 2001: 143). They come in a crucial time when Filipinos tend to view that the only source of "comfortable" travel is a car. Such vision of cars having the monopoly of the imagination for mobility as shown in the *AmBisyon Natin 2040* study, which manifests what Illich (1973, as quoted in Inman 1997: 58) calls "radical monopoly". This happens when "one industrial production process exercises an exclusive control over the satisfaction of a pressing need". It curtails the people's right to dignified travel as walking, cycling, and river travel are eliminated from the city's mobility options.

The collaboration of civil society representatives with local governments, national agencies, and the private sector contributes to enabling their meaningful participation by taking the role of a "critical friend". They become ways to confront the fragmented responsibility of distant and duplicitous government technocrats and politicians. This is through the creative and meaningful participation of a civil society whose majority does not have and does not want the car or private vehicles to be the sole means for their mobility.

This creativity manifests in the strategic use of the law, creating networks with relatively open-minded and progressive city and village council officials, social media and online petition platforms, and taking advantage of volunteer clout. Creativity then becomes a powerful tool to keep our cities afloat since it is the main problem that our cities face. As the activist Jane Jacobs (2016: 219) said, "[o]ur trouble is not that our cities, per se, are obsolete, but that they are no longer creative. This is the real problem of cities: to remain creative." The creativity in the *Bayanihan sa Daan* and walkable Pearl Drive initiatives illustrates what Illich calls an "opportunity web", which can make use of life experiences as a way to address the detrimental effects of modernity as in the case of the radical monopoly of the car. (Inman 1997: 58).

Furthermore, with a particularly strong online presence, these initiatives stand a chance for individuals and groups to share information, advocacies, and activities that can establish their values to be integrated in transport plans to aid planners in making informed decisions (Majumdar 2017). They tackle civil society participation in effecting positive social change through helping government agencies and officials understand their mandate. This is by implementing policies and projects that are not distant solutions to the traffic gridlock but as something familiar and close to community need.

The *Bayanihan sa Daan* and walkable Pearl Drive initiatives can be seen as practices that challenge what the post-development anthropologist Arturo Escobar (2018: 4) calls "hegemony of modernity's one-world ontology". This is through the creation of a wide horizon for the imagination of alternative mobilities that cater to the most vulnerable—the pedestrians, cyclists, differently abled, elderly, and children. They could be the actual realization of what Escobar (2018: 4) calls a "pluriverse" that provides experimentations for "reimagining and reconstructing local worlds".

In such an alternative world, these initiatives are active platforms for beating the traffic through a "shared responsibility (see Young 2006) of the heterogeneous constituents of the urban transport system. It enables possibilities on co-making urban mobilities, through giving way (*bigayan*) which after all is part of the Filipino practice of sharing the road. It might be inspiring heroism in every individual and local community (*bayanihan*) that could bring forth new frontiers to re-imagine mobility in our cities.

5 Conclusion: Toward a Shared Responsibility

Although Metro Manila's traffic situation is worsening and its urban transport issues continuously multiply, it is not a totally hopeless case. There are many possible solutions. They tend, however, to mainly focus on infrastructure and technological interventions with certain visions and interests that are usually embedded in a top-down approach from government technocrats, foreign creditors, and large corporations. The emphasis is usually on economic growth and global competitiveness with the people's welfare as only an afterthought.

This research asserts that beating Metro Manila's traffic problems and dealing with its many transport woes must not revolve just around these grand and expensive solutions. The meaningful participation of civil society helps address these problems through creating a safe, reliable, and efficient urban transport system. The meaningful participation of civil society, as illustrated by the *Bayanihan sa Daan* and walkable Pearl Drive initiatives, provides examples of good practices that do not take civil society as mere participants in government consultations, who are often invited just to comply with bureaucratic requirements. Instead, their participation becomes meaningful through their involvement in the co-creation of initiatives to find sustainable solutions to traffic problems.

These initiatives illustrate creative ways of re-imaging our relationality with our streets. Such is a reminder of the struggles and the victories inspired by the life of activism and community engagement of Jane Jacobs—that we should not lose grasp of creativity in our cities. With such creativity in utilizing the provisions and power of the law, online platforms, and the commitment of civil society groups and individuals, there is hope that Metro Manila's roads can be for the people. This is through a transport system that is constituted of "vital communities" (Jacobs 2011) that enable people to flourish since they are not restricted by car dependency.

In this way, the meaningful participation of civil society in conceptualizing and sustaining urban transport reforms and innovations foster a "shared responsibility "(Young 2006) approach to the complex urban transport issues of the metropolis. Through collaborating with government agencies, the private sector, and academia, there are possibilities for the community ownership of solutions. These ways of addressing the gridlock through bringing back unacknowledged aspects of the political and cultural domains in the arena of conversation—together with a rethinking of economic and ecological domains—could open possibilities for addressing Metro Manila's urban transport crisis. Such shared responsibility involves a constant practice of negotiation and compromise, providing hope that a change on how we view our streets can make an impact in creating livable communities, especially in the cities of the Global South.

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Urban Low-Income Housing in Thailand, Manifests on Thai Democratization

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Abstract In 2003, the Thai government ambitiously planned to deliver one million low-cost housing units by 2008. The government assigned the National Housing Authority (NHA) to deliver 600,000 We Care Housing Program (Baan Eua-Arthorn or BEA) low-cost subsidized units and the Community Organization Development Institute (CODI) to deliver 300,000 Secure Housing Program (Baan Mankong or BMK) slum improvement units throughout Thailand. This paper observes that Thai political and democratic evolution to its present conundrum provides a framework for understanding the housing projects. The major finding of the paper is the conflicting character of Thai democratization, presented in the 1997 People's Constitution, as manifested in these two contrasting public mega-projects. The top-down and fast-track We Care Housing Project is responsive to policy-driven electoral democracy. In contrast, the bottom-up practice of "Secure Housing Project" reflects participative democracy and involves complex, difficult processes of stakeholder empowerment, and collaboration that do not synch with election cycles.

Keywords Democratization · Thai urban low-income housing · We Care Housing Program (BEA) · Secure Housing Program (BMK)

1 Introduction

In 2003, the Thai government ambitiously planned to deliver one million low-cost housing units by 2008 through implementation of three mega-scale housing projects (CODI 2004). First, the government assigned the National Housing Authority (NHA) to deliver 600,000 low-cost subsidized units via the We Care Housing Project (Baan Eua-Arthorn or BEA). Second, the Community Organization Development Institute (CODI), through the Secured Housing Project (Baan Mankong or BMK), was

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to deliver 300,000 slum improvement units across Thailand. Lastly, the Government Housing Bank (GHB) was to provide housing loans for 100,000 low-income households within 5 years (National Housing Authority of Thailand, 2009:14). This paper observes that Thai political and democratic evolution to its present conundrum provides a framework for understand the housing projects. Specifically, the paper argues that the conflicted character of Thai democratization, presented in the 1997 "People's" Constitution, is manifested in these two contrasting public mega-projects to house the low-income and the poor and that each reflects the differing interpretations and appropriations of democracy by the elected and bureaucratic elite. The top-down and fast-track BEA project is responsive to policy-driven electoral democracy. In contrast, the bottom-up practices of BMK reflect participative democracy and involve complex, difficult processes of stakeholder empowerment and collaboration, which do not synch with election cycles.

2 A Brief Timeline of Thai Democracy

The bloodless coup of 1932 ended the absolute monarchy and introduced Thailand to democratic practices. While over the ensuing decades there have been frequent internal disruptions, with 18 military coups alternating with unstable coalition governments, there has a long-term trajectory toward greater democratization in conjunction with modernization.[1] Electorally, a majority of voters are registered in rural areas,[2] even though many of these voters shift back and forth between rural and urban employment. Hence, political parties with a strong provincial base often form the government, later to be bought down by Bangkok-based elites/voters/media that have a differing vision of democracy. Critically, it is the rural–urban migrants who significantly contributed to the expansion of informal settlements in post-WWII Bangkok and other urban centers that are the target groups of both BEA (at least initially) and BMK.

The 1997 Constitution[3] marked a critical juncture in Thai democracy. Thai politics prior to this was characterized by collusion between business and military elites and their conflicts with the urban-based middle class. Addressing middle-class concerns, the major objectives of the Constitution were to keep the military out of politics,

[1] The evolution and contestation of the notion of "corruption" from an accepted traditional practice based on patron–client relationship to legal norms more consistent with Western practices (Phongpaichit and Piriyarangsan 1996) reflect this process.

[2] As of 2019, urban population (% of total population) in Thailand was reported at 50.69% according to the World Bank collection of development indicators compiled from officially recognized sources in August of 2020 (Trading Economics 2020).

[3] In 1992 when the coup makers attempted to maintain their influence in the post-coup elected government (many whom they accused of corruption), the middle class protested on the streets, which led to the Black May crackdown and the disgrace/fall of the military from politics. This event also instigated the drafting of the 1997 Constitution by a popularly elected Constitutional Drafting Assembly.

strengthen the power of the executive branch to mitigate for the unstable coalition, create independent bodies to manage elections and fight corruption, explicit recognition of many human rights of the poor and marginalized, endorsed public participation in law making, and public developments. The Constitution desired reformist leadership to implement organic laws; however, the ensuing decade did not evolve to the charter writers' plan.[4]

3 The 1997 Constitution Decentralization Act; The Core Component of Thailand Political Structure and Thai Urban Low-Income Housing Development Process

By 1994, the Thai cabinet approved an Act of the Tambon[5] Council and the Tambon Administration Organization. This was followed by the declaration of the Constitution of the Thai kingdom that announced the Act of Provincial Administration Organization in 1997. These actions represented a significant evolution of Thai political structure from centralization to decentralization. The change resulted in the transfer of mandates to local government agencies,[6] for example budget authority, manpower, and particularly decision-making power. While the national government gradually became smaller and specifically focused mainly on national obligations, local governments turned to greater responsibility and roles, including in local development. They have their own policies on administration, governing, and finance management.

The distribution of political power from national to local agencies resulted in the key characteristic and operational principle of Thai urban housing planning, seen in bottom-up planning and public participation. With bottom-up planning, numerous urban planning tasks that used to be developed and initiated by national government agencies have been delegated to local authorities, including urban land used planning, developing urban physical plans, and urban transportation planning. The national government has shifted its role from leading agency to technical assistance and facilitation. Government agencies provide guidelines and other technical assistance for planning development, supportive institutes, and the provision of budgeting and other technical expertise. As a facilitator, they promote connections across institutions and local government agencies to form partnerships for local projects. This typically and ideally results in the signing of a Memorandum of Understanding (MoU) agreement by representatives of all associated partners.

[4] Through the constitution's framework, controversial former Prime Minister Thaksin Shinawatra (2001–2006) can be credited with changing electoral politics and, through rallying his support base to his cause, the rise of urban and rural poor as a political force, which was steps forward in Thai democracy. However, he also brought the army (and police) back into politics and compromised the 1997 Constitution's checks-and-balances mechanisms, which were steps backwards.

[5] Tambon is a form of government organization at local scale; it could compare to sub-district.

[6] The target of transferring is 245 activities.

Secondly, political decentralization provides opportunities for greater public participation at various levels, national to local. Increased public participation is emerging as a leading urban planning principle and reflects the growing need of Thai people to have an active voice in determining the future of their communities at various scales. It promotes the democratic decentralization of power to the local people and breaks the monopoly on decision-making traditionally held by politicians, professional planners, and national government officers. Direct participation in urban planning is carried out through strategies such as public hearings, public forums, and community consultations. This is the collective information from the local community that connects individual scale into citywide scale. Locally, rooted information then feeds into the initiation and development process of state urban planning policies and programs that ensure state policies include the actual needs of local people as an essential element.

Compliance with the 1997 Constitution's Decentralization Act, which is the core component of Thailand's development process, means people in local communities and their networks should be able to monitor, control, and oversee the results and performance of the local administration. Consequently, local community participation in housing development projects and urban planning has been increasingly recognized as the more consensual system of the decision-making process. Since the Eighth Thailand National Economic and Social Development Plan of the 1990s, the concept of decentralization and participation has been accepted and flourished in the process of development in Thailand. This was especially the case with housing development projects and urban planning and design projects. In the context of housing projects, the 1997 Constitution is characterized by explicit orientation toward the needs and concerns of the urban and rural poor. The Constitution promotes public participation in government development projects; consequently, local communities are a core component of urban housing developments in Thailand. However, the Constitution contained inherent conflicting objectives of stable government and empowerment of the public. As the following case studies will show, the conflicting visions-enabled policies that benefit the low income in contrasting ways in terms of housing.

4 Case Studies of Two Housing Projects (BEA and BMK): Examining the Nature and Patterns of Conflict in Planning and Development

With respect to housing projects, the 1997 Constitution provided an explicit orientation toward the needs and concerns of the urban and rural poor. With both politically ambitious and high-minded intentions, however, the Constitution contained inherent conflicting objectives of a strong, stable government and the empowerment of the public. These conflicting visions-enabled policies that benefit the low income and poor people in contrasting ways in terms of housing, the focus of this paper. The

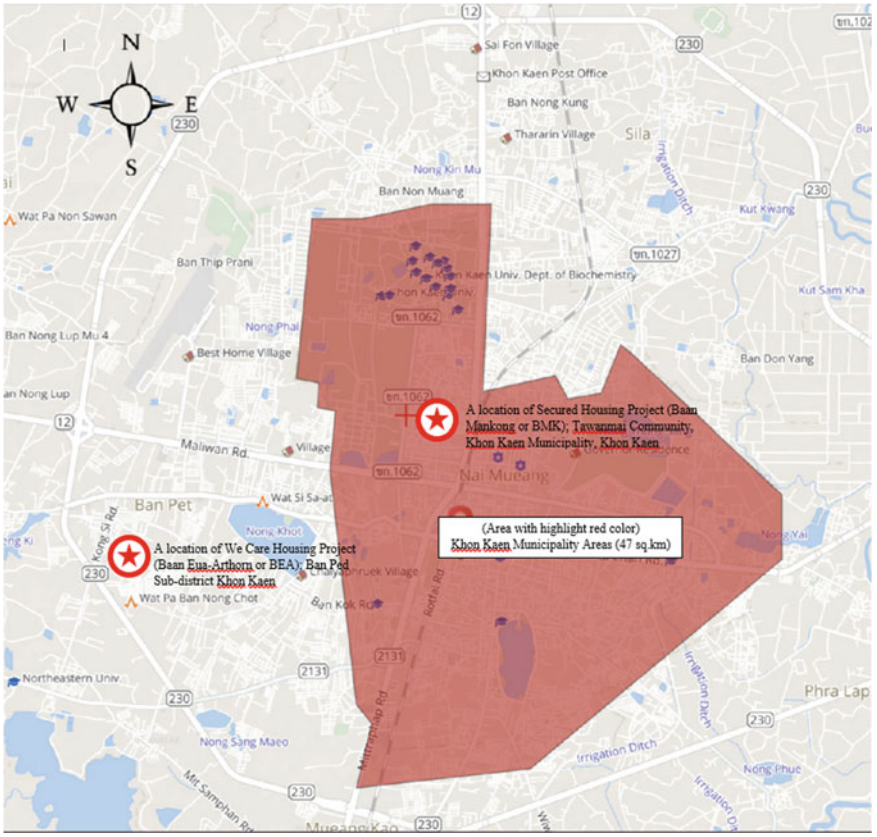

Fig. 1 Map of case studies area, We Care Housing Project at Ban Ped Sub-district and Secured Housing Project at Khon Kaen Municipal, Khon Kaen Province

following sections discuss the housing projects' background and delivery processes as observed through BEA and BMK cases in a Province name Khon Kaen (see Fig. 1).

4.1 We Care Housing Project (Baan Eua-Arthorn or BEA); Ban Ped, Maung Khon Kaen Province

Consistent with other developing countries, the scarcity of housing in Thailand had become increasingly serious as a result of rapid urbanization and industrialization since the 1970s (Takahashi 2009; Yap and Wandeler 2010). In 1973, the Thai government (then under the military rule) established the Thai National Housing Authority (NHA) (Institution-of-Thai-Highest-Court 1994). The role of the NHA is to provide housing for Thai citizens, especially low-income residents, and, over decades, there

have been many housing schemes built by the NHA, ranging from walk-up flats in the inner city to land subdivision in the periphery to support growing Thai urban populations. However, in practice, NHA has not addressed the problem of housing for the poor and mainly functioned as a developer in the real estate market.

In 2003, the government, the first formed under the 1997 Constitution, assigned the NHA to deliver 600,000 units in five years—which was more than the NHA had delivered in its previous 30 years of existence.[7] The BEA project was initially introduced as a policy during the election period in 2000–2001 to provide a large number of affordable housing units for low-income citizens throughout Thailand. *Baan Eua-Arthorn* conveys a sense of government caring about poor citizens. Consistent with the standard of other typical gated and self-contained communities, BEA provides housing with basic infrastructure (e.g., water, electricity, sanitation, and paved concrete roads) and public facilities (sport fields, childcare, and communal parks, etc.) that privately developed middle-class housing offers, albeit of lower quality.

In 2003, the BEA project began with the NHA-run housing exhibitions in order to both advertise the project and to let potential residents register their names and identification numbers in order to gauge demand. The name lists were made to ensure no repetition of candidates in projects within each city. Low-income citizens eligible to purchase BEA houses could be any Thai resident whose family income was less than 15,000 baht per month (approximately US$480 exchange rate in 2003). A large number of residents expressed interest in securing rights to purchase houses under the BEA program as it is a government-subsidized housing provision that required minimal rent-to-own payments of US$25–37 per month (Boonyabancha 2005:24). Moreover, government housing provisions are generally perceived as more secure than private lower to middle income housing developments.

In 2004, soon after the NHA-run housing exhibition, the BEA project was implemented by groups of private contractors organized by the NHA at Ban Ped Subdistrict, Khon Kaen Province. The project comprises 990 housing units for 4950 residents with public facilities including a service center, community office and multipurpose hall, childcare, community market, sport fields, communal park, and a garbage collection building. The following section discusses the project and its implementation, based on a field survey conducted in 2017.[8]

The Process of Planning and Design, Construction, and Completion of the BEA Program

Performing as a developer, the NHA had to conduct feasibility surveys, select a location, and purchase land to build the BEA projects (see Fig. 2). However, since the government at the time provided full financial support to the housing program, BEA projects became very popular, not only among low-income citizens but also

[7] From 1973 to 2006, the NHA delivered 544,686 units including BEA project (www.nhanet.or.th accessed June 2009).

[8] Dhabhalabutr conducted field survey at BEA community at Ban Ped BEA community, Khon Kaen Province from April to May 2017.

with middle-class residents who wanted to purchase new houses with limited budgets. Because of this, the entry income threshold was revised upward to less than 30,000 baht (US$960) per household per month. As a result, the construction of the BEA projects was accelerated throughout Thailand. Each BEA project experienced varying processes due to distinct and localized circumstances. Figure 2 shows the standard process of the BEA that was applied throughout the country.

Planning and Design Stage

The large demand for BEA houses inevitably led to the use of private contractors to help the NHA deliver the projects. Contractors, both invited and self-nominated, conducted feasibility surveys, purchased land, and built public infrastructure and houses. Once the NHA received the feasibility report from the contractors, government funding was approved to pursue construction. It was expected that the use of private contractors would simultaneously increase the construction of a large number of BEA projects; however, the process of building BEA projects became more hierarchical with an increased number of private contractors of varying capacity,

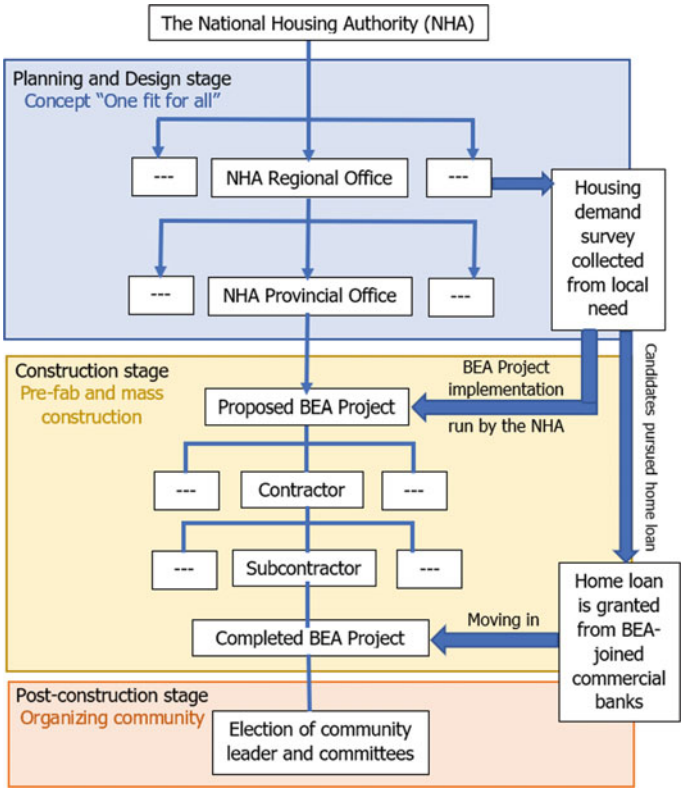

Fig. 2 Baan Eua-Arthorn overall process (Natakun and O'Brien 2009)

which consequently contributed to a longer process of decision-making. On the other hand, by employing one universal design applied to all locations for two-story detached houses, the design process was expedited and involved laying out two-story detached house and common facilities onto selected sites. There are two types of the BEA project offered, walk-up flats of 45 m^2/unit and two-story detached houses of 47.98 m^2 in area (see Fig. 3). Both types are ready-to-occupy housing with floors tiled, walls painted, and toilets furnished. For the detached housing, the NHA created a new design that can be constructed with a minimal budget. In contrast to the BEA walk-up flat, the detached house employed a middle-class housing model, as evident in a number of ways. First, the project advertisements were shown in billboards describing facilities provided with more affordable rent-to-own prices than other similar-sized private housing developments. Secondly, the analysis of the project morphology reveals a similarity between the BEA project and middle-class housing projects. The road network system and basic services are of similar standards with 12-m-wide main streets and six-meter-wide laneways, for example.

Construction Stage

Like other real estate developments, the construction of the BEA project at Ban Ped, Khon Kaen Province, was mainly reliant on relatively large construction companies, subcontracted by the NHA. Many of these companies, in turn, subcontracted part of the work to smaller contractors to complete the construction as scheduled. This often led to delays, and many times, uneven completion of the projects as planned by the NHA. Moreover, from the field study, a number of residents criticized the use of substandard construction materials in building their houses and had complained to the NHA, requesting repairs.

Post-Construction Stage

After completion of construction, residents moved into their ready-to-occupy houses and set up their community. A community leader was elected by residents with

Fig. 3 Two types of the BEA housing provisions: (top left) walk-up flat (https://www.terrabkk.com/en/articles/13924/case-study-3, accessed on 12/08/2020) (top right) two-story detached house at BEA Ban Ped Khon Kaen Province. *Source* Author, 2017

Fig. 4 (Left) the under-construction community center at BEA Ban Ped community, Khon Kaen Province and (right) house modification of BEA at Ban Ped Community. *Source* Author, 2017

minimal support from the local NHA office at Khon Kaen Province. As with other gated communities, BEA communities seem to experience problems such as weak social cohesion, lack of residents' cooperation for the public good, and a lack of participation in community events. Interviews and observations of the BEA Ban Ped community have shown that not many residents were willing to pay the monthly common maintenance cost for garbage collection, upkeep, tending communal parks, and for electricity to light the public spaces and streets at night (see Fig. 4). Furthermore, with minimal interior space provided by the BEA houses, house modifications have been prevalent. Though there are established rules introduced by the local NHA office to prevent dangerous modifications, the rules have failed to control practices of house modification in the case study.

4.2 Secure Housing Project (Baan Mankong or BMK); Tawanmai Community, Maung Khon Kaen Province

While BEA's delivery is consistent with NHA's previous top-down practices, Baan Mankong (BMK) can be considered an offspring of decades of advocacy and activism by NGOs and slum communities/networks.[9] Their actions yielded formal policy advancement such as the 1982 Overcrowding Act that supported self-help housing policy and community-based organizations (CBO). A decade later, realizing the failure of market-oriented policy to address housing for the poor, their activities contributed to the establishment of Urban Community Development Office (UCDO) in 1992 under NHA supervision, which acted as the housing financial fund for the urban poor.

[9] In 1990, Thailand had a total slum population of 1,763,872 (3% of the total population). Of this 62% was concentrated in Bangkok and 22% in the surrounding provinces. Only 18% were considered squatter settlements (Pornchokchai 2008:36).

In 2000, UCDO was transformed into an independent public organization, Community Organization Development Institute (CODI), and in 2003 was assigned responsibility to support and facilitate the BMK process within city networks and the distribution of budget from the government to communities (Boonyabancha 2005:24). CODI was set the target of 300,000 households in 2000 poor communities in 200 cities within five years, which represented at least half of all poor communities in the country (Boonyabancha 2005:25).

The community-centered BMK process aimed to comprehensively address long-term urban poor housing development, including tenure security. Here, CODI provides direct funding for infrastructure subsidies and soft housing and land loans with planning, implementation, and management of budget carried out by the community, supported by external groups and networks. The communities work with local governments, professionals, universities, and NGOs in their city to survey all poor communities and then plan an upgrading program to improve conditions within three to four years (Boonyabancha 2005).

In 2004, Khon Kaen City (KKC) initiated the upgrading of three pilot low-income communities with support from CODI. The Tawanmai Community, previously known as "Dynamo slum," is one of the pilot projects and consists of 146 households with 384 residents. Tawanmai Community successfully applied community participation throughout the process and transformed the physical and social aspect of a poor slum into a revitalized community in the city.[10]

4.2.1 The Process of Planning and Design, Construction, and Completion of the Baan Man Kong Project in Khon Kaen

Broadly, the overall process of community participation at BMK projects, including the BMK project for the Tawanmai community, comprises two levels (see Fig. 5). First, at an institutional level, the core actor CODI invited various local agencies to become BMK stakeholders: the Faculty of Architecture, Faculty of Human and Social Sciences, and Research and Development Institute (RDI) from Khon Kaen University (KKU); Khon Kaen Municipality (KKM); and Khon Kaen Co-operative (KKC). Second, at a community level, the Tawanmai community committee and residents are the core actors and take part in every process, some directly and some indirectly, with the stakeholders above. Interactions between the two levels occur via the Dynamo Community Co-operative Board (DCC) and CODI. At the operation level, the participation process can be divided into four major phases: (i) Savings Cooperatives (ii) Land Purchase (or long-term leasing); (iii) Master Planning and Housing Design; and (iv) Construction Management.

First, the DCC is responsible for all decisions on policies on the strategic level. The crucial characteristic of DCC is the membership, which consists of 23 people from

[10] Dhabhalabutr was involved throughout the BMK process at Tawanmai. This section is based on Dhabhalabutr's field survey at Tawanmai Community from June to December 2004 and in early 2017.

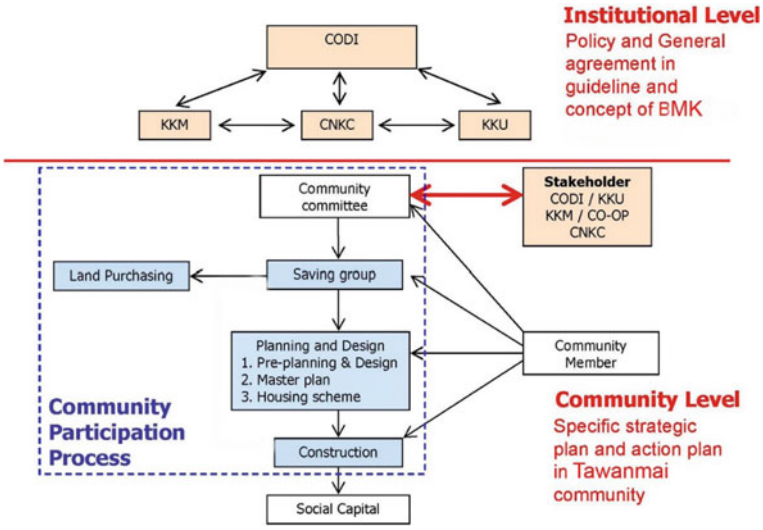

Fig. 5 General process of community participation of BMK project at Tawanmai Community. *Source* Author, 2005:3

the community, university, and government organizations. Eight members are from external partners while 15 are internal residents in the community, who are selected by the cooperative's members. As a result, residents who formed a majority of board members were able to secure resources and influence policies in the DCC throughout the decision-making process. In practice, the community board functions as the mediator, monitoring financial resources between CODI and community members for housing improvement loans.

Participatory process in savings cooperatives

Participation in saving cooperatives is a first process of a BMK project, encouraging individual household to save money to purchase their own housing. Money being saved for a collective purchase was gathered by the cooperative committee and forwarded to a commercial bank that held its account. The residents required a financial mechanism in which saving and lending are quick, simple, and relevant to their real daily needs, and, most importantly, the saving process must be controlled and managed by the community. Thus, "daily saving" became the core practice of savings cooperatives, and residents made daily deposits to the savings committee at the community center (see Fig. 6). The residents established two main objectives for the savings cooperatives regarding community problems and income (Dhabhalabutr 2005). The first objective was to accumulate savings for housing and land purchasing. This was a fixed amount of 50 baht (~US$1.5) per day. The second was for general expenses such as education, income generation, emergencies, and informal debt repayments, about 10 baht (~US$0.3) per day).

Fig. 6 Participation of Tawanmai Community in saving cooperatives for housing. *Source* Author, 2004

The process was initiated by CODI, and the network staff provided information about the BMK project to the community and encouraged inhabitants' discussions. KKC then ran several seminars in the community and conducted field site visits at neighboring cities with the aim of enhancing management skills and educating the community savings committee. Consequently, in conjunction with the search for suitable land as discussed below, the community formulated and submitted a loan proposal to CODI at the end of 2004 and received approximately 8.5 million baht (~US$271,570) to purchase 10,672 m^2 of land.

Participatory process in land purchasing

The land acquisition process became a crucial issue for the community as the landlord at the old location set a very high price for the land on which the community lived. The community agreed to relocate and came up with six criteria for land purchasing, based on community income and the requirement to be near sources of work. This was followed by the process of searching for new land from various sources. The committee surveyed and collected information, selected alternatives according to the savings budget and CODI loan, and discussed and voted for the suitable site (see Fig. 7). Finally, the community bought a piece of land at Nong Weang near Khon Kaen University around four kilometers from Khon Kaen CBD, which was considered relatively far , but commuting is convenient and the price reasonable.

Participatory process in design and planning process

As the community is the key subject of the design process, the approach has been changed from the conventional top-down to bottom-up collaborations so that the community requirements, income, social relations, etc., are used to generate the scale, function, material, and form of the final design. The planning and design process can be divided into three main stages.

In the pre-planning and design stage, in order for the CODI to provide micro-credit for housing upgrades, the residents must put together a community proposal for the CODI that not only includes a community master plan and a house plan but also represents how they can efficiently manage the use of land with social equity and environmental friendliness. Encouraging the community to be aware of living conditions improvement is a learning process that was achieved through exchange programs in which the committee went to see other BMK projects in neighboring cities. These intensive programs helped establish and strengthen networks among urban poor communities. The community then worked toward a consensus on a housing scheme, identifying the concept and pattern of housing, functional requirements, and land plot system.

In the master plan development stage, the community was encouraged to organize the land space and position their houses to achieve a scheme that considers the community's strengths and limitations (see Fig. 8). The residents were divided into sub-groups of three families each, formed by residents themselves based on friendship and kinship ties, to work on the layout of their homes to suit their small clusters and the overall neighborhood.

In the housing scheme development stage, the design of houses was approached from a human scale, starting from one function and working toward the whole house. A housing function and layout plan were then developed utilizing square grids and a filling-in color technique to determine area requirements and function relationships. The participants then organized the space, layout, and orientation to relate better with the neighboring units and the master plan. Through this process, the housing scheme emerged. Architecture students from KKU then helped with details of the housing

Fig. 7 Participation of Tawanmai residents in land searching and purchasing. *Source* Author, 2004

Fig. 8 Participation of Tawanmai residents in community master plan and housing design. *Source* Author, 2005

design and provided technical support for material, color, and façade design. Lastly, the designers drew up the master plan for houses and common facilities as well as the construction drawings, while the community formed construction worker groups and undertook construction training.

Participatory process in construction

Effective construction management was one of the central concerns among the stakeholders. It was agreed that the Tawanmai savings cooperatives would take the key role in construction planning and management. Therefore, the community procured building materials through the savings cooperatives, rather than individually, which helped save on costs. Based on the evaluation of the community's capacity for construction, the residents selected "the construction collaboration between subcontractors and community labor" mode of delivery (Usavagovitwong and Posriprasert 2006, p.4). The construction work is classified into two types and phases: site work and structure building (see Fig. 9). The first phrase is the construction of central facilities such as landfills, infrastructure, and roads, which was carried out by an external contractor. The second phase is individual house construction, which is the responsibility of each house owner, trained by KKU's Faculty of Architecture, paired with builders and contractors selected in coordination with the savings cooperatives.

Participatory process post-construction

Two years after the completion of the project, the Tawanmai Community is a transformed, vibrant community with strong social cohesion, a higher standard of living, and effective participatory management (see Fig. 10). However, this also resulted in clear segregation from new squatter settlements in adjacent plots of land, as expressed by the inhabitants who now identify themselves as secure homeowners. Moreover, the land price has significantly appreciated, from 1.4 million baht/1600 m^2 in 2007 to 30.12 million baht/1600 m^2 in 2020,[11] in conjunction with new surrounding suburban

[11] Interview with community leader April 2020 and commercial advertisement land for sale at ddteedin.com https://www.ddteedin.com/real-estate/435760, accessed August 12, 2020.

Fig. 9 Participation of Tawanmai residents in building construction. *Source* Author, 2005

developments that further enhanced perceptions of increased wealth and social class. In other words, the Tawanmai Community has become more integrated with the surrounding middle-class suburb.

Fig. 10 Tawanmai Community housing and facilities. *Source* Author, 2017

5 Conclusion

The paper observes that the BEA and BMK housing programs manifest the conflicting objectives of Thai democracy as outlined in the 1997 Constitution. The conflict reflects the socio-economic gap and differing perceptions toward democracy between the urban-based middle classes and the rural- and urban-based poor. The Constitution arose out of the aspirations of activists, intellectuals, and the middle class and reflects their definition of democracy, and, in part, can be seen as patronizing of the poor.[12] This group desires government accountability with effective checks and balances to mitigate corruption, which they see as a major barrier to democratic development. On the one hand, the Constitution, with the aim of strengthening electoral politics, views the poor as voters to be appeased, and solutions need to be provided, preferably in synch with the election cycle, reflecting a desire for effective government. In contrast, the document also strongly advocates for the decentralization of government and citizen participation in development that affects them. Here, low income households (and all other groups) are seen as people facing real everyday life issues which they should have a leading role in addressing.

For the BEA, the positive development is that the project is part of unprecedented policy-based politics, geared toward elections, that mitigates the problem of vote-buying. However, the BEA process, being highly centralized and also profit-oriented, is afflicted by corruption[13] in the expenditure channels, consistent with past state-run projects (Phongpaichit and Piriyarangsan 1996:11). In contrast, the highly decentralized BMK process is characterized by delays that naturally occur throughout the participation in decision-making processes.[14] Apart from being customized to the inhabitants' livelihoods, the BMK process requires intensive capacity and skills building for all stakeholders and thus is not suited for mass implementation. In fact, the project has been accused of inefficient use of both public financial and land resources (in the case of long leases of government-owned land) (Pornchokchai 2010), even while the funds have been managed far more transparently relative to BEA.

In an electoral democracy the supreme power rests in the body of citizens entitled to vote and is exercised by representatives chosen directly or indirectly (Diamond 1999). Politicians take advantage of the 1997 Constitution's objective to maintain political power and election favor. On the other hand, participative democracy emphasizes more engaged forms of citizen participation beyond elections and expects people to play leading roles in addressing and solving problems. The key attributes of

[12] One example is the requirement that members of parliament must at least hold a bachelor's degree, a rarity among the poor.

[13] As of January 2020, the corruption case against the former minister of the Social Development and Human Security Ministry has gone to court (Nationweekend.com 2020). The Thai cabinet approved reduction from 300,504 to 281,556 units—already substantially lower than the 600,000 units aim. This suggests the initial numbers were unrealistic in the first place, but it is still a substantial number.

[14] As of 2009, 78,607 households in 725 projects in 1287 communities were implemented—significantly short of the 300,000-unit original objective—with 3.4 billion baht infrastructure subsidy and 2.8 billion baht in household loans approved (CODI 2009).

the 1997 Constitution, in contrast to electoral democracy, are the increase in the scale of decentralization and the decrease of government power. Ideally, both processes should be coordinated within the framework of democratization. In practice, the processes have been independently implemented and arguably helped contribute to the conflicting views of democracy that partially explain the political conflicts in Thai society today. This can also be attributed to the ambitious scope, in time and scale, of both public housing mega-projects that have been geared toward differing socio-economic groups. The two Thai cases investigated in this paper demonstrate both the successes and the pitfalls in the context of Thailand's democratization processes.

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Perseverance in the Face of Water Scarcity in Hot Summer Seasons: A Case Study of Slum Communities in Indore, India

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Abstract According to a report by the National Institution for Transforming India (NITI) Aayog, Government of India (Composite water management index: a tool for water management. https://niti.gov.in/sites/default/files/2019-08/CWMI-2.0-latest.pdf, 2019), nearly 600 million people in India face extreme water stress. The problem is exacerbated in the hot summer months, when slum dwellers in particular face formidable challenges in accessing and storing water for meeting their basic needs, with women typically bearing the brunt of these burdens. The purpose of this study was to assess the challenges, short-term measures, and coping mechanisms in regard to water access, and to suggest ways of improving water accessibility during the summer seasons for the slum population living in the city of Indore, India. Qualitative methods such as field observation and interviews and/or focus group meetings with female slum residents, municipal authorities, and frontline health workers were utilized in achieving these objectives. The findings revealed that the slum population has a high dependency on private water sources, as well as on other informal and local mechanisms for accessing and storing water during the summer. The study also highlighted different ways in which the slum communities negotiate with municipal authorities and private players for gaining accessibility to water. In the light of increasing water scarcity, as evident in India and other low- and middle-income countries (LMICs), the findings herein should be of use to civil society organizations, municipal authorities, academics, and other stakeholders as they work to develop equitable water provisions for the slum communities.

Keywords Water scarcity · Summer seasons · Slums · Climate change · India

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1 A Brief Background and Context

Acute water shortages are exacerbated during the summer seasons, with heat, extended periods of warm weather, sudden heavy rainstorms, and drought as defining features of summer that affect lives of city dwellers in India. Mekonnen et al. have assessed water scarcity on a monthly basis across different regions/countries of the world. Their study found moderate to severe water scarcity from February to May or June in South Asia, including India (Mekonnen et al. 2016).

It is estimated that by 2050, half of South Asia's population will become vulnerable to the effects of climate change under a carbon-intensive scenario (Mani et al. 2018). According to the National Institution for Transforming India (NITI) Aayog report (Aayog is a Hindi word meaning "commission"), nearly 600 million people in India face extreme water stress (World Resources Institute Aqueduct cited in NITI Aayog 2019). Residents of the slum communities in the larger urban settlements in particular face enormous challenges accessing general (non-drinkable) water to meet their basic needs. The NITI Aayog report further warns that the water supply challenges will be further exacerbated by the continued migration of slum populations to major Indian cities, as low-income residents search for a better livelihood. This influx of people in major cities puts additional stress on the already insufficient water resources and inadequate city infrastructure.

Continued urbanization drives demand for water in cities, putting additional pressure on freshwater resources (Chakraborti et al. 2019; du Plessis 2019). The water needs of city dwellers are greater than those living in rural areas, as affluent communities consume larger amounts of water for domestic use, including cleaning and maintaining gardens/lawns (Jain 2011; Srinivasan and Kulkarni 2014). Vast and congested expanses of urban sprawl, combined with a rapid increase in population, result in greater needs for water. This in turn leads to the depletion of groundwater via overexploitation and compounded by mismanagement (Ramaiah and Avtar 2019). The demand for water in cities increases as the city grows. In addition to sustaining life, water is required for sanitation, horticulture, beautification projects, and the hospitality/tourism industry. Urban commercial and industrial activities also use large quantities of water.

The demand for water continues to increase rapidly in India owing to swift population growth in urban areas, fast expansion of the urbanized area itself, and rapid industrialization (Sachidanand et al. 2016; Lundqvist 2003). Drinking water filtering plants also put pressure on an already limited water supply (first author's first-hand observation from 10 cities in India, Bangladesh). The growing population in cities, of course, exacerbates urban water needs (Chakraborti et al. 2019; Vörösmarty et al. 2000). It is projected that the urban water demand will increase 80% by 2050, while climate change will continually alter the timing and distribution of water availability (Flörke et al. 2018).

Acute water shortages are greater during the summer season in urban areas and are being exacerbated by climate change (Finley and Basu 2020). Urban water demand in India is growing, along with an increased frequency of drought, rising temperatures,

and consecutive days of extreme heat (Satterthwaite et al. 2018; Pedro-Monzonís et al. 2015; Revi 2008; Vairavamoorthy et al. 2008; Gosain et al. 2006). The 5th IPCC Assessment Report predicts with 90% certainty that heat waves will be more frequent and longer-lasting (IPCC 2013). In the decades between 1990 and 2009, mean annual temperatures across India increased up to 1 °C relative to historical averages (between 1961and 1990) (Attri et al. 2010).

Based on World Resources Institute Aqueduct water stress projections, India is forecasted to be rank 40th in the world for water stress by 2040. This projected ranking is based on data from the Intergovernmental Panel on Climate Change (IPCC) under the business-as-usual scenario (Luo et al. 2015). According to the "National Compilation on Dynamic Ground Water Resources of India, 2017," more than one third of India's population lived in water-stressed areas in 2017, and this number is set to increase due to depleting groundwater and increasing urbanization (Central Ground Water Board of India 2019).

Large cities are becoming increasingly vulnerable to water scarcity (NITI 2019). In 2011, it was estimated that by 2050, about one billion people around the world would live in water-vulnerable cities (McDonald et al. 2011). If the potential water stress from climate change and the complexities of water quality issues (especially in developing countries) is considered as well, then that number could easily increase, perhaps by another billion people (ibid).

Aside from the seven largest cities/urban agglomerations (Mumbai, Delhi, Bangalore, Hyderabad, Ahmedabad, Chennai, and Kolkata) of India by population, the next twelve largest cities, with populations ranging between 4.5 million (Surat) and 1.8 million (Bhopal), are depicted in Table 1, with the extent of water stress for each city noted. Using the Beta Aqueduct Water Risk Atlas, the "water stress" values of these eleven cities were determined. There are about 50 additional cities in India which had populations of nearly one million people in the 2011 Census, and more recent surveys have recorded populations closer to 1.5–2 million people, all competing for renewable water supplies now and in the coming decades. In 2019, the World Resources Institute (WRI) projected that many of these emerging Indian cities are at the brink of water stress. These are the cities which are emerging as (and expected to become) bigger urban centres of economic activity, attracting large populations to them and thus increasing the likelihood of water access stress and related challenges.

"Water stress" here measures the ratio of total water withdrawals to available, renewable surface, and groundwater supplies. Water withdrawals include domestic, industrial, irrigation, and livestock consumptive and non-consumptive uses. Available renewable water supplies include the impact of upstream consumptive water users and large dams on downstream water availability. Higher values connote more competition among users. The extreme degree of water stress in Indore (80%) suggests that those needing water overwhelms the renewal sources that provide such water (WRI 2019). This also contributes to the high degree of inequality in water distribution in cities with high water stress.

As noted above, the need for water increases in the summer, as does its cost and the difficulty in water availability. This challenge affects informal settlement residents

Table 1 Water stress in Indian cities (urban agglomerations of 1.8–4.5 million population range)

S. No.	City/UA	Population census 2011	Water stress
1	Surat	4,591,246	Medium high (20–40%)
2	Jaipur	3,046,163	Extremely high (>80%)
3	Kanpur	2,920,496	Extremely high (>80%)
4	Lucknow	2,902,920	Extremely high (>80%)
5	Nagpur	2,497,870	Medium high (20–40%)
6	Ghaziabad	2,375,820	Extremely high (>80%)
7	Indore	2,170,295	Extremely high (>80%)
8	Coimbatore	2,136,916	Medium high (20–40%)
9	Kochi	2,119,724	Low–medium (10–20%)
10	Patna	2,049,156	Medium high (20–40%)
11	Kozhikode	2,028,399	Low–medium (10–20%)
12	Bhopal	1,886,100	Extremely high (>80%)

Sources Census of India (2011); Aqueduct, a database on global water stress (the ratio of total water withdrawals to available renewable surface and groundwater supplies) by World Resources Institute (WRI 2019)

more than it affects the more fortunate city residents (Subbaraman et al. 2013). Kim Dovey describes, "informal settlements or slums" as "the major morphology through which cities have absorbed the massive urbanization of the past half-century." Dovey further mentions that informal settlements grow globally out of the immediate need for shelter and community and are legally precarious, transgressing established codes of "land tenure, urban planning, design and construction" (Dovey 2013).Living conditions in informal settlements include overcrowding and the lack of access to basic services, such as water and sanitation. The consequences include physical and mental stress and insecurity, with already dire conditions worsening during floods and other natural disasters (Rashid et al. 2013).

This research has confined its focus to the government supply of general use water (or non-drinking water) as the drinking water supply has not been extensively investigated and studied yet in the slums of Indore. Earlier research has described

the negative health outcomes of Indore's water, such as diarrhoea associated with poor water supply in urban slums (Agarwal and Taneja 2005). Poor water supply can contribute to infections associated with insufficient cleaning of houses and clothing, including viral hepatitis A, hepatitis E, and scabies (personal experience of author 1 as a medical professional). Unclean water can also result in intestinal parasites (Unger 2013).

Using qualitative interviews with slum dwellers and key informants comprising of ward councillors, health and ICDS (Integrated Child Development Services of the Department of Women and Child Development, see Endnote 1) outreach workers, this research hopes to contribute to a body of literature on climate change and water scarcity and its effect on the lives of slum dwellers in low and middle-income countries, as well as the short-term measures and coping mechanisms adopted to deal resiliently with the challenge. Studies have highlighted that Indian megacities would be crucial respondents to climate change, particularly from the perspective of marginalized slum dwellers (Chatterjee 2010; Revi 2008). The response is needed and expected in order to combat the multiple challenges of access, inclusivity, livelihoods, and overall well-being (Khosla and Bhardwaj 2019).

With some exceptions, few studies have analysed water accessibility problems faced by the slum dwellers in Indian cities, particularly in the summer months, when the need—as well as the cost of water—increases in tandem. Kher et al. (2015), describing the situation of slums in Delhi, mentions that women face far greater difficulty in fetching water during summer months as compared to the months of November—February. The study reports that the demand for general use water (as well as drinking water) peaks in summer and that women have to spend far more time fetching water during summers, leaving them less time for household chores, care of children, leisure, sleep, and income-generating activities. Residents were forced to engage children in fetching water. Another study found that slum residents in Delhi experienced water shortage far more often during the summer, when people even had to buy water. The stress related with this water scarcity also resulted in conflicts between slum residents (De Feyter et al. 2017). Subbaraman et al. (2013) focused on the experience of slum dwellers Mumbai. In summer and during episodes of system failure, most households were forced to pay additional weekly fees to acquire extra water. Bhuyan and Hussain (2013) have studied the situation in the slums of Jorhat. Assam described that women mentioned that they could not bathe regularly during summers, and that there were fights over who got water. Taneja and Agarwal (2004) studied the slums of Indore and learned that there were water shortages in slums and challenges in bringing water from its source to the slum neighbourhood. They have remarked that water shortages affect the health-promoting practice of handwashing.

Despite the research efforts noted above, it is apparent that this increasingly consequential issue has not received the attention that it deserves. In the present case study of the city of Indore, in India, a programme site for the Urban Health Resource Centre (UHRC) was undertaken to address this void. The study focuses on understanding a) challenges of increasingly severe water scarcity faced by the residents in slums

and other informal settlements during the summer seasons; b) short-term, temporary measures taken by residents to access non-drinkable water for general use[1]; and c) coping mechanisms adopted by slum families and their medium to long-term implications. The study concludes with suggestions on how best to mitigate the challenges, as offered by some of the stakeholders. Based on field observations, focus group meetings, and interviews with slum dwellers and key informants from various agencies, the research hopes to meaningfully contribute to a body of literature on climate change and water scarcity.

2 Study Setting and Methodology

2.1 Study Area

This research was carried out in Indore, a fast-growing city in India. Indore is the economic capital of Madhya Pradesh, with a population of 2.17 million in the metropolitan area and a 44% decadal growth rate during the 2001–2011 time period (Census of India 2001, 2011). While Bhopal is the administrative capital of Madhya Pradesh, Indore and its surrounding areas form the main industrial and commercial hub. Being a fast-growing hub of commercial activities, Indore has a rapidly increasing population in the slums and informal settlements, with residents who work as labourers receiving low wages for different industrial and commercial activities in the city (Agarwal 2016). The study area is depicted in the map labelled Fig. 1.

Indore has a semi-arid climate. At present, Indore's temperature can reach about 40 ºC in the summer, but projections suggest that temperatures may reach close to 50 ºC on some summer days by the 2030s (TARU 2012). The Indore city resilience strategy identified water scarcity as the key result of the city's population growth: one which needs to be addressed as soon as possible (ibid; Sharma et al. 2013). In Indore, the months of April, May, and June include harsh summer weather, with rains beginning by the end of June.

A large part of the city relies on bore-wells for water. Bore-wells deplete ground water and contribute to the depletion of the city's water sources (Lele et al. 2018; Anand and Tandon, undated). A study of Indore slums in 2004 showed that the water supply in the city's slums varied from no water at all to a fair amount (Taneja and Agarwal 2004). The city draws from the Narmada River for its water supply (located 70 km away), and dependence on the Narmada River makes Indore's water supply extremely precarious, with just 2–3 days of water reserves available at any given time (ISET and Pacific Institute 2011, p. 25). As a result of climate change and over-use,

[1] In this research, we had to confine our focus to the non-drinkable water supplied by the government for general use (e.g., washing, bathing, etc.), as the drinking water supply has not yet evolved to an extent that can be studied in the slums of Indore. The term "general use water" will be used throughout the paper as a means to reiterate this crucial distinction.

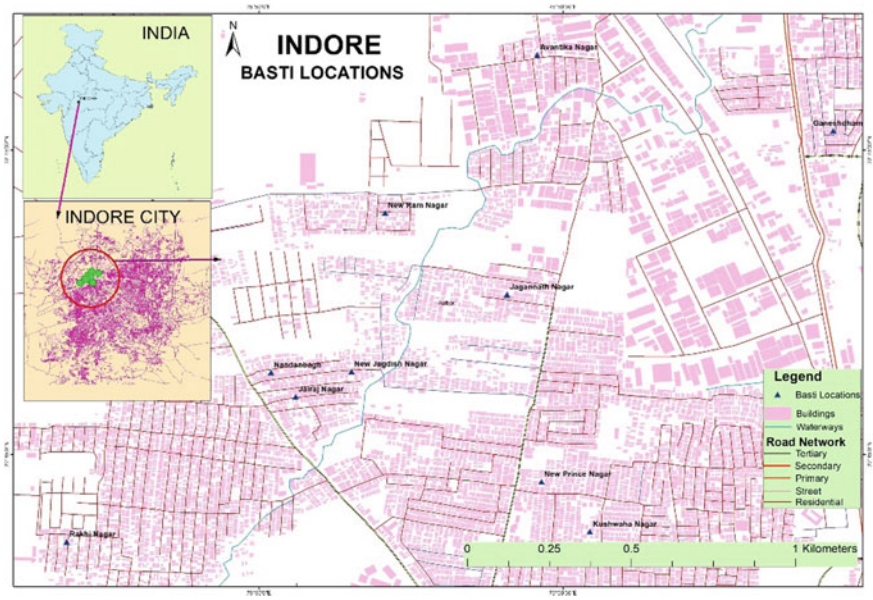

Fig. 1 Map of Indore with the ten sampled slums plotted

the Narmada River basin is likely to experience regular water-stressed conditions (Gosain et al. 2006).

2.2 Methodology

This study employs qualitative assessments based on interviews and Focused Group Discussions (FGDs) with slum women, municipal authorities (elected ward representatives and Zonal officer; see Endnotes 2 and 3), and Government frontline health functionaries such as Accredited Social Health Activists (ASHAs), Anganwadi workers, Anganwadi Helpers, Auxiliary Nurse midwives (ANMs), and Sector Supervisors (see Endnotes 4–8). The rationale for interviewing government frontline workers is that they frequently interact with the slum population being studied and have the first-hand experience of observing challenges related to water access in slums and informal settlements. Municipal authorities were interviewed in order to understand the challenges with and potential opportunities to address water scarcity from the service provider's perspective.

FGDs with slum women were held in 10 slums in Indore, involving 161 female respondents. In slums, it is women who take care of household chores, including managing water availability. The respondents were selected with the help of UHRC-mentored women's groups in the slums. In each slum or lane of larger slums, a women's group member who agreed to allow the FGD to be held at her house or

Table 2 Number of households and participants for focus group discussions in selected slums

Slums	Estimated households	No. of FGDs	No. of participants
Rakhinagar	145	1	10
Nandanbagh (lane No. 1, 2, 3, 4)	5972	4	25
New Jagdish Nagar (lane No. 1, 2)	700	2	20
Ganeshdham (lane No. 1, 2)	488	2	16
New Prince Nagar (lane No. 1, 2)	672	2	14
Kushwaha Nagar (lane No. 1, 2, 3)	2250	3	28
Jagannath Nagar	500	1	10
Avantikanagar	500	1	10
Jairaj Nagar	352	1	9
New Ram Nagar (2 parts)	400	2	20

her neighbour's house was identified. Then, with her support and the help of two to three other women's group members, women from different parts of the lane or slum willing to spend time for the FGD were invited to join. It was ensured that respondents whose houses were five houses or less apart were not included in the sample of respondents. These women, aged 25–40 years old, were either home-based workers (e.g. garment workers, jewellery makers) or homemakers. Group discussions were conducted with 6–10 women representing 6–10 families in each slum or lane of the slum. One or two women had to leave the group discussion quite early owing to her child needing attention, and were not included in the final number of respondents. After seeking their permission, their home water storage situations, including storage tanks and vessels were observed. Please see Table 2. Additionally, transect walks were undertaken to observe several water-related circumstances first-hand in the slums. Water tankers were observed and inspected outdoors in the lanes of slums.

Qualitative open-ended probes were used, and slum residents were encouraged to share their experiences with respect to a) water supply challenges faced during summers; b) temporary methods they adopted to seek relief from the water scarcity challenge; c) coping mechanisms they use to enable the families to better deal with growing water scarcity during summers; and d) suggestions for improving water provisions in Indore slums. The discussions were conducted in June 2018 and early 2019.

Key informant interviews were conducted with 26 people. These included elected Ward Councillors (2), Zonal Officer of the Municipal Corporation, frontline functionaries of the Department of Public Health and Family Welfare (10), and the Department of Women and Child Development (13). Key informants are listed in Table 3. To supplement the key informant interviews, transect walks were made to observe water-related circumstances in slum areas and household water situations were also noted. These key informants reside primarily in slums/informal settlements and provide services to informal settlement families. The Zonal Officer and the Ward Councillor are representatives of the Municipal Corporation (Urban Local

Table 3 List of key informant interviewees

Affiliation/Departments of key informants	Key informant interviewees and number of interviews
Dept. of Women and Child Development/Integrated Child Development Services	Interviews with 6 Anganwadi Workers (AWWs), 7 Anganwadi Helpers (AWHs), and 1 Sector Supervisor were carried out in the slum environment during the key informant's workday at a time suitable to her
Dept. of Public Health and Family Welfare	Two Auxiliary Nurses Midwives (ANMs) were interviewed during their visits to the slums. Eight Accredited Social Health Activists (ASHA) residing in the slums were interviewed at their homes
Zonal office of the Municipal Corporation	One Zonal officer was interviewed at his office
Elected Politicians	Interviews with two Ward Councillors were carried out in their office which was in the neighbourhood of the slums

Body) and responsible for the provision of water in slums. The Ward Councillor, in addition, has to connect with the slum residents since s/he seeks their votes prior to Urban Local Body elections. They also provide a government perspective, being representatives of government departments or the municipal corporation. We learned how they view the summer water challenges and also about efforts of the Municipal Corporation/government to mitigate these challenges.

FGDs have been conducted in ten slums (please see Table 2). Data from two slums adjacent to one of these sampled slums was also collected and included in the analysis and results. Hence, the results describe qualitative data from twelve slums with an estimated population of 39,835 (see Endnote 9), collected and analysed thematically.

The Urban Health Resource Centre (UHRC), an NGO, mentors slum-based women's groups by building their capacity to amiably negotiate with government and civic authorities in Indore city. With its fourteen years of efforts towards community mobilization and programming, the UHRC has established a strong presence in its catchment area. It has become a sustained and uninterrupted support system for the slum communities. The present study also presents an opportunity to deepen UHRC's learning in understanding the challenges of slum communities and subsequently work in the direction of solutions.

3 Findings

3.1 Challenges in Accessing Water

> "The public bore-wells dry up and we end up purchasing water from private tankers at a high cost" – Leela,[2] a resident of Kushwaha Nagar in Indore.

The government bore-wells are the main sources of water in the slums of Indore. With the onset of the summer season, the bore-wells dry up and families are forced to turn to private sources to fulfil the mounting water needs. In interviews with key informants, many claimed that in the past two to three years, the bore-wells have started to dry up much earlier in the month of January (the coldest month in India) as the groundwater recedes, forcing the slum residents to summon private water tankers. Private suppliers seize this as an opportunity to hike the cost of water for profit (also mentioned by Baisa et al. 2010).

In the Focused Group Discussions, it emerged that while the slightly economically better-off families are able to purchase water from private tankers, a large section of the residents in the slums and informal settlements is largely dependent on public water tankers sent by elected ward representatives free of cost. However, due to their limited capacity, these tanks are only able to cater to a small section of the slum community. Respondents reported that private tankers and other private water suppliers increase the cost of water during peak summers to take advantage to the heightened need of slum dwelling families. As the residents jostle among themselves to fetch water, brawls erupt among them. These "mini water wars" usually take place because many families try to fill many buckets and cans, creating problems for other families. These observations were noted during the transect walks. Such fights leave water tanker suppliers hesitant to provide water. (UN HABITAT 2006).

Interviews with the Zonal Officer and Ward Councillors also revealed that most of the time, the Municipal Corporation is not able to send the required number of free water tankers due to a strained water supply, as well as fewer than needed water tankers being available for dispatch at any given time. Owing to the unplanned expansion of Indore and its slums, the Zonal Officer and Ward Councillors reported that the Municipal Corporation is not able to extend water pipelines and connections to slums, resulting in insufficient provisions of water. Lack of water sources within the ten selected and two nearby slums was a major challenge reported during the interviews with the slum dwellers. Another challenge reported by slum families is the lack of storage spaces and vessels to store water in the slums themselves. Please see Table 4 for challenges faced in accessing water.

[2] Names have been changed to protect the privacy of the respondents.

Table 4 Challenges faced by slum dwellers in accessing water

Challenge	Description	Extent to which slums families are affected
Lack of adequate storage space and vessels	Most slum households do not have adequate space to keep large vessels to store water for use	Moderate-More than half of the families are affected as very few families in slums are able to find space to keep vessels and store water
Drying up of bore-wells beginning in January	Bore-wells are the most common sources of water supply in slums. Many bore-wells start drying up in the winter season as the ground water recedes	Alarming/Severe-Almost everyone is severely affected as bore-wells are the most used source of water in slums
Water not available in slums hence forced to walk distances	Water sources are often not available within and nearby slums resulting in many families having to walk over long distances to procure water	Moderate-More than half of the families are affected as some families buy water to reduce the burden of fetching water
Municipal tankers unable to fill the need resulting in the spike of the cost of private tankers	Due to water shortage in the months of summer, the ward councillor sends free water tankers in slums which are only able to cater to a small section of the slum. This results in many families accessing water through private tankers who in turn charge exorbitantly	Moderate to severe (every family wants free water; it is insufficient hence affects the people in large measure)
Households having private deep bore-wells charge a lot	Many economically well-off slum households dig deeper bore-wells and provide water at a higher cost	Severe for those unable to afford; less for those who buy only those who can pay and chose to purchase are affected

3.2 Temporary Actions Undertaken to Overcome Acute Water Stress in Summers

The temporary actions undertaken by slum dwellers to obtain water however necessary are meant to be a short-term last resort. This are described in Table 5. However, the longevity of these measures is not fully controlled by slum families. For example, slum families can make written and verbal requests for better water access, but municipal or private tankers may or may not deliver water when needed.

In Indore, with the mentoring support of the UHRC, slum families have been able to collectively negotiate for the provision of more free tankers from the Municipal Corporation, through collectively written and verbal requests to the elected ward representatives (Ward Councillors). With repeated requests, families have been

able to get more frequent deliveries in slums like Jairaj Nagar, New Jagdish Nagar, Nandanbagh, Ganeshdham, and Avantikanagar, where the community is well collectivized, and they come together and negotiate for free municipal water tankers through polite written and verbal requests to the respective Ward Councillors of their areas. Some community members are experienced in negotiating cost with private water tankers, pooling contributions from a critical mass of families to pay private suppliers. A few economically well-off families install deep bore-wells, which do not dry up in summers. Some slum families decide to pay a private deep bore-well owner for their, choosing an owner located in or near their settlement. The core principles of negotiation between the informal settlement community and the municipal corporation or alternative government provider are primarily both amiable and perseverant. When the government provider falls short of the requirements, the community negotiates collectively with private water providers.

> "When the need for and cost of water increases, more so in April–May, we all team up to negotiate with local private tankerwala to reduce the cost of water. The takers are more and those able and willing to pay are fewer" – Aarti, a resident of Jairaj Nagar in Indore.

Women from Rakhi Nagar also reported the ability to access water from a farmer's tube-well at cost, owing to the slum's close proximity to the adjoining peri-urban farm. Further, some "good samaritan" farmers even provide water free of cost in slums like New Ram Nagar (2000 population), Bajrangpura (1700 population), and New Bajrangpura (1000 population). This peri-urban water connection has been described as an emerging "informal water market" by those studying water tanker independence in Chennai, India (Srinivasan et al. 2010). Vij et al., note that scarcity of water can trigger elements of cooperation by encouraging peri-urban communities, like those in the Gurgaon region, to share wastewater (2018).

Other contemporary studies also detail mitigation strategies adopted by slum communities when faced with water scarcity that compare with the findings in the present study. Drawing from Swyngedouw (2004), which investigates strategies of negotiating water in marginalized spaces, Dovey (2013) describes how slum communities access water, citing the coping mechanism of "passive acceptance," the study brought forth the difficult situation where residents do not articulate their right to water, but rather seek private, individual solutions to the problem (such as negotiating with private tube-well operators, private tankers). Other strategies include the formation of cooperative "self-organization" and "social mobilization" with support from a non-government organization aimed at improving access to services (including water supply). Unfortunately, many of these strategies are temporary in nature, and do not offer long-term solutions in reclaiming slum residents' right to water (Roy 2013).

As Chatterjee (2008, p. 58) points out, "these claims of the poor, even when recognised and fulfilled, never become rights," and they continue to experience local, informal struggles to fulfil their need for water.

Table 5 Temporary actions undertaken by slum dwellers to access water

Community strategy	Description of action undertaken	Monetary cost incurred?
Collectively negotiating for free municipal tankers from elected ward representatives	Slum communities are able to collectively negotiate for free municipal water tankers through politely formulated written and verbal requests to the respective Ward Councillors of their areas	No
Getting private tankers from other sources by collectively negotiating for a price	Community members with experience in negotiating cost with private water tankers take the lead; a critical mass of families contribute to access private tankers	Yes
Storing as much water as possible in as many vessels or underground storage as possible in one day	Families try to store water in as many vessels as they are able to obtain so the water lasts them several days. One wage earner in the family would often not go to work on that day; both children and women contribute to fetching water	Yes—to purchase additional water storage vessels
Purchasing from private bore-wells located in the bastis (slums)	Families who are able to or decide to pay a private deep bore-well owner for water, purchase from such a family in their neighbourhood	Yes
Obtaining water from farmers in close proximity to the slum	Families living in close proximity to peri-urban farms are able to benefit accessing water from farmer's tube-wells	Yes, however, to a certain extent as farmers charge lesser than other private sources

3.3 Coping Mechanisms Adopted by Slum Communities to Access Water

Coping mechanisms, in this study, are the long-term or short-term strategies adopted by households to mitigate acute water scarcity during the summer months. These are described in Table 6. These mechanisms are initially adopted by a few families, then subsequently spread among other families, helping them to be more resilient when dealing with challenges. These are strategies that give control of the water supply back to the families, at least to some extent.

Many economically better-off families are able to construct underground and over-ground water storage tanks known locally as "*hodis.*" "Storing as much water

Table 6 Coping mechanisms adopted by families to access water

Coping mechanism	Description	Long-term/short-term measure
Fetching free water from long distance	Women and children walking to fetch water face heat stress. They also lose out on time to study, work and play	Short-term coping measure
Foregoing a day's work to fetch water from a distance to store for long	Families forego their day's work or half day's work in getting water from a distant source sometimes resulting in wage loss	Short-term coping measure
Building underground or over-ground water storage tank or storing in several large cans	Known as *hodi*, families who are able to save water store in underground or over-ground water storage to be used for longer periods	Long-term measure after one time investment
Use water sparingly	Families reduce water use for cleaning house, toilet, washing clothes, bathing, and other general purposes, use it for essential needs such as handwashing so that the water lasts longer	Temporary and desperate measure
Sharing water	Families are able to share water with neighbours by storing together water in *hodi* or lending water	Short to intermediate-term measure

as possible in as many as vessels or *hodi* as possible in one day" is another coping strategy adopted by many households. Similar coping mechanisms have been observed in other South Asian societies as well. For example, Baisa and co-authors report that in the cities of Bandung and Jakarta, Indonesia, residents store water in tanks called *torens* in response to unreliable municipal water service (Baisa et al. 2010). This water, stored in underground spaces, is mainly used for general purposes such as washing homes and clothing, not for drinking and cooking. Subbaraman et al. (2013) have pointed out that these community-created, private and informal mechanisms of accessing and storing water are an increasingly important area of research.

> "My girls walk 2–3 km from the neighbouring basti to fetch water from a public tap." - Anju, a resident of Prince Nagar, Indore.

In many families, the burden of fetching water falls solely upon the women and children, as the menfolk have to report to work. As a result, the amount of water retrieved is sometimes inadequate for the whole family. Studies have pointed out the disproportionate share of labour that women have to fulfil in the slums, the measure of which no statistics to date have properly captured. (Bapat and Agarwal 2003).

Research has been undisputed in terms of women shouldering the largest share of the burden when it comes to fetching water, and they bear heavy physical, emotional, and psychological costs (Cooper-Vince et al. 2018; Stevenson et al. 2012). Women and girls miss out on education, skill development, and training owing to the burden of fetching water (Chant and Mcllwaine 2016; Das 2011). When the family is dealing with challenges, young girls are urged to drop out from school to share the burden of water collection with their mothers along with sharing the burden of other household chores (Brown 2012).

Women reported that many families in slums fetch water from long distances, thus trading their work hours and incurring wage loss. Using water sparingly by many families is another coping mechanism that families reported, such as foregoing baths and washing. Evidence from Bolivia also suggested that a high proportion of women and men experience "emotional distress" when trying to solve the problem of water scarcity (Wutich 2009). Observations made during transect walks also suggest that some families had substantially greater water storage capacity in underground storage "haudi" and/or cans than many other families with smaller storage capacity. It was also observed that many of those who had bigger storage shared water with their neighbours, setting examples of mutual cooperation.

4 Concluding Thoughts

Community's Amiable Negotiation with Government Sector

This study brings forth practical ways that slum communities, with support from civil society organizations (Urban Health Resource Centre, in this case study), can implement/undertake temporary measures to overcome water scarcity both in the immediate and near future. These strategies include negotiation with government water supply departments or municipal corporations, a mechanism which is adaptable in other Indian and LMIC cities. This approach places the onus on the government system, where the responsibility actually lies for supplying water to planned colonies (where better-off citizens reside) and equally to informal settlements or slums (where the poor reside). As observed in the present research, Chidambaram's work in the slums of Delhi also notes that while community self-help is undertaken by slum dwellers to obtain water, this in no way negates the need for well-functioning public sector institutions (Chidambaram 2020).

A community's own coping mechanisms emerge when the government does not play its designated role in serving the people. Gross shortage of government public water supply forces many low-income slum residents to purchase water from private vendors, who can charge much more than the cost of municipal water (Agarwal 2011).

Subbaraman and co-authors, using their study from a slum of Mumbai, explain that in the absence of the provision of water by the government, informal distribution and storage systems emerge out of necessity. (Subbaraman et al. 2013).

The close proximity of peri-urban slums to farms presented an opportunity for rural–urban cooperation. The research finds that farmers are willing to help slum families tide over the acute water scarcity during the summer shows the potential of adapting similar rural to urban water assistance in other cities.

Suggested government sector measures in short to medium term: Municipal/government bore-wells are an interim measure at best, since an optimally functioning piped water supply to each slum house may take decades. From analysis of National Family Health Survey—4 (conducted during 2014–2015), in the poorest urban quartile in India, based on the wealth index used by NFHS (or DHS as it is referred to globally), 70.1% of residents did not have access to piped water in their own dwelling or yard (Agarwal and Kaushik 2021). The bore-wells dry up during the summers and also deplete ground water. Yet they remain the measure that the Municipal Corporation choses when unserved communities demand water. Erecting water tanks made of plastic material, most commonly polyethylene, to store water in large capacity in slums would be a longer-lasting solution. In slums where such large water tanks have been established and are filled with a bore-well twice a day, the supply to the community becomes more efficient.

Inevitably, the provision of free municipal water tankers during the acute water shortage of summers will be required, since many cities are becoming progressively water stressed (see Table 1).

Suggestions for Longer-Term Government Effort

Another suggestion for combating water scarcity is to connect slum households with the Narmada pipeline where it has not been connected already, and to increase the water flow pressure and frequency of water supply where it is operational. This is fraught with uncertainty about the capacity of the Narmada water supply system to provide sustainable water supply to Indore city, as the Narmada water supply project is already stretched (ISET and Pacific Institute 2011, p. 25).

Storm water drains are no longer being made when slum lanes and even main roads are paved in slum clusters. Consequently, the fully impervious asphalt obviates the possibility of rainwater from being soaked into the earth. Harvesting of rainwater to recharge the groundwater is crucial for cities (Central Ground Water Board of India 2000) through preservation of ponds, wells, large wells, large and medium width drains, and the digging of water recharge pit wells in informal settlements, small houses, and public places such as community halls, schools, temples, and Anganwadi Centres. A typical groundwater recharge pit, usually 1–2 m wide and 2–3 m deep, allows the rainwater to replenish groundwater (Central Ground Water Board of India 2000) and is can be conveniently dug by masons residing in slums. Recharge wells, usually of 2–5 m diameter, and 3–8 m depth are being constructed in residential complexes and public places in Chennai (Lakshmi in The Hindu 2018) and in Bangalore (Citizen Matters 2019). Artificial recharge of groundwater reservoirs is recognized as an important strategy of groundwater management to counter overexploitation. This method of groundwater recharge mitigates the decline in levels of groundwater (Singh and Singh 2002).

The study offers a qualitative insight into the challenges of slum communities in accessing water in urban India in the wake of growing water stress during the summer season. Findings from the study suggest that slum communities develop their own local, informal mechanisms of accessing and storing, which must be understood by government water supply departments and by civil society organizations and to develop better solutions for the provision of water in summer months.

It is emergent that ultimately, the responsibility of providing water supply falls to the government. During FGDs with slum women and interviews with key informants, women suggested that municipal service providers should erect water tanks made of plastic material, most common materials being polyethylene, polypropylene to store water in large capacity in slums. Another suggestion was to connect slum households with Narmada pipeline where it has not been connected and to increase the water flow pressure and frequency of water supply where it is operational. A suggestion that was reported from the interviews of both women and municipal authorities is the need to install groundwater recharging pits in each lane in all slums. Slum women demanded a greater provision of free municipal tankers, such that these are able to serve the increasing slum population of Indore.

Role of Civil Society Organizations

This research reinforces the role of civil society organizations (here, UHRC) in mobilizing slum communities and amiably negotiating through in-person and written requests with Ward Councillor to send free government water tankers. Experiences of NGOs including SEWA and SAATH in Ahmedabad (Baruah 2007) and of Urban Health Resource Centre in Indore and Agra demonstrate their vital role in forming and nurturing community-based organizations or community collectives in slums (Agarwal et al. 2008). Satterthwaite and co-authors describe the experiences of NGO mentored slum women's groups (named Mahila Milan) negotiating with the municipal government in Kanpur and Bangalore to provide hand pumps and water taps in informal settlements (Satterthwhaite et al. 2011).

NGOs like SEWA (MHT–Mahila Housing Trust) and SAATH have addressed this problem to some extent by organizing seminars and workshops to familiarize officials from the AMC with the philosophies, structures, and goals of NGOs and CBOs, but much more sensitization remains to be done for government officials to internalize the values of the project.

The role of NGOs to build bridges between the informal settlement community, and the government actor is often initially accompanied by the unequal power dynamics and prevailing mistrust. It takes perseverant efforts to amiably loosen the knots and build a more cordial and mutually beneficial relationship. (Baruah 2007).

Baruah (2007) and the present research found that to evolve partnerships, it is important to understand and accept that the nature and identity of each participating organization could be intrinsically different and could lead to small tensions among partners.

Plummer (2002) asserts that it is also incumbent upon state actors to actively build capacities for governance through partnerships. As observed in the present study, the relationship between the slum community and the state actor (usually the Municipal

Corporation) has the potential to stimulate CBOs to negotiate support for more than just improved services when the response is positive (Das 2011) motivations coalesce.

In slums, access to water supply in the intermediate timeframe (which can last several years) does not always become a public versus private ownership matter. It is also about the leverage that marginalized, and informal settlement communities have on actors within larger decision-making structures (Bakker 2010).

In pursuit of Sustainable Development Goal 11 and 6.1

This research shows experiential temporary and long-term water procurement measures that slum communities can adopt in India and cities of LMICs. Ensuring that development is inclusive of urban migrants is essential not only for Target 11, but for the SDGs as a whole. As McGranahan et al. (2016) argues, urbanization presents a critical opportunity for achieving all major aspects of the SDGs, but this depends on whether cities and urban authorities are inclusive of migrants among other disadvantaged inhabitants, including those living in slums /informal settlements. Against the backdrop of only 22% of the world's population having access to improved water sources (Agarwal et al. 1981), the UN General Assembly proclaimed 1981–1990 as the Water Decade. The goal of the Water Decade—to achieve "water for all" in developing nations by 1990 (UN 1990)—was driven by the need to improve global health through the effective development of water supply systems. After the failure of the Water Decade to achieve its "water for all" target, the UN adopted the MDGs, wherein among other privatization endeavours, water access was linked to cost recovery by private sector and Urban Local Bodies. Those who called the shots viewed water as an economic good, subject to the market, with an emphasis on profit rather than the human right to water (Bakker 2010). This was antithetical to the belief of the common public, which considered water a public good and access to it a public right (Adams et al. 2019). The inequitable provision of water in cities is continually leading to overexploitation of freshwater resources by the wealthy and powerful. Our future depends upon our ability to provide water equitably to all "citi"-zens, and to reverse the inequity that has been perpetrated over the last several decades.

Endnotes

1. The Integrated Child Development Service Scheme or ICDS is the country-wide health, nutrition, and early child development outreach programme of the Ministry of Women and Child Development, Government of India.
2. Elected Ward Representative-Ward Councillor is the democratically elected representative of the entire population of the ward, which is the smallest political and administrative unit of area under the Urban Local Body (Municipal Corporation).
3. Zonal Officer is an officer in the Municipal Corporation (Urban Local Body) who oversees and monitors urban works of the Ward Office.
4. Accredited social health activist (ASHA) is a community health volunteer instituted by Government of India's Ministry of Health and Family Welfare (MoHFW). ASHAs are the health activist(s) in the community who create

awareness on health and its social determinants and mobilize the community towards local health planning and increased utilization and accountability of the existing health services.

5. Anganwadi Worker is the grassroots functionary of a Government of India programme "The Integrated Child Development Service Scheme" or ICDS an outreach health, nutrition, and early childhood development programme operating in rural and urban areas across the country. It runs under the Ministry of Women and Child Development, Government of India, and their state-level counterpart departments.
6. Anganwadi Helper-Anganwadi Helper supports the Anganwadi worker in cooking (if supplementary nutrition is cooked at the Anganwadi Centre) and/or serve the food to children and mothers. She supports the AWW in keeping the Anganwadi premises clean, ensuring cleanliness of young children, coordinating with the Health Department's ANM for outreach healthcare sessions (e.g. immunization of infants, children, and pregnant women).
7. ANM-Auxiliary Nurses Midwives (ANMs) are outreach functionaries of the Health Department who provide immunization to infants, children, and pregnant women, anti-natal registration of pregnant women and preventive care such as chlorine tablets to disinfect drinking water.
8. Sector Supervisor-Officer of the Department of Women and Child Development. She supervises the functioning of 15 Aganwadis and facilitates coordination with the Department of Health.
9. The number of households assessed and impacted from the action/response is drawn from the knowledge of women's groups of their slum neighbourhoods. The average family size used in this action research is five which would work out to the population of 1550 for a slum having 310 households.
10. A groundwater recharge pit allows the rainwater to replenish groundwater by recharging the underground aquifers. It can be built to recharge a bore-well or just to help the water infiltration in an area. It is usually 1–2 m wide and 2–3 m deep. These can be dug in cities and slums (http://cgwb.gov.in/documents/RWH_GUIDE.pdf).
11. Recharge wells usually of 2–5 m diameter and 3–8 m depth are constructed in residential complexes and public places, parks, and gardens. The well can be deeper depending on the resources available. A recharge well takes water runoff from rooftops, paved areas and roads, filters it, and sends it underground to increase the water table. It also reduces waterlogging after a heavy downpour.

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Influence of Planning on Physical Activity in Public Spaces: A Case Study of Chirag Delhi Ward, New Delhi, India

Lakshyayog

Abstract This chapter explores the ways in which the state influences the physical activities of a city by governing public spaces. By taking the example of open public spaces such as public parks and open gyms, it aims to evaluate the techniques and methods of influencing/governing the physical activities in the city being studied. The study was conducted in the Chirag Delhi ward of South Delhi, India. By deploying a mix of qualitative methods such as multi-sited ethnography and in-depth, unstructured interviews, the study sheds light on the uneven distribution of gyms, associated politics, and governance challenges faced by the cities of the Global South. The study uses the Human Capital Model of Physical Activity to argue that across unplanned and planned areas, the nature, methods, and spatiality of physical activity varies. Through a critical reading of legal planning documents such as the Master Plan of Delhi, it situates public spaces and physical activities within the contours of planning in the city. By discussing recurring themes surrounding physical activities in the city, such as the role of language and the influence of the male gaze, it touches upon issues that have been underexplored in the scholarship on physical activity and governance. The chapter shows that the influence of the state through the Master Plan in both planned and unplanned territories is contested and negotiated in the everyday life of the city. Given that urban planning has been recognized as a multi-sectoral action aimed at achieving an active or healthy city, the informalized nature of planning in India not only defines the characteristics of such a plan but also the ways in which it influences the nature and execution of those physical activities.

Keywords Public space · Physical activity · Open gym · Governance · Male gaze · Language · Human capital

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1 Understanding Physical Activity

Be it in the narrow lanes of JJ Colonies in Delhi,[1] the basement of its posh localities on the fringe of urban Delhi, or the open parks near rural areas, gyms now have an overwhelming presence in the capital city of modern India. If gyms represent a growing consciousness of the necessity for physical activity, then whatever may be the rationale to join a gym, ranging from building biceps to staying fit, the emphasis on physical activity has become part of modern life for the new middle class of India. In consideration of this, one of the several issues related to urban planning and built environment is the need for adequate places to engage communities in physical activities that support the citizens' desire for a healthy city (NRPA 2014). Parks, open spaces, gyms, and recreational spaces have become key players in improving the avenues for physical health (Bedimo-Rung et al. 2005). But major questions remain, who works out in urban Dilli's gyms and how does the state influence the rhythm of physical activity by governing these public spaces? The latest government narrative links public health concerns to physical activity (Ainsworth and Macera 2018), which has resulted in a renewed interest in the infrastructure and facilities that can promote physical activity in communities. This research seeks to understand the ways in which public spaces influence the nature, type, intensity, pattern, and availability of physical activity. In doing so, it restricts the domain of public spaces to public parks and explores the various physical activities that are practiced in these parks. This study locates these physical activities at the intersection of state governance, public parks, and the politics of space by discussing the specific case of open gyms of Delhi. Outdoor Fitness Equipment (OFE) (Chow 2013), or open gyms as they are popularly called, typically consist of 12–18 pieces of equipment installed in parks for light, medium, and heavy exercise. They include equipment items such as air-walkers, sit-up stations, waist twisters, spinning wheels for shoulders, cross-trainers, push-up and pull-up chairs, etc.

If one wonders why so many people, after long hours of work, choose to spend more hours doing physical activity or at gym, then the understanding of Baudrillard is crucial to address, as he argues that 'private property and the accumulation of capital as the key tenets of capitalism are applied to the physical sphere, too: individuals understand their bodies as 'things' that can be invested in, worked-upon, and optimized' (Doğan 2015). This essentially means that the logic of paid labor and capitalism have infiltrated leisure time too, and thus, bodies at leisure are to be taken care of and the exercising body has become a site of production. This logic is evident given many new moves in the industry and by the state, such as the launch of India's first ever Wellness Index by ICICI Lombard, an insurance corporation in India (ICICI-Lombard 2018); the launch of the Fit India Movement by Prime Minister Narendra Modi (SAI 2020); and the fitness challenge launched by Sports Minister Rajyavardhan Singh Rathore through Twitter, which aimed to encourage

[1] Delhi is the anglicized version of the local name 'Dilli' which was popularized by the British colonizers. To me there is a symbolic distinction between the two, and I have used them interchangeably in this paper.

people to stay fit (Bridge 2018). The wellness industry also registered a growth of 18–20% in 2012, only to touch a market size of 700 billion INR in India ($9 billion USD) (PWC 2013), which is expected to become a 1800 billion INR ($23 billion USD) industry by fiscal year 2020 (FICCI-EY, 2019). Along with this, India registered a maximum prevalence of insufficient physical activity in South Asia, with 34% of Indians lacking the required level of physical activity (Guthold et al. 2018). These initiatives and changes also have an impact on the ways people imagine and work towards their 'ideal' bodies, as the 'muscular bodies in public spaces (billboards) and popular media (Bollywood, lifestyle magazines) indicates that the physical appearance of the male body is increasingly imagined to be an indicator, and facilitator, of socio-economic success' (Baas 2017). Thus, understanding physical activity requires a multidisciplinary perspective. Common physical activities can be broadly divided into two types: physical activity for recreation/leisure and physical activity as part of life/work (Lee and Moudon 2004). For example, walking as a physical activity can be practiced in the form of recreation or leisure, with an objective based on ideas of fitness; however, walking can be practiced as part of life or work for mobility and transportation. It is evident from the above categorization that physical activity is essentially a class-based activity, whereby the type of physical activity and its nature is controlled and determined by class associations (Ulseth and Seippel 2011).

Similarly, the public spaces associated with physical practices are also divided along these lines, whereby leisure-oriented spaces such as parks and other open spaces are used for leisure-based physical activities, while other public spaces such as roads and sidewalks are primarily used for work-based physical activities. These considerations can easily be understood using the conceptual framework for a multidisciplinary approach to physical activity (Fig. 1), which outlines the various elements of the approach along with its determinants and disciplinary facets, including planning.

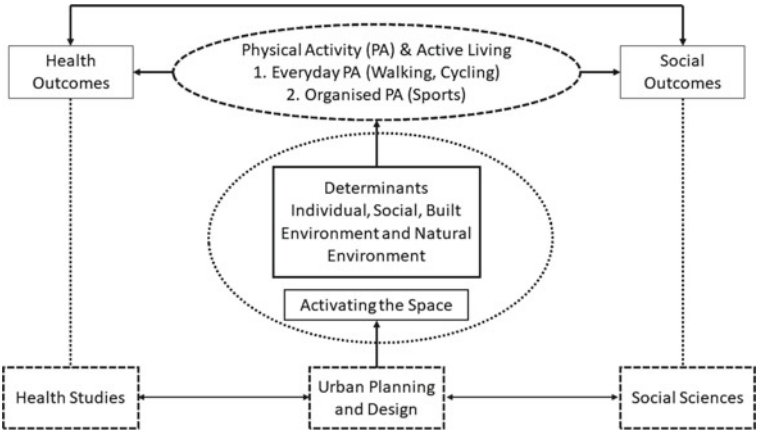

Fig. 1 Conceptual framework for multidisciplinary research for physical activity promotion, adapted and modified (Lee and Moudon 2004)

1.1 Conceptual Framework

The present chapter primarily uses the Human Capital Model (HCM) of Physical Activity (Bailey et al. 2013) to locate physical activity in the broader human capital framework. Although HCM follows a health fitness narrative as it argues that physical activities are necessary because of the increasing burden of Non-Chronic Diseases (NCDs), it views physical activity as being the fundamental part of human life and an integral element of human development. While placing physical activity in the human development framework, it conceptualizes development in terms of different forms of capital that are driven by physical activity and in doing so, physical activity is benefitted by different forms of capital. The HCM conceptualizes the development in the forms of physical, emotional, individual, social, intellectual, and financial capital. While physical capital refers to the physical health benefits gained from physical activity and emotional capital encompasses the psychological benefits, individual capital includes the elements related to a person's character. In addition to this, outcomes such as strengthening of social networks due to physical activity are identified as social capital and cognitive/educations gains as intellectual capital. Finally, financial capital denotes the gains of productivity and job performance along with reduced cost of health care (Bailey et al. 2013).

Although HCM attempts to capitalize on the physical activities and is based on a normative, positivist understanding of the physical activity, it yields a powerful conceptualization of the physical activity. Throughout the chapter, the different capital formation can be understood implicitly. While HCM views physical activity as a fundamental part of human life, states often have to employ the technique of 'nudging' to encourage physical activity among populations by installing fitness trails or open gyms in the parks. Nudging is based on the concept of 'libertarian paternalism' which aims to push people towards better choices without compromising their liberty (Hausman and Welch 2010). Thus, nudging makes one choice preferable over another by incentivizing it without reducing the number of choices. It is defined as 'any aspect of the choice architecture that alters people's behavior in a predictable way without forbidding any options or significantly changing their economic incentives' (Thaler and Sunstein 2008). Even though nudging is a powerful concept in public policy, it raises serious questions within the philosophical domain. There is also a need to understand the relationship between the practice theories and nudges, especially in the discipline of human geography, and to deconstruct the ways through which nudges conceptualize a particular human being and its end results (Reid and Ellsworth-Krebs 2018).

1.2 Research Question

This research primarily explores the following question: How does the state influence physical activity by governing public spaces across planned and unplanned built areas?

1.3 Objectives

The above research question will be explored under the following objectives:

1. To understand and compare the nature of physical activity and associated public spaces available to the state in the legal instrument of the master plan and in the field.
2. To identify and understand the different forms physical activity practiced by people in the concerned area.

1.4 Methodology

This chapter primarily uses the qualitative framework of research. The 7 P's of qualitative research, purpose, paradigms, process, practices, politics of interpretation, presentation, and promise, allow the researcher to engage with and interpret the field creatively (Markula and Silk 2011). These P's not only allow the researcher to engage with the field, but also provide a broad framework for conceptualizing, conducting, interpreting, and practicing research. The rationale of using qualitative research in this study is purely based on the nature of this research, which aims to understand and unpack the different categories of physical activities available to the state and practiced by people in the field. Since qualitative research also places an emphasis on interpretation of meanings in the field, this framework seems suitable for understanding the meanings embedded in the multiple forms of physical activities and associated spaces. As qualitative research aims to understand and describe the world 'from the inside out' as it is experienced by the people who participate in it (Flick et al. 2004), this research, which builds upon the views of people who are engaged in physical activity, was conducted using the qualitative framework of research.

For identifying and understanding the role of the state and the nature of different physical activities practiced in a given area, the study has employed the method of multi-sited ethnography (Marcus 1995). With the evolution in this method, ethnography comes out of the traditional single site of in-depth investigation 'to examine the circulation of cultural meanings, objects, and identities in diffuse time–space.' (Marcus 1995). Given the fact that there are multiple sites involved in the study and each of the sites represent a different set of connections, associations, and relationships, multi-sited ethnography was selected as the method for research and analysis,

Table 1 Methodology adopted for the study

Objectives	Methodology
To understand and compare the nature of physical activity and associated public spaces available to the state in the legal instrument of master plan and in the field	Content analysis and critical examination of documents such as Master Plan of Delhi 2021 and the zonal plan of the study area along with the textual analysis of the leading policy reports by WHO and field transcripts
To identify and understand the different forms physical activity practiced by people in the concerned area	Multi-site ethnography which involves identification of multiple sites in the study area where open gyms have been installed and frequent visits to the sites for interviews with the RWA's representatives along with unstructured and in-depth interviews with the Open gym users and non-users using the snowball sampling

especially considering that these sites are part of the urban system. It is important to note here that multi-sited 'things' do not fall directly under the scope of multi-sited ethnography; rather, they should have some connections and relationships among them (Coleman and Hellermann 2011), which is the case here. Since public spaces and open parks are not only functionally related to other spaces of the city, but are also integral parts of urban life, this approach of multi-sited ethnography helps the researcher to understand not only the production of each space (parks, in this case) but also provides the researcher with a framework for comparative analysis. However, it is also important to note that while doing multi-sited ethnography, all of the sites involved in the study (different parks, in this case) should not be understood as identical spaces due to their function; instead, the particularities of each site should be explored. The techniques of unstructured and in-depth interviews were used to collect data from trespondents. The detailed methodology employed for the study has been summarized in Table 1.

The field work was conducted over a period of 4 months in different sites of the study area. The unstructured interviews were conducted keeping in mind the following elements which define the characteristics of the open gyms:

1. Sense of place generated at the gym: Includes reasons for coming to the park, sense of security in park, and the presence of family members.
2. The gym in relation to other spaces: Covers themes such as proximity to the park, time taken to reach park, and other private gyms in the area.
3. Juxtapositions and contradictions: Features such as the location of the park and gym in the area along with preferences regarding other parks.
4. Temporality: Questions related to the weekly and seasonal changes that affect the timing of park visits.
5. Codes of conduct: Includes issues related to preference of any particular dress for visiting the park along with the choice of equipment.
6. Bodily stylizations: Refers to issues of gazing and bodily presentations considered inappropriate at the park.

7. Material practices: Includes practices which might have emerged in relation to the gym, such as yoga clubs or other related activities.

2 Study Area: Chirag Delhi and Surroundings

This section provides a brief description of the study area, which is critical for understating the nature of physical activities. For some, Chirag Delhi/Dilli precinct is famous as the historic village which 'escaped the memory of many'[2] (INTACH, Process for Historic Site Development—Chirag Delhi A Case Study 1996), for others, Chirag Dilli is merely an urban village engulfed by the expanding city of Delhi (Gupta 1986). Some consider the village as a heterotopic space[3] (Abraham 2013), and for others it is the space for production of specific consumables, such as the momo (local dumpling) factory[4] (Narayanan and Veron 2018). However, across all the available conceptualizations of the village, it is evident that Chirag Dilli and its surroundings were and still are an important part of the various cities of Delhi. Historically part of Jahanpanah, the fourth medieval city of Delhi (INTACH, Process for Historic Site Development- Chirag Delhi A Case Study 1996), presently, Chirag Delhi ward (88-S) is part of Zone F-10 of the Master Plan of Delhi 2021 in South Delhi (DDA, The Zonal Development Plan for Zone-F 2010). This ward is part of the Greater Kailash Assembly Constituency-50 along with the wards of Greater Kailash and Chittaranjan Park. The area has also been recognized as one of the Heritage Areas under the Master Plan of Delhi 2021 (DDA, The Zonal Development Plan for Zone-F 2010). The ward map of Chirag Delhi (GSDL 2016), as depicted in Fig. 2, shows the patchwork of planned and unplanned areas in the concerned space. The ward contains the three urban villages of Chirag Delhi, Sheikh Sarai, and Khirki; Jagdamba Camp, which is an unauthorized colony; one proposed lake, Satpula Lake; Satpula Lake Complex, a district park; and numerous heritage structures.

The village *abadis* (built-up area of the village meant for residential purpose), which were circumscribed by Lal Dora (MoUD 2007), not only defines residents' physical boundary and built structures but also produces a space distinctive from its planned surroundings. The lands of these villages were taken over by Delhi Development Authority in early 1970's and were granted exemptions from the bylaws in lieu of their land within the defined limits of Lal Dora, representing the limits of the village *abadi* presently. Satpula, which used to be a body of water associated with a fourteenth century weir of the Khilji Era (INTACH 2008), was systematically

[2] This phrase highlights the neglect of urban villages by planning authorities and other citizens both in the imagination and everyday practices of modern Delhi.

[3] Chirag Delhi is one of the many urban village of the city, but it also holds a special identity due to its unique past as it is home to many heritage structures of thirteenth and fourteenth century. While it is often neglected and forgotten by the citizens of Delhi, it remains functionally connected to city, which makes it a Heterotopia.

[4] Momo Factory refers to the informal cottage industry of Chirag Delhi, which is involved in the mass production and distribution of dumplings for the surrounding areas.

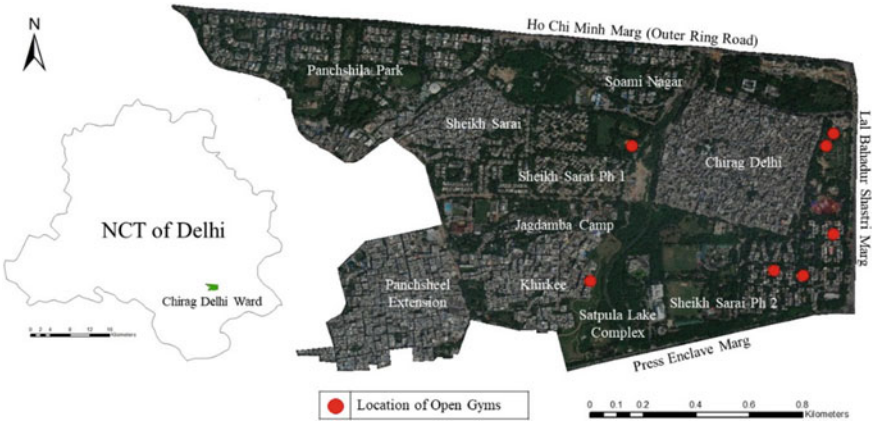

Fig. 2 Ward map of Chirag Delhi and location of the open gyms in the study area (GSDL 2016)

destroyed by DDA dumping construction waste from Saket District Place in order to create Satpula Lake Complex, a lake complex without a lake. This district park developed by DDA is now mainly used by the residents of Khirki, especially women who visit the park in the evening, thus, this open space can be understood as a connecting element in the city that was earlier a gap in the community (DUAC 2007). Kushak Nullah, which dissects the Chirag Delhi ward, used to be a revered and sacred stream called Naulakha Nullah. Today it drains the sewage of the unauthorized colonies of Sangam Vihar and Madangir. This tributary of Yamuna, on which Satpula dam was built, used to originate near Mehrauli from the foothills of Aravalli and used to flow northwards entering the city of Jahanpanah from Satpula. The stream, which used to connect the people of Chirag Dilli and Khirki, now flows beyond the imagination of the residents of these villages (Taneja 2015). Nullah serves as proof that over time, various geographies lose and acquire different meanings which redefine their identity and their relations to people. Thus, the study area presents a unique topography of different planning and governance regimes, built structures and social relations, which distinctively locate this site on the map of Delhi both historically and socially.

3 Master Plan and Public Spaces: Locating the Open Gyms

With the vision of making Delhi a global metropolis and a world-class city, the Master Plan of Delhi 2021 (MPD 2021) was prepared by the Delhi Development Authority (DDA) for the National Capital Territory of Delhi under the guidelines issued by the Ministry of Urban Development, Government of India. MPD 2021 was notified by the Ministry of Urban Development on February 7, 2007, with a perspective period of nearly 15 years (DDA 2007a). MPD 2021 discusses different forms of public spaces such as green areas, recreational parks, district places, physical and social

Table 2 Planning norms, standards for recreational areas/parks at sub-city level under the Master Plan of Delhi 2021 (DDA 2007b)

S. No.	Category	Planning norms and standards	
		Population/unit (approx.)	Plot area (Ha)
1	City park	10 Lakh	100
2	District park	5 Lakh	25
3	Community park	1 Lakh	5

infrastructure, and multipurpose grounds. All of these public spaces are regulated and controlled by the state in different forms. Their distribution across the city is determined by the standards set in the master plan and socio-historical evolution of Delhi. These public spaces, in one way or another, influence the physical activities of both leisure and work. However, for the current project, it is viable to look at the standards for public parks outlined in the document, to fully understand the open public spaces of the city, including but not limited to public parks.

Tables 2 and 3 show the planning norms and standards as prescribed by the Delhi Development Authority under MPD 2021 for recreational areas and public parks at the sub-city and neighborhood level. However, these standards are for the planned areas while unplanned, unauthorized areas of the urban villages often do not have access to these facilities. Given the historical evolution of Delhi, the planning topography of the city is heterogeneous and thus, open spaces and public parks are not uniformly distributed across the city. Since any form of construction is prohibited in the recreational areas and public parks, when open gyms were to be installed in DDA parks in 2013, the Master Plan of Delhi (MPD 2012) was modified and one more clause was added on to legalize the provision of the open gyms in the parks:

> Multi-gyms would be permissible in parks having an area of one ha. and would have built-up area up to 225 m^2 (DDA 2007b)

This addition allowed the installation of open gyms in the parks of Delhi. At this point, it is important to discuss the concepts of 'governance as inscribed' versus 'governance as performed' (Chatterjee 2011). The concept of 'governance as performed' refers to the practices of local entrepreneurialism embedded in neo-liberal

Table 3 Planning norms, standards for recreational areas/parks at neighborhood level under the Master Plan of Delhi 2021 (DDA 2007b)

S. No.	Category	Planning norms and standards	
		Population/unit (approx.)	Plot area (Ha)
1	Neighborhood park*	10,000	1.0
2	Housing area park	5000	0.5
3	Tot lot at housing cluster level	250	0.0125

* Multi-gyms would be permissible in parks having an area of one ha and would have built-up area up to 225 m^2

urbanism as opposed to the concept of 'governance as inscribed' which denotes the documentation of policy based on scientific planning. These concepts produce the dual narrative of a performed city and an inscribed city, whose interplay characterize the new urban governance (Chatterjee 2011). This conception also allows us to explore the ways through which the standards inscribed in the plan (planning norms, standards for parks and recreational areas, etc.) are manifested in the performed city, or if not performed, the ways in which they are negotiated (modification of the master plan for the installation of open gyms, for example). Thus, despite the population-based standards of the MPD 2021, not all citizens have access to facilities and thus, the nature of physical activities varies. Now, it is important to discuss the discourses which are available in the literature and the planning documents.

The literature available on the issue of physical activity conceptualizes it as a need emerging due to changing lifestyles, and thus, as an extension of the preventive healthcare measures for NCD's (Bailey et al. 2013). They argue that due to the increasing burden of the non-communicable diseases, the necessity of a minimum requirement for physical activity is increasing. Under this health/fitness narrative, fitness is considered to be part of public health, not sports per se. While on the other hand, planning documents such as the MPD 2021 place physical activity under the chapter of Social Infrastructure: not under health, but sports infrastructure (DDA 2007b) which enforces the view that fitness and physical activity are integral part of the sports and recreation. Thus, under this sports/fitness narrative, fitness is considered part of sports.

This view is more pronounced in other sections of the Master Plan of Delhi, where MPD 2021 says 'Further, Sports Complexes, which were included in the green/recreational use category under the MPD 2001 will be seen under a separate category of sports.' Thus, recategorization of sports complexes from green and recreational areas under the MPD to sports essentially means that sports and sports infrastructure are imagined to be markers of the development of the city. Essentially, sports infrastructure influences how the state uses public spaces for physical activities.

4 Enhancing Physical Activity: Case of Open Gyms

The story of open gyms started in Delhi when the New Delhi Municipal Corporation (NDMC) under its 'Go Green, Open Gym' Project (IANS 2014) decided to set up open gyms in 30 of the 124 parks that are under its jurisdiction. These 30 parks included famous green spaces such as Lodhi Gardens and Nehru Park, which covers an area of over 1000 m^2. Subsequently, South Delhi Municipal Corporation (SDMC) also passed a resolution in its standing committee, held in the month of August, 2014, to establish open gyms in every ward as a pilot project. The New Delhi Municipal Corporation further expanded the project to 18 more parks in nine other areas, resulting in at least one park in each area under NDMC (Nath 2016). The earlier parks included 12 pieces of equipment as compared the recent ones which

comprised of 18 different pieces of equipment such as air-walkers, sit-up stations, waist twisters, spinning wheels for shoulders, cross-trainers, push-up and pull-up chairs, parallel bars, self-weighted rowers, chest press, leg stretch, mini skis, and hanging wheels. Later, South Delhi Municipal Corporation decided to expand the facility of Open Gyms to 400 more parks as compared to 121 parks on December 2016 (PTI 2016). South Delhi Municipal Corporation has now opened nearly 424 open gyms in the last five years (Tribune 2017). The New Okhla Industrial Development Authority (NOIDA) also decided to setup open gyms in its parks. Thus, the idea which was started by New Delhi Municipal Corporation in 2014 has become popular, and has been adopted by other cities as well, including Mohali, Chandigarh, and Hyderabad.

Recently, Chirag Dilli Park was also selected to install a new facility which is called the fitness trail. It is an upgraded version of the open gym concept, which consists of a walking path and three different junctions of light, medium, and heavy exercise. Chirag Dilli Park is one of the 20 parks selected by SDMC to install this facility (Manohar 2018). As was evident from the map of the study area in Fig. 1, open gyms are not equally distributed in the ward and few of the areas, such as Sheikh Sarai and its surroundings, have as many as five gyms while the other areas have only two gyms. This uneven distribution shows that the standards of the inscribed governance are negotiated when they are performed in the city. The local politics and microphysics of power relations are important determinants. The local Member of Legislative Assembly (MLA) of the Aam Aadmi Party belongs to the village of Chirag Delhi, which might be one of the reasons for such preferences for the provision of open gyms. However, the Member of Parliament (MP) of Bharatiya Janata Party (BJP) for the constituency has also approved an equal number of gyms in order to compete with the local MLA. However, gyms in Sheikh Sarai funded by the MP are mostly underutilized, which begs the question of whether open gyms were a local need or an instrument of the populist politics of provision.

4.1 Populist Intervention or Local Need?

Any intervention in the cityscape cannot be seen in isolation from the politics of provision, which prevails in cities, as cities are the centers of political action. Thus, the present intervention also cannot be seen in isolation from the electoral politics. But before understanding the political economy of the open parks, it is important to understand the current political regime of Delhi. The parks of Delhi, where these open gyms have been installed, are under the ownership of the Delhi Development Authority but managed by the respective Municipal Corporation. The Municipal Corporation is responsible for various development and management works at ward level, which range from sanitation, health, and education to infrastructure. They also come under the responsibilities of the Member of Legislative Assembly, who is the manager of the MLA Local Area Development (MLALAD) Grant. The Municipal Corporation of Delhi, which is divided into three municipal corporations, North Delhi

Municipal Corporation (NDMC), South Delhi Municipal Corporation (SDMC), and East Delhi Municipal Corporation (EDMC), is headed by the Bharatiya Janata Party (BJP) majority councilors, whereas the Government in NCT of Delhi has been formed by the majority Aam Aadmi Party (AAP), and the New Delhi Municipal Corporation is an executively run institution without any electorally-elected councilors. The open gym program was started by NDMC, which does not have any elected councilor and was subsequently adopted by SDMC and other civic bodies which have elected councilors for each ward. This issue of multiple agencies under different ruling regimes represents the classic problem of urban governance.

As evident from Fig. 3, there have been several confrontations between the leaders of both political parties in order to take credit for the installation of equipment, so much so that the Chirag Delhi Park now has two open gyms: one sanctioned by the councilor and another being sanctioned by the local MLA. The South Delhi Municipal Corporation, whose elections were won by the Bharatiya Janata Party, passed a resolution recently directing its staff that neither LED lights should be installed/replaced nor any NOC should be issued for installation/replacements of streetlights 'on the roads/streets under the jurisdiction of SDMC by utilizing MLA funds' (Lalchandani 2016). The directive also covered children's play equipment installed in parks. However, the Aam Aadmi Party (AAP)-led government has accused the BJP-led civic body of trying to sabotage the work being done by the MLAs, saying that though the funds had been lying with the corporation for about a year, it purposely delayed work (Lalchandani 2016). In reply to MLA's question on the status of work, the corporation, through the urban development department (UD), said that the delay was due to the unavailability of the entire fund and the fact that five projects had been delayed due to the monsoon. In September, MLA complained to the Speaker of Delhi Assembly, alleging 'incomplete and wrong/incorrect reply submitted by UD' (Lalchandani 2016). Thus, the commons in an urban area are often a subject of disputes between political parties, and any intervention cannot be seen without the politics of urban commons and provision. Table 4 below shows the governance levels and associated ruling parties, which are the cause of confrontation and conflict.

4.2 Place and Physical Activity

Language Puzzle

One of the most understudied issues in physical activity literature is the role of language. Figure 4 shows two boards which have been installed in Chirag Dilli Park as part of the fitness trail. The first board, providing information about the Warmup Station, is in Hindi, which is also the local language, while the second board, which provides the information regarding the benefits of physical activity and the calories ratio to time, is in English.

It is important to note that the board in English, which provides the rationale of the activity, is out of the reach for most of the population, especially women and

Lekhi, Bhardwaj bicker on Twitter over open gyms

TIMES NEWS NETWORK

New Delhi: The BJP parliamentarian for New Delhi, Meenakshi Lekhi, and AAP MLA Saurabh Bhardwaj, who represents Greater Kailash, were caught in a battle of words on Twitter on Thursday over setting up open gyms at NRI Colony in Alaknanda.

After Lekhi called Bhardwaj a "copycat", he put up scanned copies of documents claiming that the money for the project was transferred to the south corporation from his MLALADS funds in March 2016, much before Lekhi made a similar proposal. Denying the charge, Lekhi claimed she had started the process in 2015. She, however, is yet to provide any documentary evidence.

NRI Colony will now have two open gyms in the same park. The gym set up with Lekhi's funds is ready for use while the other one will be available in a day or two.

WHO PLANNED IT FIRST? The gyms have come up at Alaknanda

"Copycat is apt word. First open gym project in whole of India was mine, told Radheyshyam Sharma (then standing committee chairman) to approve for MCD," Lekhi tweeted, adding, "Saurabh, enough work is left to be done where MP funds can't be used but MLA funds can be. Why didn't (you) pick up water, sewage, PWD roads?"

Bhardwaj returned fire, tweeting, "Check ur facts. I transferred funds in March 2016. For ur inflated ego, later u gave funds for second gym" He said, "Your BJP-ruled MCD delayed open gyms in GK just out of petty politics. Put your docs on Twitter that you did earlier than me." Bhardwaj's documents showed he had transferred Rs 1,34,98,800 for installation of open gyms and play equipment for children in four locations, including NRI Colony.

Lekhi's last tweet says, "AAP neither has original thinking nor interest in work, thus continues to create ruckus."

Fig. 3 Newspaper report referring to the conflict between Member of Parliament (MP) and Member of Legislative Assembly (MLA) regarding the installation of open gym (MP and MLA belong to different Political Parties—BJP and AAP, respectively)

Table 4 Governance levels and ruling parties

Governance level	Ruling party	Representative from Chirag Delhi
Municipal Corporation of Delhi- Councilor	Bharatiya Janata Party (BJP) Majority	AAP
Government of National Capital Territory (NCT) of Delhi: Member of Legislative Assembly (MLA) Funding-MLALAD	Aam Aadmi Party (AAP) Majority	AAP
Union Government—MP Funding—MPLAD	Bharatiya Janata Party (BJP) Majority	BJP

the elderly, who are most likely to use the fitness trail. This highlights yet another government challenge: uneven access to information.

Fig. 4 Boards providing information about fitness trail and its importance

Gaze that Matters

One of the persistent issues discussed and raised by various women during the field work in Chirag Dilli was the issue of male gaze. Open gyms are the places which encourage working out in the open. However, not all the members of society can access them freely. Women from the village reported incidents of being 'watched over' while exercising in the park. It is interesting to note here that while open gyms seem to be neutral to all, they are not accessible to all. Most women who exercise in open gyms belong to the age group of 50 years or more while the younger women face a social barrier that keeps them from accessing the gyms. The spaces of urban villages are representative of the informality both physically and discursively. The social norms and values are still different in these societies despite the influx of a substantial migrant population. The mere copresence of men and women in a planned space is different from that of an urban village. While urban planners and designers have come up with innovative solutions, such as the Parda Park or Women Only Park developed for women and children under the Urban Renewal Initiative of Nizamuddin Basti in another part of Delhi, gender-inclusive planning remains a challenge for the state.

5 Conclusion

Throughout the chapter, it can be seen that the state substantially influences levels of physical exercise and related activities that occur in public spaces in cities. Even as this research only considered how the state, via the legal instrument of the master plan and performed governance, influences one form of public space (public parks), it also provided useful insight into the nature and importance of the state's role in influencing physical activity. However, it is important to keep in mind that these ways of influencing, which are called techniques of influence here, will also vary according to the nature of the public spaces and the nature of physical activity. It is also crucial to mention that the methods of influence are also different in a planned and unplanned built form. Although planning seems to be done in the inscribed city, there is a significant amount of scholarship available in the planning field which shows that the plan has major impact on the ways that spatial practices are produced in both planned and unplanned areas. Thus, as Ananya Roy argues, 'India's planning regime is itself an informalized entity, one that is a state of deregulation, ambiguity, and exception' (Roy 2009). Planning for spaces of recreation or even public parks is also characterized by this kind of deregulation, ambiguity, and exception. State-influenced urban activity development in both planned and unplanned areas is both contested and negotiated. When the city aims to plan for an active city or healthy city, the informalized nature of the planning, in India at least, not only defines the characteristics of the plan but also the ways in which it influences the physical activities and nature of those physical activities in the city.

The Open Gym project is a unique case study, one which helps stakeholders understand the governance challenges associated with the provision of urban services and infrastructure as first launched by the NDMC, which an executive municipal body originally managed by the Central Government and later adopted by SDMC and other municipal bodies appointed by civic election. Since open gyms and their locations within each ward were determined by the municipal authorities without any consultation with the local communities, the principle of subsidiarity, which is a crucial principle of urban governance was sidelined in the process of project implementation. Thus, in the process of creating opportunities for physical activity for urban citizens in the parks, the community became only a beneficiary of the project, not the partner in the project. The communities were not involved in the implementation, and the Residents Welfare Associations were also not part of the maintenance program, which is a challenge now for the municipal authorities. However, it is important to understand that whatever the issues and challenges, physical activities are an important part of the urban life and planning practices of Indian cities, and they need to be examined critically in order to develop insights for the field of urban governance.

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Limitations of Public Open Spaces in Ho Chi Minh City, Vietnam: Some Perspectives from the Elderly

Le Thi Thuy Hang and Le Thi Thu Huong

Abstract An increase in the proportion of elderly residents in cities raises the need for increased attention to public open spaces for socialization, outdoor activities, and exercise, universally acknowledged as vital for the mental and physical well-being of the elderly. With a sharp change in its demographic profile towards the aged and aging population since 2011 and a projection for this trend to continue, Ho Chi Minh City (HCMC) in Vietnam is a prime candidate for a well-planned system of age-friendly public open spaces (POS). However, a shortage of space—with an estimated green area of only about 1.36 m^2 of land per capita—and other problems, especially in terms of spatial quality that limit the use of the POS by the elderly, this topic is gaining urgency. This paper is an attempt to address this issue. We used first-hand observation and a questionnaire survey in selected POS locations to explore the limitations of public open spaces in HCMC from the perspective of the elderly. Their response shows that although most of them are generally happy with public open spaces, many have considerable concern over issues such as accessibility, proximity, cleanliness, natural condition, security issues, and exercise equipment. We conclude with a set of proposed solutions based on the findings of our study as well as on good practices in other countries as gleaned from the literature.

Keywords Public open spaces · Green spaces · HCMC · The elderly population

1 Introduction

Public open spaces (POS) play important roles in improving the quality of life of urban residents, providing creative places, reducing incidents of crime and anti-social behaviour, promoting neighbourhood social cohesion, improving air quality, and reducing urban heat island effects and water run-off (Montenegro et al. 2012). They seem to benefit the elderly more than other age groups because the elderly

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often spend a larger proportion of their time in the neighbourhoods, whether they are retired or working at home (Sarkissian and Stenberg 2013). In addition, activities in POS promote the elderly's well-being: Walking helps reduce the risk of a heart attack by 50%, diabetes by 50%, colon cancer by 30%, and fracture of the femur by 40% (Rappe et al. 2006).

Since 2011, with a 9.9% population aged 60 and above, Vietnam is one of the fastest aging countries in Asia (Thuy-Ha Nguyen 2017). By 2019, the proportion of the population 65 years and over in Vietnam was 11.3%, which is around 11 million (GSO 2019). This proportion is anticipated to be 20% in 2038 (Trotsenburg 2016). The number of people over 75 will double to almost 5 million by 2035 (Kim-Thanh 2019). In contrast to some developed countries such as France, Switzerland, and the United States, where the demographic shift took place over 75–100 years, it has taken only 20 years for Vietnam to experience this phenomenon (Trotsenburg 2016). It has been commonly acknowledged that the elderly need more social interaction to reduce loneliness and boredom as they get older (Marcus; and Francis 1990). In Vietnam, nearly 50% of urban elderly frequently feel lonely because they have no one to share their feelings with or do not receive understanding from family members of other generations (Moc-Lan Hoang 2011). Therefore, they prefer frequenting POS. A survey (Le 2013) showed that in 2010–2011 in Hanoi, Vietnam, around 26% of visitors to parks were over 55, of which nearly 90% visited the POS on a daily basis. They were there for sports and exercise (62%) and 28% for relaxation. However, POS in big cities of Vietnam has many problems in quantity and quality. For instance, the average ratio of public green space per capita in Ho Chi Minh City (HCMC) and Hanoi is about 0.49m^2 (Thanh 2019) and 0.9 m^2 (Duc-Nguyen Pham 2018) respectively, while the minimum green space per capita recommended by the World Health Organization is 9 m^2. In addition to their relative scarcity, poor maintenance, and management of those green spaces reduce their quality, so many older men and women are reduced to using the alleys and sidewalks in their neighbourhoods for daily exercise.

Even though the problems of POS are recognized, studies on POS are still limited in developing countries, as most studies have been conducted in developed countries. For instance, Australia had detailed guidelines on the planning of POS towards the elderly's benefit (Sarkissian and Stenberg 2013) and urban space design for an aging society (Josep 2009). The United States issued policies related to the elderly in any development (San-Francisco Planning-Department 2014). In Vietnam, the official definition of "public open spaces" or "urban spaces" in legal documents is not clear or consistent (Tran et al. 2015; Pham 2016), and guidelines for planning towards the elderly have not been mentioned by any institute. The new development areas or new investments with large green spaces mainly consider middle-and high-income groups; meanwhile, users like the elderly play passive roles in the urban planning process. In that context, this research aims to study how the elderly use and their evaluation of POS in HCMC to recommend relevant solutions for improvement. These, to a certain extent, can help create a "city for all" where all generations will be recognized and share in public spaces comfortably.

2 Literature Review

2.1 What Are Public Open Spaces (POS)?

The notion of "public space" comes from the idea of the Greek agora and the Roman forum where public affairs of the city were discussed among an assembly of equal citizens. In the first definition of "open spaces", it was used for public space, meaning the streets, parks and recreation areas, plazas, and other publicly owned and managed outdoor spaces (Tonnelat 2004).

However, that notion of "public open space" coming from the Western concept is hardly appropriate in the context of Vietnam because in the latter case, the boundaries between public and private spaces are fluid and routinely transgressed. (Drummond 2000; Kürten 2008). According to Drummond (2000), public spaces in Vietnam hardly involve public discussion or expression as in the Greek agora or Roman forum. It is also practically violated by individual commercial activities, such as food stands or private motorbike parking in public corridors, streets, or laneways. Meanwhile, private domestic life in Vietnam is interfered with by the public through regulation of birth strategies, household registration, and focus on domestic duties of Vietnamese women (Drummond 2000; Kürten 2008). In Vietnam, public spaces can be divided into two categories: (1) traditional rural as alleys, local markets, pagodas, temples, and (2) modern, Western styles, such as squares, monuments, and parks (Ly 2004; Kurfürst 2011, p. 61).

Vietnam policy language, in which "public spaces" was not defined clearly until 2009, called it "community living space, parks, gardens, squares, and walking areas organized as open space, with places for leisure, recreation for the spiritual life of the urban population[1]" (Tran et al. 2015). In this paper, the term "public open space" incorporates three properties: access (physical access to spaces, access to activities and intercourse, access to information and resources), agency (status of agents—an agent acting privately or publicly), and interest (status of people who will be better or worse off) (Benn and Gaus 1983; Madanipour 2003).

2.2 The Need of the Elderly for Age-Friendly POS

The physiological and psychological needs of the elderly are important to consider when designing age-friendly POS. These needs can be classified into three groups: physical needs (physical health, safety, and comfort of use), information needs (the way environmental information is perceived and assimilated), and social needs (privacy and social interaction issues) (Heitor and Cabrita 2001). Regarding the physical and social needs, POS impacts the physical and mental health of residents and increase movement inside the POS as well as from space to space (Woolley et al.

[1] Article 6.d – 34/2009/TT-BXD.

2003). In addition to offering a sense of security, calmness, relaxation, and a high standard of environmental comfort, the POS plays a role as places for intergenerational socialization for the elderly (Josep 2009).

Happiness and optimism for the elderly appear to rise proportionately to their met needs. However, the perceived needs appear to vary among countries as well as by occupation, livelihood, health status, and household type within the same country (Nguyen et al. 2017). In Hong Kong, for example, the most important needs of the elderly seem to be "social and physical activities", "community life facilities and services", "social network", and "clean and pleasant environment"(Yung et al. 2016). In England, older people are very sensitive to the presence of others in public places and tend to avoid areas heavily used by teenagers and young adults. They also avoid places that are dark or deserted or lack seating, lighting, toilet facilities, and shelter (Holland et al. 2007). In Iran, most elderly emphasize "convenience, accessibility, safety, and citizen participation" (Fallahi and Momtaz 2018).

However, POS across the globe do not always meet the needs of the elderly. For instance, in Los Angeles, seniors have minimal access to open spaces and parks. Thus, the concept of POS is unfamiliar to them, so they define parking lots, driveways, and even balconies as open spaces (Loukaitou-Sideris et al. 2014). In Singapore, most people use informal settings for spontaneous activities rather than organized places. It requires the state to think about preventing artificial separation of spaces in which the elderly conduct their daily activities (Teo 1997). In Vietnam, low rates of involvement in sports are due to the low development of technical facilities for sports and physical exercise and an insufficient number of cultural or historical sites, museums, and scenic places of interest (JAHR 2018, p. 198).

2.3 Designing Age-Friendly POS

After determining needs, the most important consideration for designing POS for the elderly is social connection (Yung et al. 2017). Other criteria include (social) participation, environment, outdoor physical activities, safety and security, accessibility and proximity, comfort, flexibility, transversality, and governance (Sassi and Molteni 2008; Martinoni and Sartoris 2009; Loukaitou-Sideris et al. 2014; Yung et al. 2017).

Based on the above criteria, key factors for designing POS are summarized in Table 1, and design guidelines are shown in Table 2 as follows.

Table 1 Key factors for designing POS

Key factors	Sources
– Variety in types of space	Sarkissian and Stenberg (2013)
– Taking into account heat, cold, sun, glare, shade, and wind (microclimate)	
– Security and freedom from intrusion and outsiders	Marcus and Francis (1990), Sarkissian and Stenberg (2013), and Loukaitou-Sideris et al. (2014)
– Contact with the natural world	Sarkissian and Stenberg (2013) and Loukaitou-Sideris et al. (2014)
– Barrier-free environment	Sarkissian and Stenberg (2013)
– Distribution of public spaces	Srichuae et al. (2016)
– An environment designed to support social interaction	Sarkissian and Stenberg (2013), and Loukaitou-Sideris et al. (2014)
– Age-friendly design that encourages physical activity	

Table 2 Design guidelines for POS

Guidelines	Sources
– Management: city for the elderly is a city for all through governance and control as well as active participation of the elderly in the design process	Josep (2009) and Loukaitou-Sideris et al. (2014)
– Mainstreaming: a variety of choices, harmony in social support	Marcus and Francis (1990), Josep (2009) and Loukaitou-Sideris et al. (2014)
– Urban context: accessibility and connectivity to a variety of outdoor areas and activities (both informal and formal), intensity	
– Quality of space: conviviality; flexibility; security and safety; comfort to enjoy nature and social interaction but still keep privacy such as subspaces for meeting a few friends or for solitude, and care of aesthetic as well as sensory delight	

3 Methodology

3.1 Study Area and Site Selection

Ho Chi Minh City, the largest and the most populous city in Vietnam, with 7.96 million citizens officially (not including non-registered citizens or immigrants) including 663,491 elderly as of 2014 and 2061.2 km^2 (UNPFA and GSO 2016; PSO 2017) was chosen to represent large urban centres in the country. Districts with a

Table 3 Survey districts

Districts	The number of elderly in 2009	Area (km^2)	The elders/ha
District 1	19,074	7.73	2,468
District 3	20,182	4.94	4,085
Phu Nhuan	17,728	4.88	3,633
District 4	14,862	4.18	3,556
District 6	20,240	7.17	2,823

Source Authors, 2019

Table 4 Survey sites

Types of POS	CBD District 1 and 3		Non-CBD District 4, 6, and Phu Nhuan	
Park	Tao Dan park (10 ha)	Le Van Tam park (6 ha)	Binh Phu park (10 ha)	Phu Lam park (6.1 ha)
Riverside park	Nhieu Loc		Ton That Thuyet	
Pocket parks and alleys/sidewalks	Ward 12, District 3		Ward 1, District 6	
Others	Nguyen Hue Boulevard			

Source Authors, 2019

high proportion of elderly (per the latest population census, in 2009) were selected for this study of POS, which, in turn, were divided into two groups based on their location in central and non-central business districts (CBD/non-CBD) (Tables 3 and 4; Fig. 1).

3.2 Data Collection Methods

This study employed on-site observation, literature review, and a questionnaire survey of the elderly residing in the studied areas. In addition to the demographic and socio-economic profiles of the respondents, the questionnaire was designed to collect an array of information, including their intended activities, usages, preferences, and assessments as related to the selected POS sites. The survey was conducted face to face in the chosen sites from December 2018 to February 2019 with the support of a group of students. The data collection process went smoothly. Most elderly were willing to answer; many of them even gave their phone numbers and their home addresses for further information if necessary. A copy of the questionnaire is offered in the Appendix).

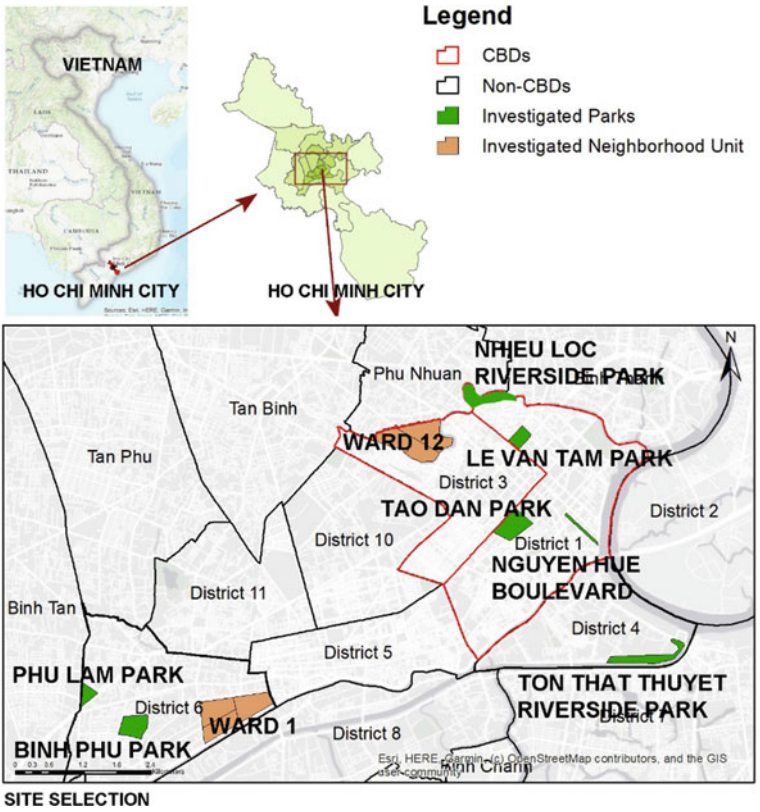

Fig. 1 Survey sites. *Source* Authors, 2019

The calculation of the sample size of 274 respondents was based on Cochran's (1977, pp. 75–76) formula.[2] The distribution sites of the questionnaires are presented in Table 5.

[2] The survey sample size is calculated by following Cochran's formula (1977, pp. 75–76):
Sample size $N = (Z)^2 \text{ x } (p) \text{ x } (1\text{-}p)/c^2$.
Where Z is Z value (e.g. 1.96 for 95% confidence level),
p is percentage picking a choice = 0.5,
c is confidence interval = 6%.
The result of this equation was: $N = 1.96^2 \times 0.5 \text{ x } (1–0.5)/ (0.06)^2 = 267$. However, in reality, the collected questionnaire was 274 due to the contingency.

Table 5 Distribution sites of the questionnaire

Types of POS	CBD districts	No. of questionnaires	Non-CBD districts	No. of questionnaires
Park	Tao Dan park	44	Binh Phu park	22
	Le Van Tam park	24	Phu Lam park	25
Riverside park	Nhieu Loc	42	Ton That Thuyet	47
Pocket parks and alleys/sidewalks	Ward 12, District 3	15	Ward 1, District 6	48
Others	Nguyen Hue Street	7		
Total		132		142
		274		

Source Authors, 2019

4 Results and Discussion

The results[3] of the questionnaire survey are summarized in the following sections, and the discussion on each result is integrated.

4.1 Participants' Characteristics

Basic information about 274 elderly residents who participated in the survey is presented in Table 6.

Table 7 reflects the low income of the elderly in the city, regardless of whether they are retired or still working. In addition, this also reflects the multi-generation living culture in many Asian countries. More than 50% of the elderly are living in a big family and have to spend lots of time for caring others. As a consequence, they do not have enough time to care for themselves at this age. One-third of the people surveyed are in not good health. This result is based on their self-evaluation during the survey.

[3] All results of the questionnaire survey are imported into Microsoft Excel software version 2013 by Microsoft Corporation to clear the data, e.g. remove duplicated cases or vague information. The clean data are imported into SPSS (Statistical Package for Social Sciences) software version 22 by IBM Corporation to analyse. The departure point of the POS users is recorded, then imported into ArcGIS for Desktop version 10.2 by Environmental Systems Research Institute, Inc. (Esri) to calculate the distance to POS from the reality of the surveyed users.

Table 6 Participants' characteristics

Gender	Male		Female		Total	
	138	50.4%	136	49.6%	274	100%
Age	60–69		70–79		Over 80	
	147	53.7%	107	39.1%	20	7.2%
Marital status	Married		Widowed		Single/Divorced	
	187	68%	52	18.9%	36	13.1%

Source Authors, 2019

4.2 The Usage of POS

Although the elderly have quite a lot of caring and earning responsibilities, they still spend time frequently in POS. The survey results show that around 80% of them spend time daily in parks, which are formally planned and designed for physical activities. The yards of religious buildings (like churches and Buddhist temples) and some informal spaces such as sidewalks and alleys are also being used for outdoor activities (Fig. 2).

As Table 8 shows, more than 70% of the elderly participants indicated that they come to the POS for walking (37.5%) and exercising (34.2%), and to a lesser extent, socializing (5.4%). Activities requiring a regular schedule (e.g., group exercises, sports, and meetings), as well as sedentary activities, were much lower in frequency. As for the amount of time spent, as well as the time of day preferred by the elderly, the survey showed a clear pattern. Close to 80% of respondents spent between half an hour to one and a half hours in the POS, while the early morning (5–7 am) and early evening (5–7 pm) hours were deemed most preferable by 28 and 25% of respondents, respectively, likely due to the comfort of the microclimate, including heat, wind, and temperature, at the POS. Information of this nature, e.g. intended activities, duration of time spent, and the times of visit preferred by the elderly, can offer valuable insight in mitigating negative issues and planning for an age-friendly POS environment. This is a strong argument for seeking input from targeted groups in planning facilities for their benefit.

Choices of visitors to POS are influenced by many factors. As Table 9 shows, accessibility and proximity take top priority for nearly 60% of respondents. Meanwhile, social interaction is the most significant criterion for designing age-friendly POS in Hong Kongong (Yung et al. 2017); in HCMC, it was top rated by more than 40%. Besides, the organization, management, and maintenance of POS also play significant roles. More than 50% of respondents prefer physical activities and the comfort of POS. Small fees such as entrance fees or parking fees are not a concern when choosing POS. Those fees can contribute a small part to maintenance of the parks.

In summary, accessibility and proximity to the POS are the most influencing factors for the elderly to select and use POS. However, the distribution of POS

Table 7 Participants' socio-economic condition

Occupation	Retired				Continue working							
	171	62.2%			89	37.8%						
Income (million VND per month)			Less than 4[4]		4–10 million[5]				Over 10 million[6]			
			39%		49%				12%			
Responsibility for	Self-caring		Spouse/partner		Children		Parents/relatives		Grandchildren		Sister	
	44.94%		35.58%		10.49%		3.75%		3.37%		1.87%	
Living with	Children/children's family			Spouse/partner			Parents/relatives/friends			Alone		
	55.2%			36.11%,			1.39%,			7.29%		
Health condition	Very difficult/difficult				Normal				Quite good/good			
	32.4%				28.3%				39.3%			

Source Authors, 2019

[4] 1 USD = 23,240 VND as of 25 June 2019.

[5] Minimum living cost in HCMC was 4.2 million VND per month since 2017, based on the standard of Vietnam General Confederation of Labor).

[6] Average salary in HCMC in 2018 was 10.3 million VND per month, as a survey of Navigos Group – the biggest career website in Vietnam.

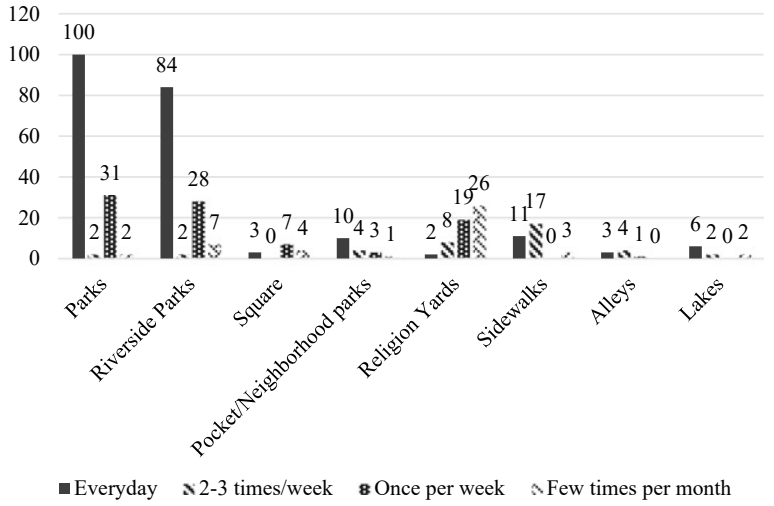

Fig. 2 Frequency of use of different types of POS. *Source* Authors, 2019

Table 8 Activities in POS of the elderly

Intended activities		Time spent	
Activities	Proportion (%)	Duration (min)	Proportion (%)
Walking	37.5	<30	11.0
Exercise with equipment	13.5		
Exercise with slow movement (e.g., Tai-chi)	13.1	30–60	50.0
Group exercise	7.7		
Meeting friends	5.4		
Playing sports (e.g., Badminton)	2.3	60–90	29.0
Nature watching	6.6		
People watching	3.9		
Sitting and thinking	2.7	>90	5.0
Reading	1.2		

Table 9 Impact factors when selecting a POS to visit

Impact factors	Proportion (%)
Social interaction	44.1
Accessibility and proximity	58.4
Availability of physical activities (group practice of tai-chi or yoga, well-equipped machines)	54.8
Comfort (cleanliness, spaciousness, quietness, and available benches)	54.5
Safety and security	41.5
Parking fee/entrance fee	3.3

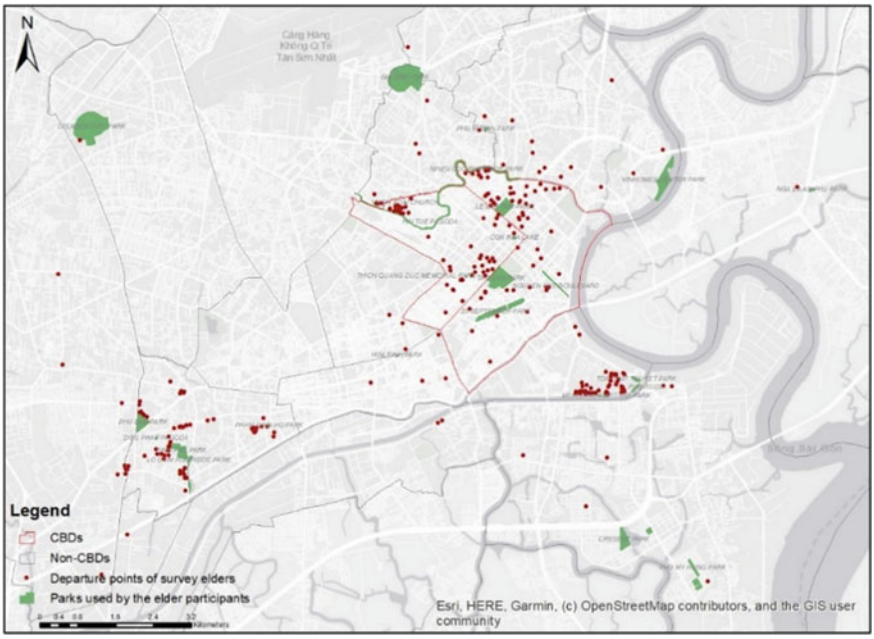

Fig. 3 Distribution of surveyed users and POS. *Source* Authors, 2019

in HCMC is still a serious problem. Figure 3 shows the distribution of the users' departure point (mostly their home) to their favourite POS in the city; some users live relatively far from their favourite POS.

Table 10 shows that the median distance to POS is around 300 m, 170 m in CBDs, and 618 m in non-CBDs, respectively. The average distance to POS is around 615 m, and this is not suitable for many elderly people because 31% of them face difficulty when walking 200-300 m (Thanh-Long Giang 2013). The survey results also show a big gap between the median and average distance as well as between the minimum and maximum distance (615 m and 302 m, and 12 m and 6,955 m, respectively). The reason for this gap lies in the quality disparity of different POS in the city. For instance, Tao Dan Park—considered the best park in CBDs—can attract some people to travel by motorbike as far as 7 km to use it. In non-CBDs, Phu Lam Park attracts the elderly from a distance of nearly 1 km due to its greenery, water surface, and not being invaded by restaurants or commercial activities, as currently happens at Binh Phu Park—a closer park in the same district.

In comparison with the Vietnam Building Code (M.O.C 2008), which says the service radius of a pocket park in a neighbourhood unit should be less than 500 m, this distribution does not meet the standard. Not only the distance to POS, but travel time is also a concern of the elderly. Table 11 below shows that nearly 70% of the questionnaire respondents spend less than 15 min travelling to the nearest POS. Around 30% of the remaining respondents spend more than 15 min, even 1–2 h if

Table 10 Distance to POS for users

Parks	Average distance	Median	Minimum distance	Maximum distance
CBDs	**351.1**	**170.9**	**12**	**6954.8**
Tao Dan park	757.6	182.1	16.8	6954.8
Le Van Tam park	144.2	80.5	17.2	591.6
Nhieu Loc park	271.1	195.2	12	2537.7
Pocket/Neighbourhood parks	231.4	272.3	30.5	661.3
Non-CBDs	**806.2**	**618.4**	**15.8**	**4304.7**
Binh Phu park	806.5	274.8	119	3072
Phu Lam park	1047	946.1	125.6	4304.7
Ton That Thuyet park	727	669.2	36.8	3352.5
Pocket/Neighborhood parks	644.3	490.3	15.8	2176.3
Nguyen Hue square	**508.8**	**316.3**	**35.7**	**1531.6**
Total	614.6	301.9	12	6954.8

Source Authors, 2019

they go by bus (0.2%). This does not compare favourably to the modern guidelines of the American Planning Association in 2006 that require 2–6 min' walking to a pocket park (Park and Rogers 2015) (while there is no standard for this in Vietnam). Regarding means of travel, public transport such as buses is listed at the bottom of their favourite means, i.e. only 1.6%, due to its delayed time or lack of bus stops. Their preference is walking, with nearly 50%. Motorbikes and bikes are used but by less than 20%.

Table 11 Traveling time and means of transport

Traveling time	Proportion (%)	Means of transport	Proportion (%)
<15 min	68.5	Walking	49.7
15–30 min	15.6	Motorbike	19.9
30–60 min	5.7	Bicycle	15
1–2 h	0.2	Bus	1.6
No answer	10	Lifting by others	1.6
		No answer	12.2

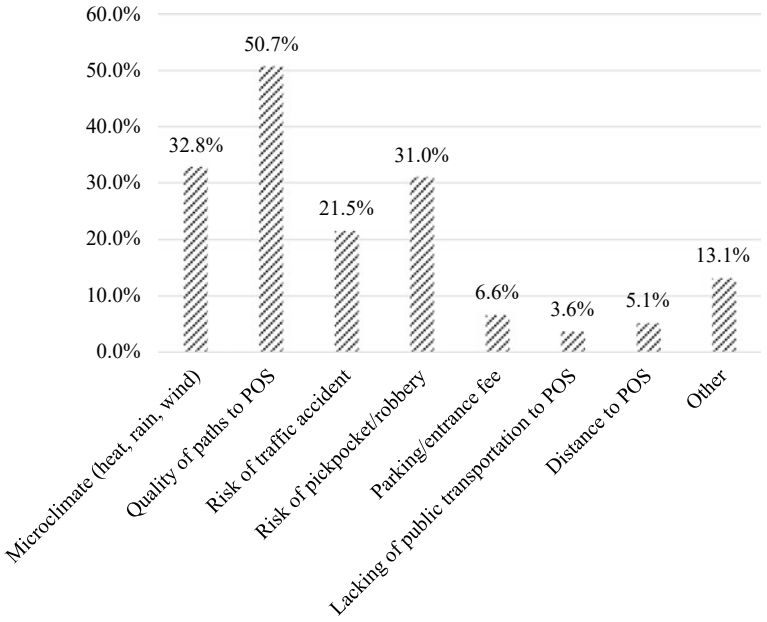

Fig. 4 Obstacles to access POS. Source Authors, 2019

4.3 Evaluation

The survey shows the high demand of the elderly for using POS as well as certain difficulties they have been experienced. Besides long distance and travel time, the accessibility to POS is not convenient. Most of them when interviewed said that walking to their favourite park is also a form of exercise. Therefore, long distance is not an obstacle for them. The biggest challenge for them is the poor quality of paths to POS (50.7% of responses), such as bad quality of sidewalk surfaces, no sidewalk, or sidewalk occupied by street vendors that create risks for pedestrians when they have to walk on the roadway with vehicles. The second challenge is uncomfortable weather (32.8% of responses), which is quite hot for walking (normally over 27°, even in the early morning) due to fewer trees along the street and urban heat island effects. In addition, pickpockets and other robbery are quite serious problems in HCMC[7]; 31% of the surveyed elderly are afraid of such crimes, and the other 21.5% worry about the risks of traffic accidents when using their own vehicles or crossing streets to POS. Other issues such as entrance fees, parking fees, and public transportation to POS are not their major concerns (see Fig. 4).

Nevertheless, although they face many difficulties in using POS, in the survey, the elderly gave positive feedback on the current quality of POS that they visit most often, as shown in Fig. 5 below. From their point of view, “equipment for relaxing”,

[7] Statistics of HCMC’s Police for first three months of 2016, 1,305 robbery cases were recorded.

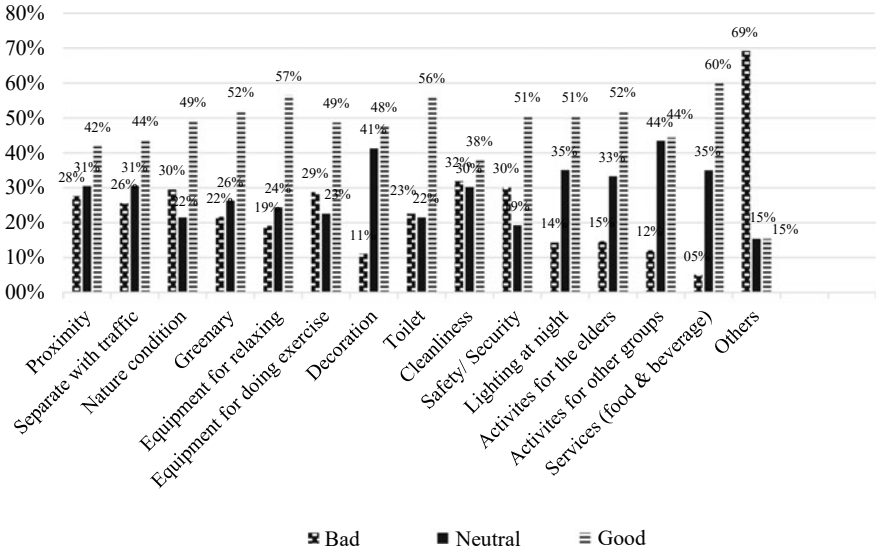

Fig. 5 Evaluation of POS from the point of view of the elderly. *Source* Authors, 2019

"toilet", and "services" are the factors that receive the highest positive feedback (57%, 56%, and 60%, respectively). Meanwhile, "cleanliness", "safety and security", "natural condition", and "equipment for doing exercise" factors are evaluated in bad condition with 32%, 30%, 30%, and 29%, respectively. Other unlisted factors of POS in Fig. 5 include poor maintenance of sports equipment, poor organization of cleaning teams, poor caring for greenery, reduction of POS, or privatization of POS for beverage and commercial purposes (69% share in total).

Therefore, based on existing problems, the aspects that the elderly want to improve include cleanliness (17.2%), more facilities (16.4%), more green spaces (14.5%), larger areas of POS (14.2%), better security (13%), and better sidewalk surfaces leading to POS (6.7%). Not only provision but maintenance of sports equipment in POS is also important (4.5%). Nevertheless, even though the evaluation of elderly people on POS is quite positive, if compared with aforementioned design guidelines, the POS in HCMC still has many limitations, as listed in Table 12 below.

Finally, to move towards the development of age-friendly POS in HCMC, the overall situation of POS in relation to the elderly should be identified through a SWOT analysis as shown in Table 13 below.

4.4 Solutions for Improving POS

From the point of view of the elderly, "accessibility, proximity, cleanliness, natural condition, security issues, and exercise equipment" are existing problems of POS.

Table 12 Limitations of POS in HCMC

Guidelines	HCMC situation
– Management	– Not only the elderly but all communities are still passive participants in the planning and management of POS. The community-based design process is still new in the master planning of HCMC
– Mainstreaming	– Lack of housing, goods, and services for daily use of the elderly (Trung Minh 2017; Vietnam News Agency 2017), and lack of POS for the elderly to use as a replacement
– Urban context	– Far distance, unequal distribution of POS, lack of public transportation to POS
– Quality of space	– Quality of POS is not so bad. The problem lies in cleanliness, maintenance, and security

Source Authors, 2019

Table 13 SWOT analysis

Strengths	Weaknesses
– Interest of the elderly in using POS – Positive perception of the elderly toward current situation of POS in HCMC	– Lack of green spaces in HCMC – A decline in number of POS – Illegal privatization of POS – Lack of awareness regarding urban spaces toward the elderly – Lack of maintenance of POS – Hard to mobilize private sector's investment for developing POS
Opportunities	**Threats**
– High demand for using POS, not only by the elderly but also by all other age groups – Some regulations and research have started focusing on public space planning. Foreign organizations and NGOs are supporting studies on POS	– Overlapping in management of POS in Vietnamese laws (Thi Hien et al. 2015) – Differences between master planning and implementation of POS – Rapid increase of urban immigration and population that leads to a lack of land for POS – Lack of funds for POS construction

Source Authors, 2019

Based on the current situation of HCMC and theory, design guidelines for POS towards the elderly are recommended in Table 14 below:

5 Conclusion

Throughout this paper, the distribution, provision, and quality of POS in HCMC have been analysed and discussed. The accessibility to POS, especially paths that lead to POS, is one of the concerning issues, which needs to be improved by removing

Table 14 Set of solutions for improving POS for use by the elderly

Guidelines	Solutions	Examples
Management	Getting opinions of the users through public survey, not only the elderly but also all residents	This survey
Main streaming	There should be more places for the elderly to come, such as semi-public zones in high-density residential areas, with a walking distance less than 300 m in order to make access easier for the elderly Figure 6	Figure 7 Design the entrance of a commercial building as a semi-open space for pedestrians. Steps and a fountain make it more attractive
Urban context	Increase number of POS by utilization of vacant urban lands	Create small parks in vacant lots under bridges, space that is often illegally occupied by parking or commercial activities, or create urban community gardens (see Table 15)
Quality of space	Cleanliness: should have more boxes of bags for collecting dog waste. The collection of falling leaves can use by car ((??)) Natural condition issue: putting urban farms in vacant places Security issue: when the places attract more users, they will have more eyes for security Maintenance of exercise equipment: the sponsor company should maintain regularly	Figure 8 → Change to urban community gardens Figure 9

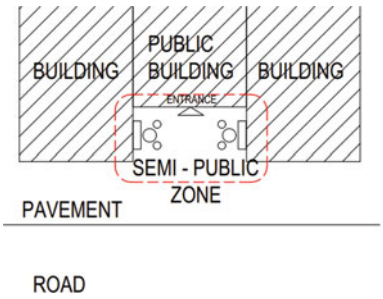

Fig. 6 Sketch concept of semi-public spaces. *Source* Authors, 2019

street vendors and motorbike parking on the street pavement. Proximity to users' houses, even though it is not a problem from the point of view of the elderly, is seriously under the standard, especially considering the health condition of most elderly users. The elderly seem to prioritize or pay more attention to cleanliness, natural condition, safety and security issues, and exercise equipment in the parks. Therefore, although the accessibility and proximity are not good, the elderly still

Fig. 7 Entrance of commercial building in district 7, HCMC. *Source* Authors, 2013

Table 15 Examples of improving quality of POS

Current situations	Solutions
Figure 10	Figure 11
Figure 12	Figure 13

Fig. 8 Empty vacant lots. *Source* Authors, 2019

Fig. 9 Urban community gardens (Jeff Wright/Wikimedia Commons 2015)

Fig. 10 Illegal use of vacant land under a bridge in district 1 (VGP/Anh Tuấn, 2018, retreived from http://tinhot24h.vn/tin-trong-nuoc/sau-lenh-cam-gam-cau-tai-tphcm-van-bi-xe-thit.html)

Fig. 11 Ton That Thuyet Park—utilized land under the bridge to create a park. *Source* Authors, 2017

Fig. 12 Vacant lot with "rubbish forbidden" sign. *Source* Authors, 2013

Fig. 13 Benches and trees are set up for social interaction. *Source* Authors, 2013

have quite a positive assessment of POS in the city. From the authors' point of view, a possible explanation for this positive evaluation is that the elderly get used to the problems of an overcrowded city with high population density and insufficient public spaces. In other words, they somewhat accept the current condition of the POS due to limited choice.

In addition, knowing that it is a big challenge for the city to have more POS due to limited land, the elderly do not expect to have more parks or green spaces but rather want to improve the condition of existing ones. Some possible improvements are proposed in management, mainstreaming, urban context, and quality of space, of which the most important concern is how to better distribute POS in the city. This can be done by optimizing semi-public spaces such as the courtyards of public buildings, increasing urban community gardens, and making small parks in vacant lots under bridges or undeveloped lands. Such development should be supported by a clear management mechanism to ensure that the new POS will be sustainably developed and operated. The solutions, either new development of POS or improvement of existing ones, will benefit not only the elderly but also city residents as a whole.

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Tourist Development and Spatial Transformation of Mekong Delta Flower Villages: A Case Study of Tan Quy Flower Village, Vietnam

Huynh Trong Nhan, Mai Thanh Binh, and Le Hoang Thien Long

Abstract The Tan Quy Dong Commune is a long-standing community in the Mekong Delta region that has the distinction of being a flower village. Due to the low-lying terrain, this area's landscape changes seasonally and is influenced by tides of the Sa Dec River. Residential development is interwoven with the cultivated areas to form a unique and recognizable urban space. Urban growth and tourist development, however, are driving changes in economic structure and spatial form in this flower village, particularly in the relation to the dwellings and the canals. This research asks how village space is changing under the impacts of urban development. Combining spatial analysis using Web-based GIS with site survey, this paper will explore the relationship between economic-tourism development and the transformation of the Tan Quy Dong flower craft village. Planners and other city government officials can use this analysis to inform urban design that balances landscape preservation with development.

Keywords Spatial transformation · Tan Quy Dong flower village · Web-based GIS

1 Introduction

With a spatial form typical of a water ornamental flower trade village, Tan Quy Dong craft village has long had a distinct identity. The regional landscape changes with the seasons and tides. For many years, the morphology consisted of residential spaces along canals, interspersed with ornamental flower gardens that have become a typical urban spatial form of the region, which is called Mekong Delta "water civilization." With a rapid increase in urbanization within the region and as the tourist market matures, many localities continue to promote tourism in the unique landscape of craft villages. The Tan Quy Dong ornamental flower village has the value of the existing distinctive landscape of ornamental flowers and is developing together with

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the typical regional river system of the Southwest. There is a great potential for craft village tourism.

2 Typical Landscape Spaces of Tan Quy Dong Ornamental Flower Village

The Tan Quy Dong ornamental flower village (hereafter referred to as Tan Quy Dong) is not a miracle of nature nor a masterpiece of ancient architecture, but rather the result of the skillful hands of many generations of artisans over the last century or so. It has now emerged as a leading tourist destination amidst the unique nuances of the Mekong River (Fig. 1). The hydrological regime is directly influenced by the Tien and Sa Dec river flows, with abundant rainfall, a dense system of canals, and two distinct seasons (rainy and dry). The topography slope from the Tien River inland is relatively flat. The medium terrain elevation is from +0.8 to +1.2 m, the highest is +1.5 m, and the lowest is +0.7 m (EAI 2019). The topographical surface is divided by a dense system of canals beneficial for irrigation of ornamental flowers.

The architecture of the area has a Southern style, combining tradition and modernity. With a long-standing tradition of attributing value of the real estate to its location, there is an adage in Vietnam. "The first is near the city, the second is near the river, and the third is near the road." As such, most of the housing projects are located along the two channels and the roads of the area. Housing is built with low construction density, consisting mainly of one-story houses. Most of the houses have front yards and backyards planted with ornamental flowers, which has created a green form all year round. These features together make a relatively consistent regional landscape that can be easily observed when traveling along roads or canals. In addition to the ornamental flowers in cultivated areas, almost all households have planted ornamental flowers along the canals, creating a landscape space that follows the adage: "Above is the dock, and below is the boat" (Pham TL 2002). This adage means that the houses and living spaces of inhabitants here are associated with the river: They build houses near the riverbank and travel by boat (Fig. 2).

3 The Impact of Urbanization

With the application of modern farming techniques and technology, farmers have engaged in intensive cultivation of ornamental flowers, which in turn has led to a diversification of the flowers being grown and at the same time resulted in soaring productivity in Tan Quy Dong. In addition, the impact of urbanization and urban construction planning on handicraft villages is increasingly clear and evident, especially the regional transportation system. According to a Department of Agriculture of Sa Dec city report, the Sa Dec flower village has an area of 527 ha with 2300

Fig. 1 Typical spaces of Tan Quy Dong flower village (*Source* Author)

households participating in production; the value of flower production in the locality in 2018 reached 1550 billion VND, accounting for 65% of the value of agricultural production of the city (Department of Agriculture 2018). The widened roads have increased the accessibility and efficiency of landscape space use, thereby promoting the development of farming space and improving the quality of life (Fig. 3).

Urbanization of Tan Quy Dong has brought about many positive effects on the economy, landscape, and society. Although the cultivated land areas and the living environment of the people are affected by urbanization, it is an inevitable trend in Vietnam. It is important that Tan Quy Dong can still develop in both quantity and quality while ensuring its own identity and, most importantly, promoting the life of the people in the growing village. Land use classification and imagery from satellite Sentinel-2 make the influence of roads on the construction of houses clear (Fig. 4).

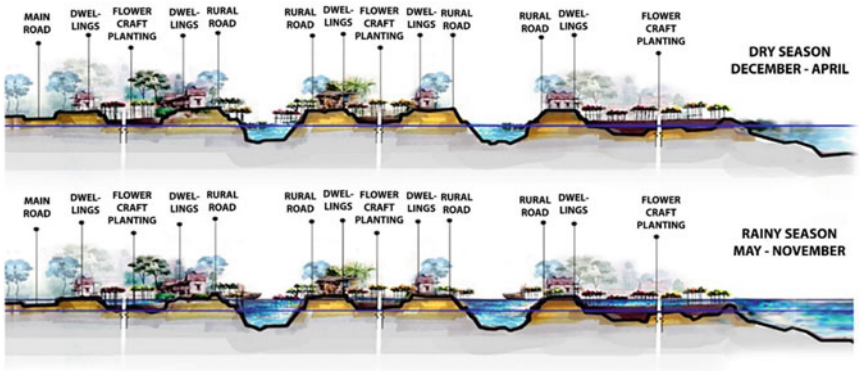

Fig. 2 Section of landscape of Tan Quy Dong ornamental flower village (*Source* Author)

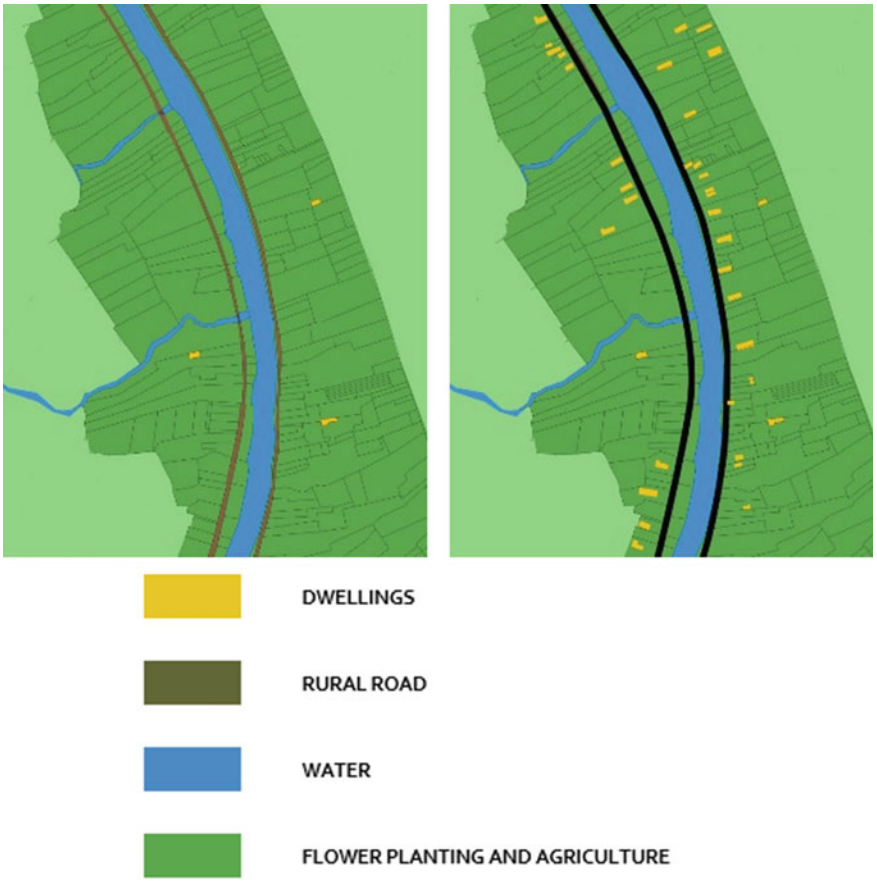

Fig. 3 Impact of urbanization on transport and village spaces before and after 2015 (*Source* Author)

The higher the level of urbanization, the more concentrated housing developments are closer to roads. A histogram chart (Fig. 5) also shows that over 40% of the built-up area is 110–440 m from the road.

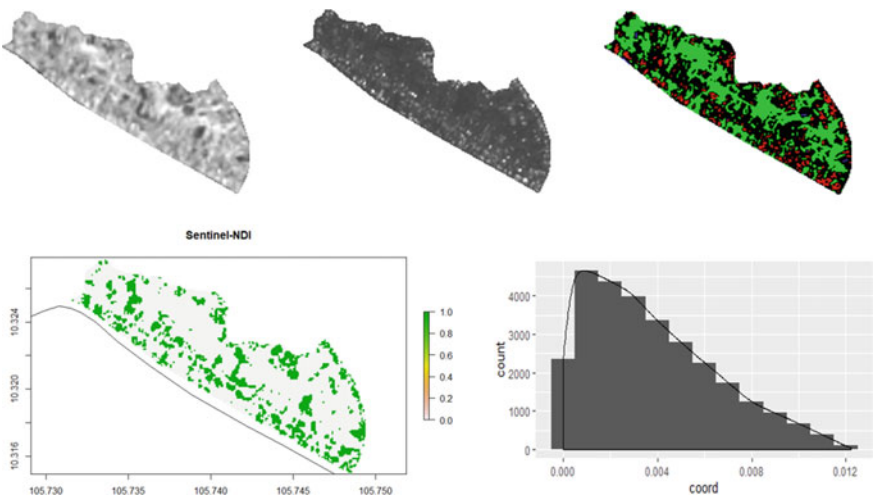

Fig. 4 Tan Quy Dong flower village built-up area shown by sentinel-2 data on July 30, 2019 (*Source* Author)

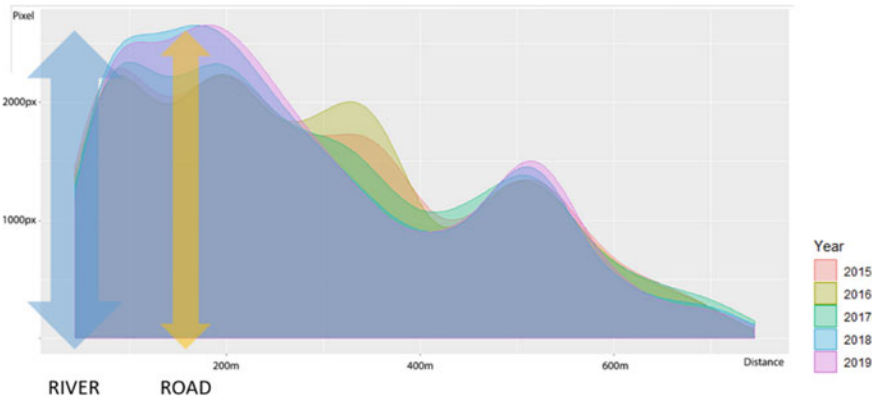

Fig. 5 Density chart of distance distribution from built-up area to the main road in Tan Quy Dong flower village from 2015 to 2019 (*Source* Authors)

4 The Impact of Tourism

Many visitors are attracted to the ornamental flowers cultivated in Tan Quy Dong flower village, from larger flower fields to clusters of flower plantings made by families, interspersed along the canals and rivers of Southern Vietnam. It is also a typical scene for the area that creates potential tourism that we need to understand and utilize appropriately:

- There is a wide range of ornamental flowers in terms of species and colors. The most intense blossoming happens during the Tet holiday and related festivals;
- Typical of the southern river region, the water level rises and falls by season, day by day, changing the landscape continuously and attracting more and more tourists.
- In 2018, Dong Thap tourism in general and Tan Quy Dong ornamental flower village welcomed over 3.33 million tourists, an increase of more than 25% over the previous year. Total revenue from tourism in 2018 reached 684 billion VND, an increase of 40% over 2017. It was expected to soar up to 6 million visitors by 2020 (Tan Quy Dong Ornamental Creature Assn., 2009).
- It is located on an important tourist waterway of the region (Fig. 6), which is the connection point for tourist destinations in the Mekong Delta.

Fig. 6 Mekong Delta river cruise routes (*Source* Mekong Eyes Cruises, 2020)

Tourists come to Tan Quy Dong ornamental flower village tourist area mostly for sightseeing, staying, exploring, and experiencing the local ambience and activities, with overnight stays being most consequential. Therefore, we need to pay special attention to the organization of the landscape space that would meet the tourists' needs and continue to draw them to the area, such as:

- Sightseeing: Characterized by its location by the river, the flower village is a major draw for sightseers. Therefore, in order to attract tourists, it is necessary to organize its landscapes of ornamental flowers by growing and displaying those associated with the water, especially adapting the landscape to the dry and the flood seasons.
- Exploring and experiencing: The abundance of blossoms and the variety of species of flowers have created a colorful flower village that is associated with the lifestyle of the people of the South. This is also an attraction for tourists, which offers an opportunity for creating conditions for visitors to learn or experience the villagers' lifestyles and activities, while fostering a sense of closeness and familiarity. The demand for experience-based tourism is increasingly; visitors want to experience daily activities with local people, including farming and taking care of the ornamental flowers.
- Staying: Tan Quy Dong tourist area meets the demand for short-term stays by having local people share their living space with the tourists. All options for short- and long-term stays ought to be explored.

5 Proposal for Typical Spaces of Tan Quy Dong Flower Village

Tourism to Dong Thap in general, and to Sa Dec city particularly, is increasing rapidly. Therefore, establishment of Tan Quy Dong tourist area as a special magnet for the tourists visiting this province is a very practical strategy. Based on the needs of visitors to Tan Quy Dong flower village, the specific functional spaces are identified in Fig. 7 to ensure the development of tourism in the flower village while ensuring that needs of local people. The proposed functional spaces include service and management spaces, such as residential spaces for inhabitants combined with living spaces for tourists and community activity spaces, sightseeing spaces combined with experience spaces, and exploration spaces.

In order to fill the demand, it is apparent that the functional spaces of the flower village will need to be planned for sustainable development and to transform its current profile to meet the needs of the tourists as well as of the local residents (Fig. 8).

Based on our study and field observations, we offer the following typical spaces:

1. Management-service space: It is necessary to dedicate an area where it is easy to build and that is accessible from the provincial road expected to be in zone

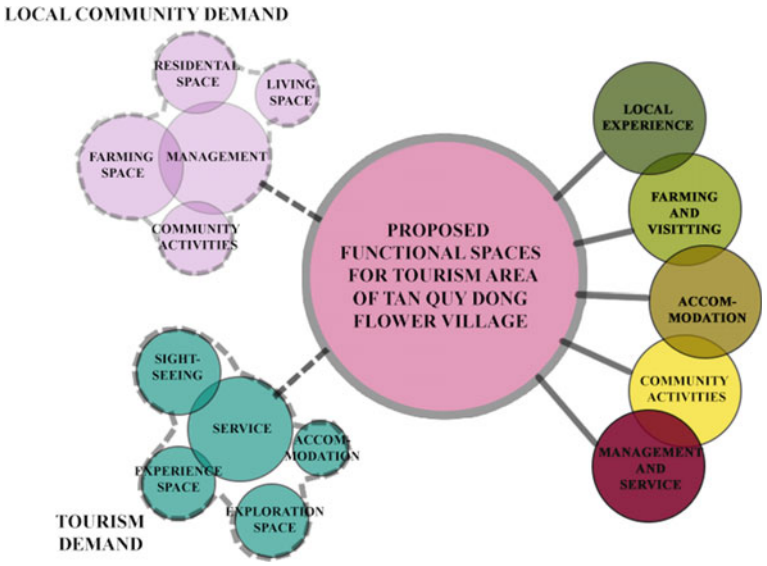

Fig. 7 Functional spaces in the tourist resort of Tan Quy Dong ornamental flower village (*Source* Author)

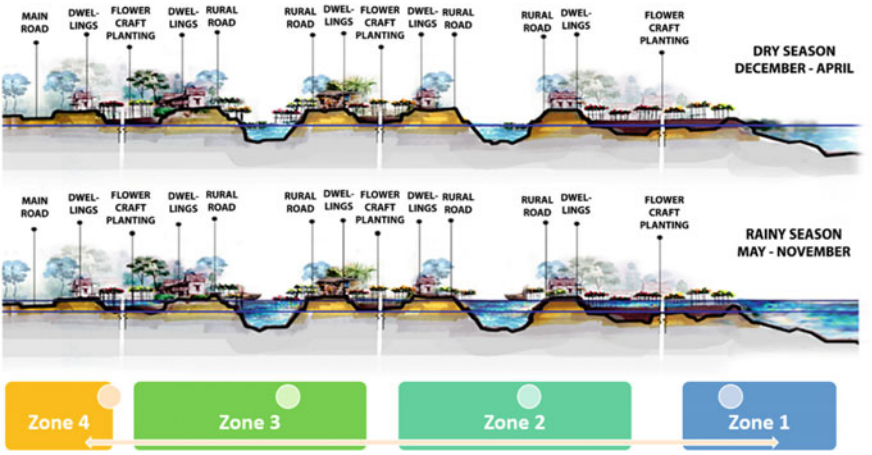

Fig. 8 Zoning for typical landscape section of Tan Quy Dong ornamental flower village (*Source* Author)

4. This is where tourists approaching the area can get information about visiting Tan Quy Dong.

2. Living space for residents and staying space for tourists: Existing residential spaces should be developed in combination with tourist staying spaces (occupy about 15% of the total construction area) (Fig. 9).

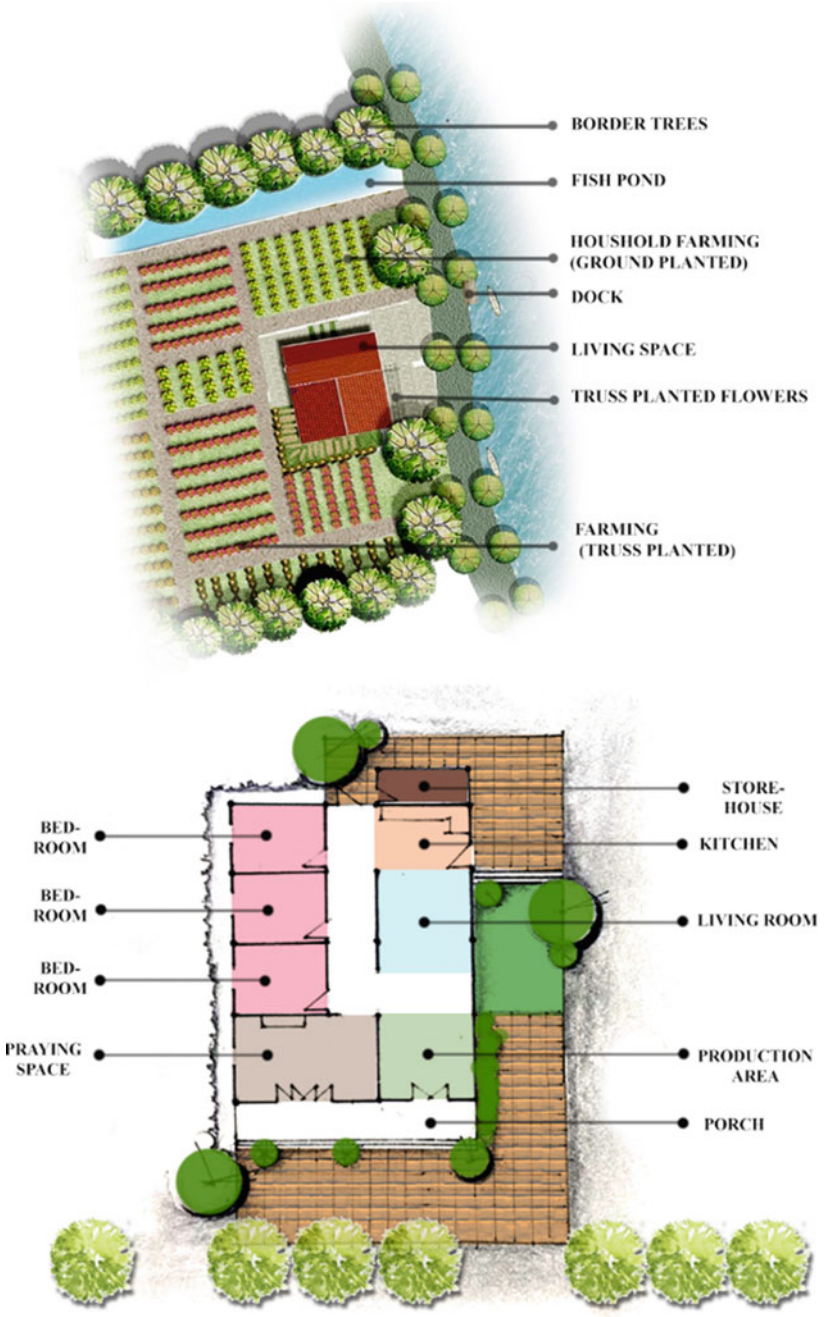

Fig. 9 Household space landscape with cultivation of ornamental flowers (*Source* Author)

3. Community living space: As a tourist area and river flower village, community activity spaces should be associated with the river as well as the flowers. Also important is easy access from main roads and a good service radius to residents and tourists.
4. The main transport system: The current road traffic system almost meets the traffic demands of the area. However, it is necessary to have plans to refurbish and improve the quality of road surfaces such as widening the road, paving asphalt and, concrete, and deceleration features. We should also encourage pedestrian traffic and restrict motorized traffic (Fig. 10). At the same time, it is necessary to have infrastructure solutions to propose for lighting systems, yards, connecting bridges, etc.
5. Internal transport: In zone 3, the traffic element is mostly the internal transport of each household, which needs to be well-organized for convenient cultivation and sightseeing of visitors, with good access to main roads of zone 1 (Fig. 11). In addition, according to the general orientation, zone 3 has two main roads: an access road and a cross-sectional road. It is necessary to have synchronous transportation solutions in zone 1.

6 Conclusion

In this paper, the results of Web-based GIS analysis illustrate the spatial transformation of the Tan Quy Dong ornamental flower village area, Sa Dec city. This transformation is caused by two main impacts: urbanization and the development of tourism. Land use classification with imagery from satellite Sentinel-2 shows that the higher the level of urbanization, the more concentrated housing works are closer to roads. While urbanization influences the location of development, tourism services impact household spatial layout.

In this case study, the spatial transformation adapts to the demand not only for farming but also for increasing tourist accessibility. Therefore, this research also pointed out our analysis of different types of spaces to meet housing and community activity needs and manage tourism services, such as management-service space, living space for residents and staying space for tourists, community living space, and main transport and internal transport systems. In future studies, analytical results should be supplemented with local and contextual information and applied to propose urban planning and design solutions suitable to the development orientation and living conditions of the local habitat.

For other craft villages in the Mekong Delta, urbanization has different impacts. However, it is possible to apply spatial analysis with Web-based GIS combined with field surveys to understand the development dynamics of each area. Based on this study, other craft villages in the Mekong Delta need to be assessed for spatial transformation in order to plan and establish spaces that balance urban development with tourism and preserve valuable cultural aspects of the craft village and the “river civilization” of the Mekong Delta.

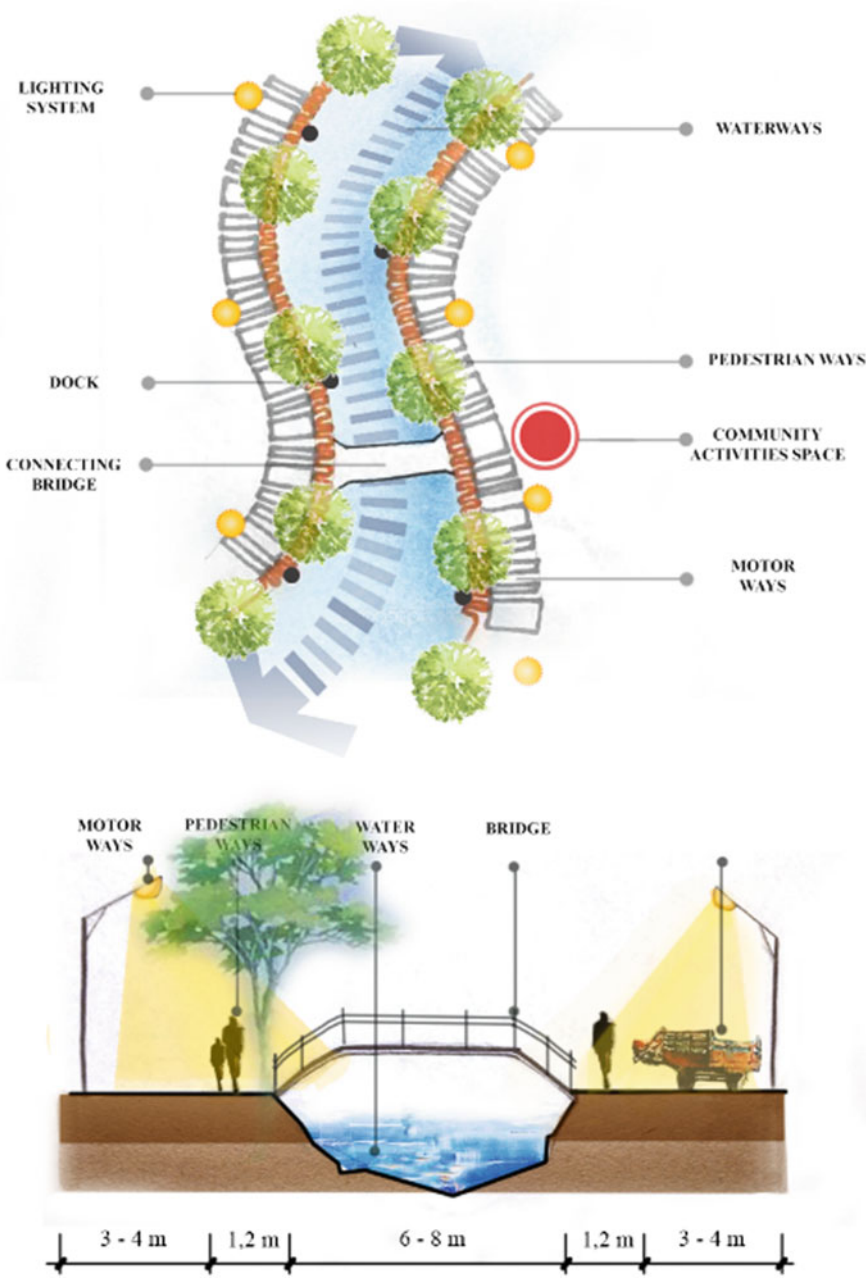

Fig. 10 Main traffic route map and typical section (*Source* Author)

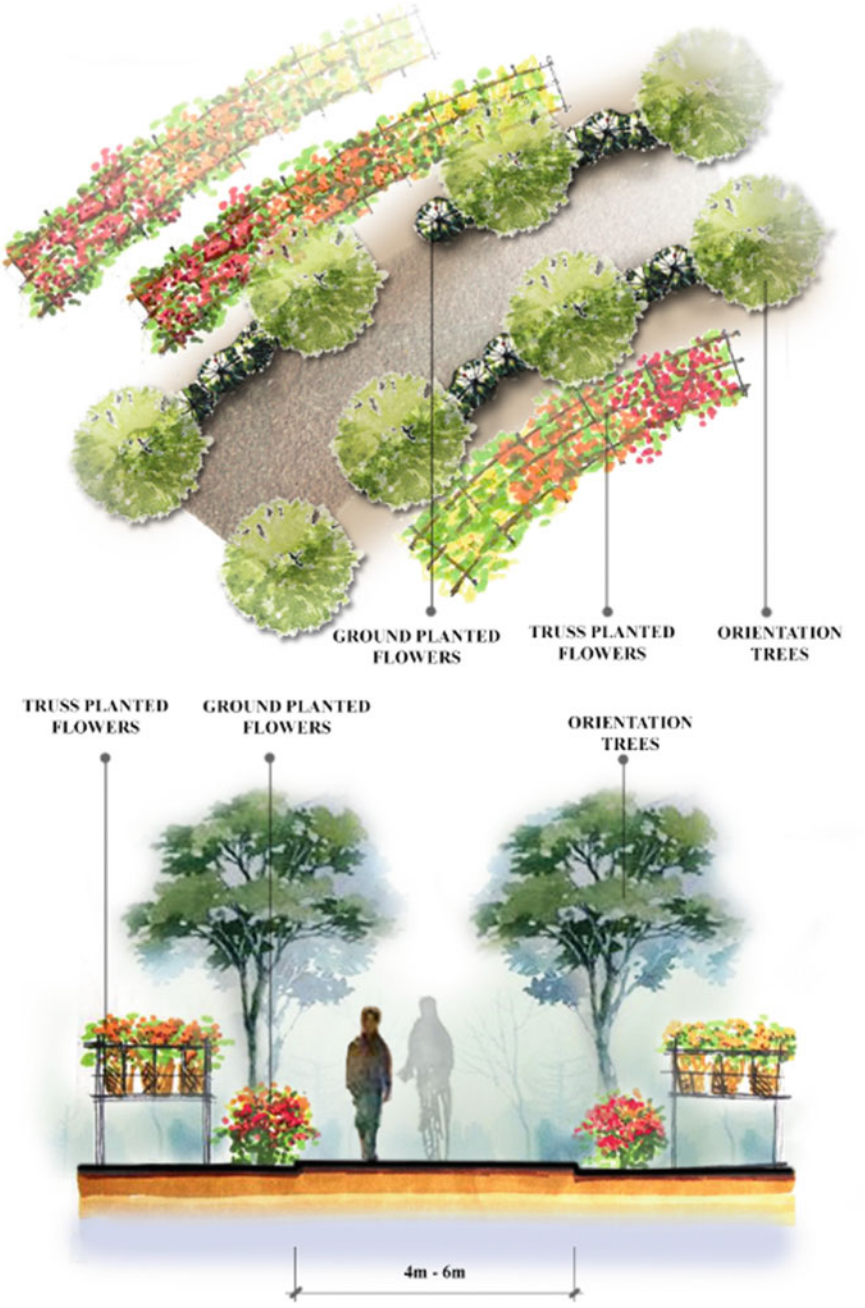

Fig. 11 Layout of transplanted trees and internal traffic (*Source* Author)

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Tracing the Evolution of Resilience in Planning Practices—A Case Study of Taichung, Taiwan

Peiwen Lu, Sheng-Yu Yang, and Lihsiung Lin

Abstract The notion of resilience has gained increased attention in academic and policymaking discourse in recent years. In practice, however, the interpretation of resilience remains confusing, especially because current uses of the terminology express minimal new ideas. This study focuses on the evolution of resilience in discourse on planning for spatial development—to what extent the notion was adopted in shaping coalitions and how it reshapes planning in practice. The empirical study is based on resilient waterfront projects in the city center of Taichung, Taiwan, which is experiencing an economic downturn due to urban extension. Data for the study were mostly based on interviews conducted over the past two years, as well as on supplementary resources for policy analysis. Following a brief introduction, Sect. 2 sets up a theoretical groundwork for assessing the evolution of the notion of resilience in discourse, while Sect. 3 presents the empirical study. It traces the notion of resilience in discourse in the policymaking process, resulting in practical implementation. All the analyses lead to Sect. 4, which addresses the evolution of discourse and the directive factors in policymaking. We conclude that it is difficult, or may be impossible, for the notion of resilience to be "dis-contextual;" resilient planning, in practice, is very much related to the particularities of a local context.

Keywords Urban planning · Policymaking · Resilience · Waterfront redevelopment · Taiwan

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1 Introduction

The study examines the evolution of resilience in planning discourse from policymaking to practice. As a profession that determined the future of cities (Faludi 2000), traditional planning managed the growth of cities via land use controls and other regulations in order to maintain the balance between economic growth, environmental protections, and cultural expectations. Planning as regulation of land use was challenged in managing the complexity and widening diversity of urban development beginning from the late 1980s. Neoliberalist planning was deeply influenced by the market and trends of globalization, even in context of coping with regional restructuring and economic growth trajectories (Eraydin and Taşan-Kok 2013). This transition reshaped planning to allow state intervention and made public spending acceptable with a dominant force of global markets. According to Peck et al. (2009), the contextual embeddedness and path dependency of urban development in many cities were heavily shaped by the divergent reactions of the state to neoliberalization. The form of governance was no longer clear but represented a series of complex and overlapping strategies (McGuirk 2005).

Unforeseen disturbances, such as flooding, global economic depression, and challenges in public health, also hastened the transition of planning. Policymakers came to realize the difficulty or impossibility, of managing urban issues through planning alone. This caused planners to seek other avenues for collaboration and discussion. Actors engaging in planning were diverse, including government authorities, private enterprises, academic representatives, and local stakeholders. The government remained important but no longer dominant. Collaboration did not always result in plans for physical implementation. It might lead to contributions such as a more specific understanding of the problems, a possible (but not prescribed) solution, or a conceptual vision of urban development in the longer term.

Success of planning collaboration relies on the role of coalitions in policymaking (Healey 2007). Coalitions, sometimes referred to as networks, include stakeholders who work collaboratively in framing their interests into policy proposals, thus resulting in direct policy change to achieve specific targets (Sabatier 1988). Coalitions are mostly formed according to shared discourse concerning an ideal approach for spatial development. After achieving the specific tasks (e.g., promoting a policy change), coalitions might collapse due to a lack of shared agreements or a transfer of interests into other policies. Although actors involved in coalitions might reframe, the key actors often stayed on from one event to the next (Lu 2014, 2016).

Discourse is essential in shaping coalitions. Policymakers prefer using comprehensive concepts, such as sustainability, resilience, or city competitiveness, as platforms for discourses in support of forming coalitions in decision-making. Their broader understandings may be confusing but also contributive to forming an umbrella framework of cooperation in and among a wider set of actors. Discourse (what is said) and practice (what is done) are interrelated attributes that occur in parallel. Planning discourse and practice are not always coherent. This interaction continues, and there is no specific end-state. For example, policymakers may declare

an intention to facilitate a climate adaptive city but remain focused on mitigation strategies in spatial development. The situation persists until the demands of adaptation become more urgent in the decision-making process. Mostly, it comes after greater damages occur.

This study focuses on the evolution of resilience as discourse in planning for spatial development—*to what extent* the notion was adopted in shaping coalitions and *how* it reshapes planning in practice. The empirical study is based on resilient waterfront projects in the city center of Taichung, which is experiencing an economic downturn due to urban extension. Data for the study were mostly based on interviews conducted over the past two years, as well as on supplementary resources for policy analysis. The rest of the chapter is divided into three sections. The first sets up a theoretical groundwork for assessing the evolution of the notion of resilience in discourse. The second presents the empirical study of the local case. It traces the notion of resilience in discourse in the process of policymaking and the results in practical implementation. All the analyses lead to the last section that discusses the evolution of discourse and the directive factors in policymaking.

2 Resilience in Planning: Discourse, Plans, and Practices

2.1 Spatial Planning and Planning in Collaboration: The Research Framework

Planning as a profession of land use management is always about sustaining the growth of cities. The neoliberalist trend brings a reconsideration in planning and shifts its focus from regulations to collaboration in the process of policymaking. Many scholars use the term spatial planning to highlight this transitional focus (Eraydin and Taşan-Kok 2013; Healey 2007). Spatial planning, originally dating back to the 1960s, sets up an interest not only in practical implementations (what to conform) but also the way in which decisions are made (how to initiate). According to Cullingworth and Nadin (2006), it is about managing "the problem of coordination or integration of the spatial dimension of sectoral policies through territorially-based strategies". In other words, collaboration and negotiation bring consequence to planning decisions. Spatial planning is generally a European term—as a fundamental dimension of territorial development associated with the process of evaluation (Haughton et al. 2010; Medeiros 2017, 2019). Outside of Europe, although the importance of collaborating and integrating activities is increasingly emphasized, policymakers seem to retain the traditional understanding of planning as a governmental approach for land use control (Lu 2014). Take planning in Taiwan as an example. Policymakers often underemphasize the importance of inviting multiple actors to engage in collaborative decision-making. This brings in at least two difficulties in planning. First, it excludes public opinion from the formal arena of policymaking. Public participation is rare

or occurs only after a plan is decided or practically adopted. Second, lack of collaboration causes challenges in coping with issues having a combination of uncertainty and complexity, such as climate change. Planning can neither provide strategies that ensure complete safety nor manage the complex impact of cities on climate change.

A rising awareness of a newer framework to assess spatial planning emerged in the late 1990s. Mastop and Faludi (1997) pointed out the need to examine planning by applying the theoretical discussion of conformance and performance. Conformance was about measuring the relations between plans and physical development. This matched the traditional concerns of planning. Performance focused on evaluating networks and discourse—the newer but increasingly critical perspective of planning (Faludi 2000, 2006, 2008; Mastop and Faludi 1997). Healey's study (1997, 2007, 2012) shared this focus but attended more to the examination of performance, the governance of planning. She used the term governance, instead of government, to highlight that planning included a wider set of groups of interests for urban development. Healey (2007) explained the levels of planning governance as specific episodes, governance processes, and governance culture. These levels were not addressed hierarchically but represented different aspects of interest in policymaking. The level of specific episodes included actors and institutional sites; the level of governance processes was about networks and coalitions, discourse, and practice, and the level of governance culture referred to assumptions hidden in society in terms of social values, appropriate modes of governance, and beliefs with respect to who makes plans in shaping a place. Planning from this perspective was a continual process that not always brought results in practice. Sometimes, it caused a change in institutions or the involvement of different actors.

Benefitting from the literature, in our previous study, we defined planning in terms of four dimensions: (i) discourse, (ii) collaborative framework, (iii) plans and policies, and (iv) spatial development (Lu 2014, 2016). As shown in Table 1, the first two focused on evaluating the performance of planning, while the last two were mainly centered on conformance. In the first dimension, actors and arena were considered. Examining the two attributes helped to illustrate the interactions between people, development, agendas, and concepts. The second dimension considered discourses addressed. By clarifying the visions accepted among a wider group of interests, it helped to represent the transition in policymaking over time and coalitions (or conflicts) among policymakers. The dimension of plans and policies concerned the written agreements for spatial development—not only government policies but also agreements of multi-actor collaboration. The dimension of spatial development, the last one, was about the practical implementation of plans and policies. It was not illustrated in Healey's model but still critical for evaluating conformance.

Our previous studies in Taiwan and the Netherlands acknowledged that the four-dimensional framework could better present spatial planning and its transition in policymaking (Lu 2014, 2016; Lu and Stead 2013). This article also used it for assessment.

Table 1 Spatial planning and the dimensions for evaluation

Theoretical discussions to evaluate planning	The dimensions of spatial planning	
Performance	Discourse: the directing objectives	Collaborative framework: the administrative structures
Conformance	Plans and policies: the conducted agendas and regulations	Spatial development: the physical outcomes

Adopted from (Lu 2014, 1016).

2.2 Resilient Planning in the Local Context

The notion of resilience has a variety of disciplinary origins, including ecology, business studies, material science, engineering, and psychology (Downing et al. 2012; Gunderson 2000; Holling 1973; Hyslop 2007). Across many definitions, the issue of change often constitutes a central dimension of illustrating the notion of resilience, both in terms of resistance to change and recovery from it. Resilience in ecological studies is about the capacity of a system to undergo changes and retain its basic function and structure along with the disturbances (Fischer et al. 2015; Folke 2006, 2016; Holling 1973). This is different from material engineering studies that interpret resilience as ductility and malleability—the capacity to minimize the possibility that disturbances will occur and therefore to remain sustaining before collapse (Hyslop 2007; Yodo and Wang 2016).

Social sciences began resilience studies in the 1980s to understand the consequences of complexity, insecurities, and uncertainty of human societies. A wide range of interpretations of resilience was addressed in at least the three following tracks: energy insecurities, terrorism, and a variety of social-ecological disturbances (J. Coaffee 2009; Folke 2016; Islam and Walkerden 2017; Thomson and Newman 2017). From the energy perspective, resilience represents an effective counter to coping with the vulnerability of energy insecurities that is highly related to the interacting factors of societies. Such factors can include the availability of energy resources, the constraints of energy supply, and political disruptions (Esteban and Portugal-Pereira 2014; O'Brien and Hope 2010; Roege et al. 2014; Valentine 2011). Planning for resilience in this regard often refers to developing interdependent energy and transport infrastructures for a lower carbon pathway (O'Brien and Hope 2010; Thomson and Newman 2017).

Terrorism studies of resilience in planning work on security and risk management as they affect policymaking and physical development (Chmutina et al. 2014; Coaffee 2008, 2009). Resilience in this context represents a broader drive that can make a city safer and more sustainable. Practical strategies are addressed, such as public transportation (e.g., metro systems), for an active emergency response to terrorist attacks (Bruyelle et al. 2014).

Studies of social-ecological disturbances focus on external disturbances and the influences on human societies. Cities, in this regard, gain particular interest in facing disturbances of exposure such as global economic crisis, flooding, earthquakes, nuclear emergency, and a rising awareness of the broader issue of climate change (Becker et al. 2015; Bosello et al. 2012; Bulkeley and Betsill 2005; Fischer et al. 2015; Gomes et al. 2014; Wardekker et al. 2010). The idea of uncertainty is highlighted in this track. Most of the studies emphasize collaboration to govern urban development in coping with uncertain disturbances (Birkmann, Garschagen and Setiadi 2014; van der Heijden 2019; Knieling 2016). Scenarios of potential disturbances are also more often addressed in such studies (Soliman 2004; Trisurat et al. 2016).

In view of the wider range of understanding, the topic of social-ecological disturbances was perhaps the sole concern of resilience in the Taiwanese context. Interest in the concept of resilience in policymaking began to emerge around the late 2000s when extreme rainfall caused severe disasters. Typhoon Morakot[1] was a key event that caused the society to realize the impossibility of resisting extreme events and the necessity of sharing responsibility in coping with the uncertainty. Disasters like this pointed to a consequence of resilience used for collaboration in coping with risks that later referred to the issues of climate change.

The notion of resilience in concept formed an umbrella framework of communication and collaboration. In practice, however, it remained unclear and interpreted by policymakers according to their owned interests and training background (Lu et al. 2016). Conflicts might occur accordingly. For example, planners interpreted resilience as a synonym for adaptation in reference to proper land use management. Hydraulic engineers considered resilience as a form of mitigation, and environmental protectors and advisories preferred to interpret resilience in reference to issues around the urban heat island effect and carbon emission (Lu 2016).

What remains unknown in this regard concerns the evolution of resilience as a discourse in policymaking. We have neither sufficient understanding concerning the way in which resilience was embedded in shaping decisions nor applicable knowledge in referring to the implementation of urban development—these cause the study to be critical at this moment. Our empirical study traces the evolution of the notion in context of two so-called resilient waterfront projects implemented recently in the city center of Taichung. Data collection comes from semi-structured interviews and policy reviews. Over the past two years, we collected data from six interviewees including government officials, consultants, and planning professionals. All are key actors in framing the projects. The reviewed documents were mainly published between 2014 and 2018, the administrative term of the former mayor. Political sensitivity is also a factor in referring to and tracing the evolution of the concept. Since the current mayor comes from a different party, the term resilience is seldom seen in policies initiated recently.

[1] Typhoon Morakot brought over three meters of heavy rainfall within four days. Hundreds of people died as a result of mudslides and other consequences. The economic loss from the flood was over 500 million euros.

3 The Empirical Study: Resilient Waterfront Projects in the City Center of Taichung

3.1 An Historical Overview: Canals and the City

Taichung is located in the middle of western Taiwan. It has been the second largest city of Taiwan since 2017, with about 2.8 million residents in the city and 4.3 million in the metropolitan region. Although the city of Taichung was first named during the Qing dynasty (1717–1895), it was no more than an agricultural settlement until the Japanese government purposely developed it to compete and eventually replace the administrative role of Changhua. The Japanese government sets up a grid street layout in the early 1910s (see Fig. 1). This became the foundation of urban development in Taichung city.

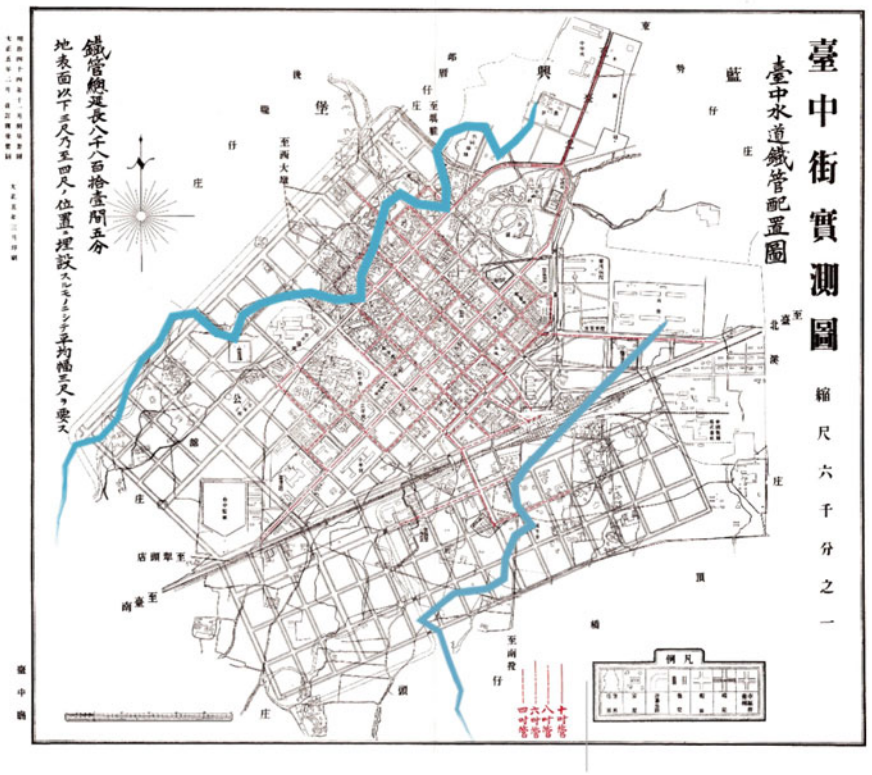

Fig. 1 Japanese government's grid plan of Taichung city. Two canals were shown in blue: The northern was Liuchuan, and the southern was Lyuchuan. Adopted from Academia Sinica (http://gissrv5.sinica.edu.tw/GoogleApp/JM20K1904_1.php)

Fig. 2 Images of Liuchuan (right) and Lyuchuan (left) in the Japanese colonial period. *Source* http://writingtaichung.blogspot.com/2017/01/1911-1970-197020042012-1224-shs-fb.html (right).)

During the Japanese colonial period, the city transformed from an agricultural settlement to a transportation hub. The Japanese government built the Taichung train station together with development of the western line of the railway system. They also formed Liuchuan and Lyuchuan as canals for logistical reasons. In Fig. 1, the northern blue line was Liuchuan, and the southern line was Lyuchuan. The area between the two canals was roughly the old city center of Taichung. Images of the canals are shown in Fig. 2. Taichung at that time was also the administrative center of central Taiwan. Government officials and their families often lived there. Cultural separation existed: The Japanese lived closer to Liuchuan, and the Taiwanese often stayed near Lyuchuan. The growth of the city continued. Commercial land use expanded and continually pushed agricultural land use to the periphery. The Kuomintang (KMT) government came and dominated Taiwan in the late 1940s. Around the late 1950s, the KMT government combined the Japanese-established neighborhoods in this area and named it the central district (Jhong Cyu in Chinese). This name continued and is used in this paper.

3.2 The Waterfront Projects: From Policymaking to Practices

Rapid growth caused the district to become overcrowded. Poorer quality of living brought population decrease—people came back only for business (Interview T3). The waterfront area was almost abandoned around the 1950s after it lost its logistic capacity and became no more than a part of the sewage system. Temporary housing occupied the waterfront. This area became problematic with drugs, violence, and urban poverty. The depressed atmosphere became most evident in the early 2010s when the Taichung City Hall relocated from the city center to a newer development district. Commercial activities shrank. Empty streets and closed shops became the new image of the city center.

This depressive city center in a sense explained why Mayor Jason Hu (from the KMT party), who had been the mayor of the city for over a decade, lost the mayoral election in 2014. The succeeding mayor, Lin Chia-Lung (from the DPP party), promised to "recover the past glory of the city center (Interviewee T3)." Mayor Lin emphasized the "urban acupuncture approach" (Interviewee T1, T3). Instead of providing large-scale public buildings, this approach provided opportunities to "heal the city center through small-scale boutiques, innovative shops, and localized business" (Interviewee T3). For example, the central district renovation station was established to investigate the values, especially the Japanese styles, of urban characteristics of the city center. Historic buildings were renovated to become hotels and shops. Activities in regard to cultural innovation grew in these years.

Waterfront projects were also initiated. Policymaking began with a clear intention to support urban redevelopment in terms of providing public spaces with green and blue infrastructure (Interviewee T5). However, it soon adopted the notion of resilience as a discourse to form a greater framework of collaboration (Interviewee T2, T5). The municipality took the lead among the others to proclaim the ambition of being a resilient city. It established the Taichung Low Carbon City Promotion Office as a leading entity to offer knowledge and information about resilient cities in coping with climate change and relevant issues. Their publication, "Resilient Taichung City Booklet (2016)" presented guidance on resilient actions through case studies across the globe. This provided greater understanding of resilience in two aspects: preparations to avoid resistance before the occurrence and performance in response and recovery after disturbances (Taichung city government 2016b).

Framing resilience in policymaking was also beneficial for collaboration across the levels of government. As mentioned earlier, Typhoon Morakot in 2009 was a watershed event transferring the focus of policymaking from resistance to resilience. In the mid-2010s, the national government too began to use the term resilience as a new fashionable word in policymaking. "Resilient Taichung City" indicated that the municipality had up-to-date concerns. This would result in better support in terms of knowledge exchange and practical implementation (Interviewee T2, T4).

At the local level, the original intention of the waterfront project, i.e., urban redevelopment, remained in spite of resilience in its title. The municipality presented the "Town-within-the-city" strategy that would stimulate urban redevelopment through tourism, green transportation, bottom-up economic renewal, cultural industry, and better quality of the environment (Taichung city government 2015)—Liuchuan and Lychuan were two hotspots of the implementation. According to the interview, the waterfront project was by itself "not only to water but also to create public space" that was very rare in the district (Interviewee T1).

The Water Resources Bureau (WRB) was responsible for making the riverfront "pleasant enough for visitors to come" (Interviewee T2). This included not only the engineering construction but also local communication with locally based activities and festivals—to "get support by the locals" (Interviewee T2). The Liuchuan waterfront reform project was accomplished first, in 2016. Unsurprisingly, it became a popular site for tourism and local recreation (Fig. 3). According to the interview, this happened "possibly because (the) city center was lacking for people spaces at

a time where there was a real thirst for places for public gathering" (Interviewee T6). Implementation of the project in Lyuchuan was completed later, in early 2017. In addition to waterfront renovation, the municipality, in collaboration with artists, helped Lynchuan become a brand. The WRB registered the Lynchuan logo, as shown in Fig. 4, with relevant products such as cakes, badges, and beers. Lectures and exhibitions at the nearby canal formed the cultural atmosphere and made the place more popular.

Fig. 3 Liuchuan in Christmas 2018. *Source* https://car0126.pixnet.net/blog/post/43852470

Fig. 4 Lyuchuan logo-branded products. Source: http://travel.taichung.gov.tw;

3.3 A Success in Practices?

There were positive and negative effects from implementation of the waterfront projects. At the city level, the projects provided public space with blue and green infrastructure. The environment was improved and became more pleasant for recreation. This encouraged recreational and leisure activities since there was never enough public space in the city center (Interview T6). The renovation also stimulated the housing market with rising prices for real estate (Interviewees T2, T3, T5). According to an interview, "housing prices rose about 10%–15% after the projects were accomplished" (Interviewee T2).

At the community level, results were conservative. The growth of the tourism economy mostly went to newly established hotels, antique shops, and hipster style restaurants. For the residents, it was nothing but crowdedness (Interviewee T3, T4). Some residents described their sense of exclusion in regard to the renewed landscape. According to them, "These lighted-up canals and public space were for the tourists but not us" (the residents) (Interviewee T3). Some of them felt disturbed due to the increase in tourists (Interviewee T1). For example, walking along the river was depressing because "the restaurants blew terrible smells directed to the back" (the riverside) (Interviewee T6).

Despite the disturbances, local residents remained positive in terms of the waterfront projects and the resulting economic growth. When Mayor Lin proclaimed: "to recover the past glory of the city center (Interviewee T3)," it rooted deeply in the residents. This directed their concerns about urban redevelopment (Interviewee T1, T5) and made them "accept and stay with the disturbances, as (they) used to live for decades" (Interviewee T3).

4 Analysis: Resilience in Planning

This section examines the evolution of resilience in the local case. The performance of planning, as well as the conformance, is both included in the following analysis.

4.1 The Performance: Discourse and Collaborative Framework

Discourse is essential in shaping collaboration. The local case presents a clear contribution to resilience, as discourse formed collaboration between policymakers at both the national and the local government. This particularly occurred among the water engineering sectors. The Water Resource Bureau of the municipality declared the necessity to implement the resilient waterfront projects—with the purpose of coping with climate change and extreme events. This persuaded the national authorities, such

as the Water Resources Planning Institute and the Water Resources Agency, Ministry of Economic Affairs (WRA, MOEA), to support implementation (Interviewee T2, T5).

However, this resilience-based framework of collaboration is neither seen in planning professions nor between actors of planning and water engineering. Cross-disciplinary collaboration remains absent in spite of a general understanding of the impossibility to form resilience by individual professions alone (Interviewee T2). In the local case, resilience is shaped mostly to environmental actions and has no direct relations to planning as tools for urban development (Interviewee T1).

The interpretation of resilience is also questionable. The local case fails to show clear evidence of resilience engaged in efforts to cope with climate change, as it is initially presented in policymaking. Urban redevelopment remains the primary focus in policymaking (Interviewee T2, T3, T5). The notion of resilience in this regard forms no more than an argument "to promote the growth of the city" (Interviewee T2). The misinterpretation indicates that flood risks are never a primary issue in this area.

4.2 The Conformance: Plans and Policies, Spatial Development

Both the divided framework of collaboration and the missing interpretation caused an absence of resilience in the conformance of planning. The resilient waterfront projects were mostly about urban redevelopment (Interviewee T1, T2). This echoed the mayor's proclamation to "save the city center" (Interviewee T3) even though the administrative parties presented a varying approach in practice. The KMT mayor preferred external investments for new shopping malls and recreational facilities, while the DPP was more interested in bottom-up, local culture-based commerce (Interviewee T1, T3).

From the local perspective, what exists in the city center today is public space and new commercial activities along the canals (Interviewee T3). This results in an increase in tourism and, gradually, reshapes the vitality of the city (Interviewee T3, T4). In addition to hipster shops, a growing number of NGOs have appeared and presented their primary focus on specific issues of the city center. For example, the Downtown Recreative Foundation (DRF) hosted a number of art activities as experiments to understand the potential of innovation-based local development. The Happen Social Design reclaimed the relationship between residents and the environment. Studio 1095 focused on immigrant workers in and around the area.

5 Conclusion: Tracing the Evolution of Resilience

This study examines the evolution of resilience in context of Taichung, Taiwan. The results primarily point out that discussion of resilience seldom reflects its original understanding in tackling issues of climate change—flooding is never the real focus. The city itself has no severe experiences of past floods (Interviewee T1, T2). Policymakers are confident in the current plan of flood protection along the periphery (Interviewee T2, T4). According to the interviews, "it would be a real disaster if we need to use the flood risk management facilities here" (Interviewee T2).

The terminology of resilience is actually used for urban redevelopment. This reflects the general desire to recover the city center from its economic downturn. However, the use of resilience as a terminology is also politically sensitive within the shared concern. Resilience in the local case was introduced by former mayor Lin. Since he lost the election, resilience is no longer addressed in policies and plans. The waterfront also "becomes dark and not suitable for public gathering anymore" (Interviewee T6). The current municipality is more interested in mega projects of investment and tends to minimize the accomplishments of the previous administration (Interviewee T2, T4).

"To revive the city center" remained the most important issue in policymaking. For both the municipality and the citizens of Taichung, the waterfront projects were about improving the quality of living in nearby neighborhoods (Taichung city government 2016a). In spite of some complaints, local residents were generally happy to have the new, walkable waterfront environment because "we can walk, chat, dance or just gather together along the river" (Interviewee T3). The increase in intensity of commercial activities also had a negative impact in the form of pollution, noise, and bad smells (Interviewee T6). This seemed to be "a necessary evil (Interviewee T3)." Local residents tolerate this situation, and the government remains part of the development (Interviewee T5).

Through this discussion, we conclude that it is difficult or may be impossible, for the notion of resilience to be taken out of context. The local case reveals why the path of resilience in policymaking is so narrow and easily replaceable. Resilient planning in practice is very much contextual, related to the particularities in a local context. Planning in this regard often remains passive until new challenges shock the ways of thinking.

Appendix: List of the Interviews

Interviewees	Affiliations	Dates of interview
T1	Professor	May 2019
T2	Government officials	May 2018; Dec. 2018; Aug. 2019

(continued)

(continued)

Interviewees	Affiliations	Dates of interview
T3	Former head of the district	Sept. 2018
T4	Consultant company representative	Nov. 2018; Jan. 2019
T5	Professor	Nov. 2018
T6	Local community representative	Jun. 2019

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A New Inner-Hanoi via Old Industrial Facilities: From Urban Renewal to Re-urbanization and Urban Regeneration

Minh Tung Tran, Phan Tien Hau, and Ngoc Huyen Chu

Abstract Urbanization in Vietnam is closely linked with administrative, spatial, economic, population, and welfare transitions. Along with the development of sprawl and the continuous peri-urban transformations creating new urban fringe belts, inner-Hanoi, with its radio-centric structure, is also witnessing significant conversion of old housing areas, industrial facilities, public facilities, and specific functional areas that can no longer meet the current needs of the city. In this chapter, we analyze the trends of several urbanization processes, such as "residentialization", urban renewal, regeneration, reurbanization, and gentrification in Hanoi by comparing specific elements in its developmental context as they relate to both the opportunities and values of these older industrial facilities. To that end, we offer a summary review of legislation and the legislative process involving urban renewal and land readjustment in Hanoi from the viewpoint of both the central and local government and consider ten typical projects for the conversion of old industrial facilities during the past ten years. Our research reveals a large gap between policy and practice and suggests that the time has come for Hanoi and other Vietnamese cities to initiate more sustainable and comprehensive development planning strategies instead of the current focus on individual urban renewal projects.

Keywords Hanoi · Spatial transformation · Urban renewal · Regeneration · Reurbanization · Residentialization · Post-socialist · Old industrial facilities · Industrial heritage · Densification · Compact city · Creative city · Privatization · Modernization · Industrialization

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1 Introduction

1.1 Situation and Background

Urbanization in Vietnam is closely linked to five transition factors: administration, space, economy, population, and welfare (World Bank 2011). The spatial transformation process of Hanoi stemmed from two simultaneous development processes: (i) sprawl development: the expansion of new urban areas through peri-urbanization; (ii) and redevelopment: the renewal of old urban areas in the inner city.

The modern urban history of Hanoi has undergone a series of phases (Tran 2016): feudalism before 1873, colonialism 1873–1954, socialism 1954–1986, and "openism" after 1986. That said, Hanoi remains a mono-centric city with a radio-concentric structure (like the spider in its web) (Fig. 1). The first expansion spread beyond the outer wall of the feudal citadel, a.k.a. the first belt. In the period 1954–1986, a series of new housing estates and factories were developed in peri-urban areas, and thus, the second belt took shape. After 1986, urbanization in Hanoi accelerated, like oil slicks, which formed the third and then the fourth, and fifth belts. Some areas were in the outskirts of the city during this period but turned into urban blocks later on due to rapid urbanization.

Since the start of the millennium, Hanoi has received significant investment in construction, redesign, and amenity development. The reason is that after nearly 60 years of modernization, facilities and physical spaces in Hanoi represented a decrease in the rationality and quality of use against the current context. Hanoi must tackle increasingly complex challenges through changes in policies and the institutional framework. The need for these changes is reflected in the increasingly essential transitions taking place in the inner city: conversions of old residential areas, industrial facilities, public facilities, and other specific functional spaces. Conversion of old industrial facilities is a significant concern, especially considering the process of residentializing brownfield areas within inner-Hanoi (Fig. 1) that were previously used for industry and where new housing can be built, as well as preservation and rehabilitation of recent heritage sites of socialist industrialization in 1954–1986.

1.2 Five Key Concepts

Hanoi, like other major cities, is facing challenges ranging from physical degradation and environmental risk management to issues related to heritage preservation, security, transport, health, and social inequalities (Barosio et al. 2016). This article revolves around consideration of five key concepts in context of Hanoi.

(1) Urban renewal, in relation to operations based on large-scale demolition or substitution of older buildings with new ones (usually completely different in

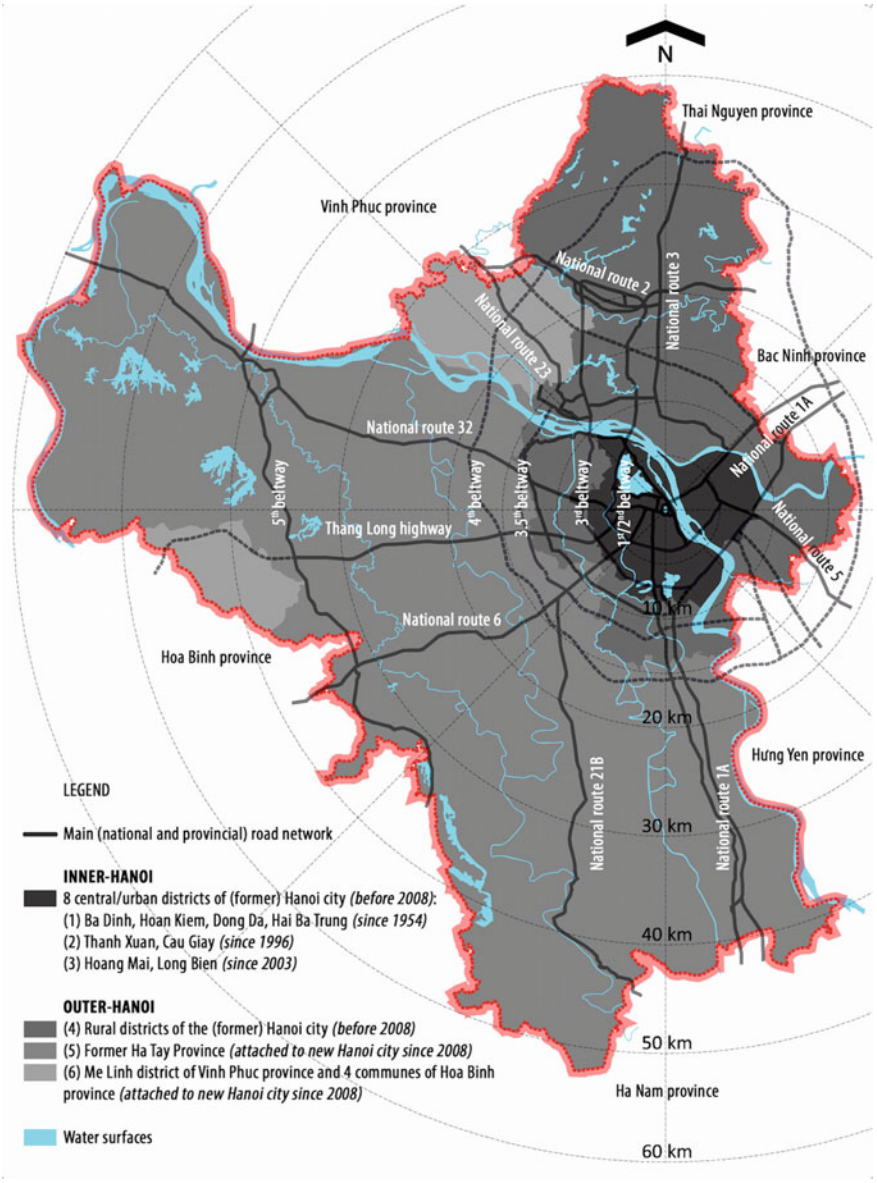

Fig. 1 Inner city in the radio-concentric structure of Hanoi (*Source* Authors)

shape or function), is defined as "the improvement and sometimes replacement of buildings in a city, especially of whole neighborhoods of housing". It is seen as a process involving "physical change, or change in the intensity of land use and buildings" resulting from the economic and social forces imposed on the urban areas (Couch 1990). Urban renewal does not simply involve brick and mortar but rather should be viewed as a process combining physical, social, and economic agendas (Priemus 2004). Different definitions are given by integrating the different dimensions: physical, social, cultural, economic, and environmental renewal (Onkar et al. 2008).

(2) Urban regeneration is widely recognized as a comprehensive and integrated vision and plan to solve multi-faceted problems of urban areas and to improve economic, physical, social, and environmental conditions of deprived areas (Barosio et al. 2016). It is a term ranging from large-scale activities that promote economic growth of a city to neighborhood interventions that improve quality of life. The UK government's view is that regeneration is a set of activities that reverses economic, social, and physical decline in areas where market forces will not do this without support from government (Department for Communities and Local Government 2008). More recently, urban regeneration processes have often aimed to counteract urban decay, in contrast to urban renewal, which is geared mainly toward fostering new urban development (Barosio et al. 2016). Some of the negative aspects of urban renewal become the conceptual basis for urban regeneration (Granger 2010).

(3) Reurbanization is the "process of optimizing economic, legal, social, built, and environmental conditions to provide vibrant living space within the urban core where individuals and households choose to live and which attracts investment" (Haase et al. 2003); described by the explanations of quantitative, qualitative, and normative concepts of demography, consumer preferences, economy, and policy (Brombac et al. 2014); and defined as the fourth stage (urbanization, suburbanization, dis-urbanization, reurbanization) of development (Berg et al. 1982). At the level of the entire city, reurbanization is understood as a process of relative or absolute population increase in the city, in comparison with its suburban zone and hinterland; at the neighborhood level, it is understood as a revival of the residential function of the inner city after a longer phase of decline by becoming populated and diversified by a variety of residential groups (Haase and Rink 2015). In a broad sense, reurbanization is more urban revitalization or local regeneration of an already urbanized environment. It is utilized in urban policy via planning tools that seek to limit commercialization and the de-population of inner-city areas and thus revitalize residential functions or even replace the original non-residential functions (Ourednicek et al. 2015).

(4) Residentialization appeared in France in the late 1990s in the social housing sector to designate new practices: It could literally be defined as the act of transforming a social housing (public housing in the U.S.) complex into a residence, and considered as a means of improving collective life, security, and social mix (Lelevrier and Guigou 2005). It has become a new means of envisioning "ways of living", with the aim of taking an approach diametrically opposed

to the functional model of the *grands ensembles* (large housing estates). The massive diffusion of this type of operation responds as much to a desire on the part of public authorities as to the calls of a portion of residents (Gosselin 2016). The introduction of more housing and therefore more residents within the city center can be defined as a process of residentialization, whereby housing replaces other land uses. The integration of residentialization within a city center with the regeneration policy was seen as enhancing the vitality and viability of city centers (Bromley et al. 2005).

(5) Gentrification, which, since 1964 has become a subject in its own right (Lees and Phillips 2018), results from a return-to-the-city movement (Marcuse 1985). It commonly occurs in urban areas where prior disinvestment in the urban infrastructure creates opportunities for redevelopment, as well as in those societies where a loss of manufacturing employment and an increase in service employment have led to expansion in the number of middle-class professionals with a disposition toward central city living and an associated rejection of suburbia (Slater 2011). There are four characteristics of gentrification: (1) it is predominantly state-led or at least state-enabled; (2) it can be newly-built and even modernist in style; (3) it goes from small scale to large scale and even to the mega scale; and (4) although displacement is still at the core of gentrification, it can play out quite differently (Lees 2019). Central to the debates of gentrification are the differential impacts on the incumbent and the new residents and the questions as to who bears the burden and who reaps the benefits of change (Zuk et al. 2017). Gentrification, which in post-socialist cities emerged as market forces began to transform these cities, was usually seen as different, or as the "other" to Anglo/Euro-American norms (Lees 2019).

1.3 Research Purpose and Methodology

The key concepts discussed above will be considered in the context of Hanoi's urban renewal, focusing on analyzing the process of converting old industrial facilities into affluent new residential areas, also on determining the nature and comment on the process of changing the spatial structure of inner-Hanoi considered "stabilized in terms of planning". First, we raised a question about the nature and manner of urban renewal through the rules and trends of converting old industrial facilities in inner-Hanoi, and also about the reasons and the land use process. Second, we asked, is this transformation, expressed by the increase and accumulation of newly selected residents, the manifestation of the reurbanization starting to take shape in Hanoi, and what is the difference between urbanization and reurbanization? Finally, we also asked whether these patterns are the first and essential signs of urban regeneration of Hanoi.

To this end, we have used the following research methods: (1) Literature review: This paper is based on document research aiming at gathering information on legal

frameworks and the status quo of urban renewal projects, identifying practical examples and a set of research questions; (2) Data collection and case studies: After obtaining information on the projects selected as case studies, we conducted field research to assess the gap between actual operation by project owners and government policies and desires; also, we simultaneously diagnosed and evaluated problems and issues; (3) Summary and comparison: Review was conducted to answer research questions by comparing the outputs with the initial hypotheses.

2 Urban Renewal Policy and Practice in Context of Old Industrial Facilities in Inner-Hanoi

2.1 Urban Renewal Framework for Old Industrial Facilities in Inner-Hanoi

The first projects involving old industrial land conversion in inner-Hanoi were often small in scale. Early examples include the Pullman Hotel, built in 1990 on land left by Dai La Brick Factory, and Vincom Center Ba Trieu, started in 2002 on the land where Tran Hung Dao Mechanical Factory was built in 1957 (Fig. 2). In 2003, the government issued a decision "to thoroughly handle establishments causing serious environmental pollution" (Prime Minister of Vietnam 2003). In view of this, Hanoi issued a decision to relocate out of the inner-city factories that failed to comply with the approved master plan or that were polluting the environment (People's Committee of Hanoi 2003), and stated post-relocation land use principles that prioritized development of public works over business, services, or other purposes. In 2009, Hanoi authorities proposed that the must-be-relocated units (1) would return the land and move to planned new industrial parks; (2) that they may act as investors to conduct transfer of land use; and (3) that they may engage in joint ventures with other investors to establish a new investment company. Those were the basis for the government to issue financial regulations on use of land gathered from old industrial facilities in 2010 (Prime Minister of Vietnam 2010). In that sense, both the central and the local governments have been using land conversion to enhance urban public utilities and improve amenities and environmental quality in existing residential areas around these old industrial facilities, also allowing businesses to convert their land to commercial and service purposes.

In 2012, the government identified five priority scenarios in Hanoi's urban renewal involving urban facilities (as per the Law on the Capital) (National Assembly of Vietnam 2012): (1) Old, degraded housing areas; (2) old industrial facilities; (3) hospitals; (4) higher education institutions and vocational education institutions; and (5) central agencies, public non-business units (Table 1). But in 2013, the government officially legalized the following terminologies (Government of Vietnam 2013): (1) An urban renewal project is a project of architectural works and socio-technical infrastructures based on existing works that have been demolished to comply with

Fig. 2 Two pioneering experimental urban renewal projects of Hanoi: the Pullman Hotel (left) and Vincom Center Ba Trieu (right) (*Source* Authors)

urban planning; (2) an urban upgrading/ reforming project means upgrading or reforming the façade or structures of existing urban areas but not changing more than 10% of the land-use norms. Thus, whereas urban renewal means changing the "contents" of an urban area through negation, demolition of all the existing elements to establish completely new one, urban upgrading or reforming means changing the "form" of an urban area that limits the "contents" intervention. Specifically, for Hanoi, an urban renewal area is seen as "a (re)development area, where new investment is built on the demolished constructions of the existing urban area, according to (the) city's planning, with scale of 2 ha or more" (People's Committee of Hanoi 2016).

In 2013, under the first scenario, Hanoi issued a resolution on measures to redevelop or rebuild old apartment buildings (People's Council of Hanoi 2013). Then, for

Table 1 Articles in the law on the capital 2012 related to urban renewal in Hanoi 2012

Article	Content
9th	In inner city, do not expand the area or increase the number of beds of the existing hospitals; do not build new industrial factories outside industrial parks or complexes, new higher education or vocational education institutions
15th	The land, after moving the industrial facilities, hospitals, higher and vocational education institutions, and central agencies, shall be reserved for the construction and development of public works and socio-technical infrastructures; it is prohibited to build high-rise apartment buildings contrary to the planning
16th	The old apartment buildings and houses shall be refurbished and reconstructed to ensure the urban scenery and users' safety. The refurbishment and reconstruction must comply with regulations on height, population, and construction density, according to the planning

(*Source* National Assembly of Vietnam)

Table 2 Construction works conditions for each type of urban renewal project 201620152014

Project types	Conditions
Both types	– Determining the boundary to implement the urban renewal project according to the provisions of law; making a detailed plan of 1/500 as a basis for controlling functions; controlling the population of high-rise buildings in the historic inner-city areas – Laying land for educational facilities and open space, increasing the area of urban greenery and public utilities such as gardens and parking spaces – Encouraging open space at the base floors of high-rise buildings in the urban renewal project, connecting with the regional space
1st type	Implement renewal in the direction of high-rise, low density; create more open space; limit regional population growth
2nd type	The height of the building is based on the maximum height allowed of high-rise buildings along the corresponding belt roads, radial streets, and main streets

(*Source* People's Committee of Hanoi, Government of Vietnam, National Assembly of Vietnam)

the remaining four scenarios, the prime minister issued Decision No.130/QD-TTg in 2015 to offer detailed guidelines on the solution and the schedule for relocation of the other urban facilities out of inner Hanoi and on use of land (Prime Minister of Vietnam 2015): (1) priority to be given to public socio-technical infrastructure in order to balance new demands; neither increase of urban wastes nor unplanned construction of high-rise tenement buildings was to be permitted; (2) open auctions to be utilized to gain re-investment finances for relocated enterprises; each location to be assessed to efficiently use land; and (3) buildings with historical, cultural, or architectural values to be conserved and restored as per the law on cultural heritage, prioritized for public purposes.

In 2016, Hanoi issued a set of Planning Management Rules for high-rise architectural structures in the historical urban area of Hanoi, which allowed construction of high-rise buildings in two types of urban renewal projects (People's Committee of Hanoi 2016): one on old apartment building areas with a scale of 2 ha or more; the other on land available after relocation under Decision No.130/QD-TTg, with a scale of 2 ha or more (Table 2).

2.2 Typical Urban Renewal Projects to Replace Old Industrial Facilities in Inner-Hanoi

From the list of the ten typical projects (Fig. 3 and Table 3), we have observed the following patterns:

(1) Old industrial facilities were mainly located inside the second belt, a dynamic development belt during 1954–1986, due to the industrialization policy that aimed to develop light or semi-heavy industrial facilities around the historic core area, closer in than the first belt that had formed before 1954. The land

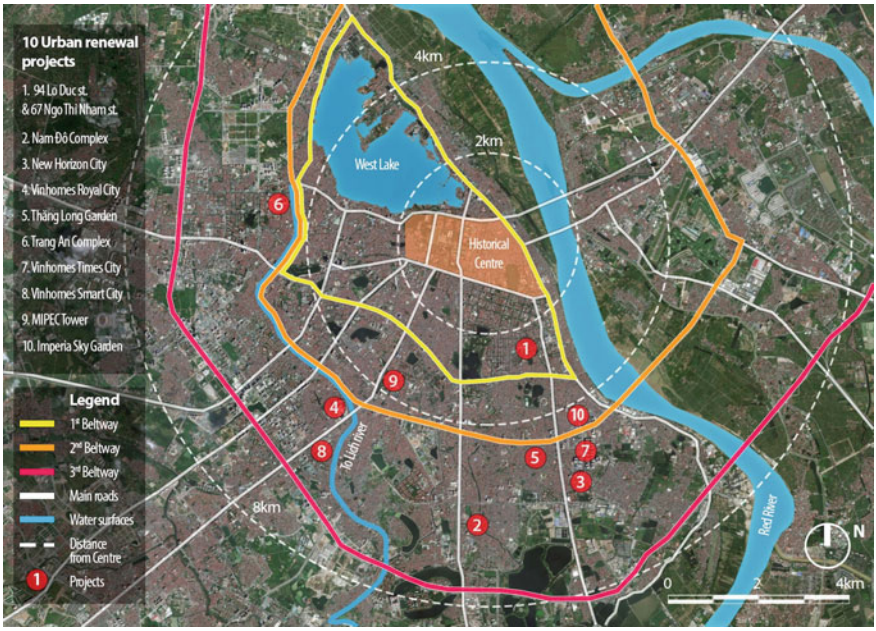

Fig. 3 Location of 10 typical conversion projects of old industrial facilities in Hanoi in the past 10 years (*Source* Authors)

plots are relatively convenient (being adjacent to at least one or more new major urban roads), and large (only two projects in an area less than 2 ha), being pooled from one or more old industrial facilities.

(2) The time window for renewal of eight of the ten projects that have been completed is short, mainly about 2–3 years. Few investors are joint venture entities. Otherwise, most projects are transferred to experienced real estate investors.

(3) Almost all projects are converted into housing, mainly high-rise apartment buildings. An insignificant number of projects are low-rise buildings. Depending on the scale, the project may integrate some public facilities such as offices for rent, commercial centers, schools, hospitals, etc., for this purpose.

(4) Upon conversion into housing, the apartment buildings have a density of about 300–400 dwelling units/ha (i.e., 1100–1500 people/ha). A few other projects have a density of 500–600 dwelling units/ha (i.e., 1800–2200 people/ha).

(5) With a minimum price of about 25–35 million VND/m^2 (i.e., 1100–1500 USD/m^2), the price for an apartment with a common area of 70–150 m^2 amounts to around VND 2–5 billion (i.e., USD 80,000–220,000). With this valuation, the projects aim to make commercial housing affordable for middle-class people. Concurrently, some projects directed to the upper classes go for prices as high as 50–60 million VND/m2 (i.e., 2200–2600 USD/m^2), which translates to around

Table 3 List of 10 typical conversion projects of old industrial facilities in Hanoi in the past 10 years

No	Project, address	Old function (year of use)	Area (ha)	New functions (after conversion)	Projects' status quo	
1	94 Lo Duc st., 67 Ngo Thi Nham st. (Hai Ba Trung Dist)	Liquor factory (1898), knitting factory (1959)	0.8	2 apartments and officetel buildings 33–35 floors (about 1,500 units)	2018–2019*	Transfer of land use
2	Nam Do Complex—609 Truong Dinh st. (Hoang Mai Dist)	Mechanical factory (1947)	2.6	2 apartment buildings 25–28 floors (about 800 units), 1 office building for rent and services 14 floors**, preschool	2010–2013	Transfer of land use
3	New Horizon City—87 Linh Nam st. (Hoang Mai Dist)	Beer factory (1966)	2.0	4 apartment buildings 17–30 floors (about 1,200 units)	2015–2017	Joint venture
4	Vinhomes Royal City—72 Nguyen Trai st. (Thanh Xuan Dist)	Mechanical factory (1958)	12.0	6 apartment buildings 35 floors (about 4500 units), complex of commercial centers (underground), schools	2010–2013	Transfer of land use
5	Thang Long Garden—250 Minh Khai st. (Hai Ba Trung Dist)	Garment factory (1958)	1.3	2 apartment buildings 19–25 floors (about 400 units), 1 office building 25 floors	2013–2014	Joint venture
6	Trang An Complex—1 Phung Chi Kien st. (Cau Giay Dist)	Cake–Jam–Candy factory (1964)	2.6	1 office building and commerce 14 floors, 2 apartment buildings 23 and 29 floors (about 900 units), 11 villas, 20 row-houses, preschool	2013–2017	Transfer of land use

(continued)

Table 3 (continued)

No	Project, address	Old function (year of use)	Area (ha)	New functions (after conversion)	Projects' status quo	
7	Vinhomes Times City–Park Hill–458 Minh Khai st. (Hai Ba Trung Dist)	Textile–Garment factory (1984)	36.0	23 apartment buildings 27–35 floors, 10 rows of townhouses (about 13,500 units), complex of commercial centers (underground), schools, hospitals, offices	2011–2017	Transfer of land use
8	Vinhomes Smart City (Cao–Xa–La)–233–235 Nguyen Trai st. (Thanh Xuan Dist)	Rubber–Soap–Tobacco factory (1957–1960)	11.0	8 apartment buildings, offices for rent 43–46 floors	Expected 2017***	Transfer of land use
9	MIPEC Tower—229 Tay Son st. (Dong Da Dist)	Mechanical factory (1960)	2.4	2 apartment buildings 27 floors (about 300 units), 1 office building, shopping mall 25 floors	2008–2010	Transfer of land use
10	Imperia Sky Garden—423 Minh Khai st. (Hai Ba Trung Dist)	Textile factory (1974)	3.8	4 apartment buildings 27 floors (about 1,900 units)	2016–2018	Transfer of land use

Notes *In 2013, the land area—94 Lo Duc was transformed into a school by Hai Ba Trung District authorities. In 2017, it was transferred to Tan Hoang Minh Group and changed to the new function as an apartment. So far, the project has not been started as planned

**Actually be converted into 30 villa plots

***After the commencement, so far, the works have not been built

(*Source* Authors)

VND 4–10 billion (i.e., USD 160,000–440,000) for an apartment, with relatively high prices for services, as well as for the "international" titles attached to schools, hospitals, etc. Table 3 offers details on the ten conversion projects.

3 Reviewing Miscellaneous '-Ization' and '-Fication' Strategies at Work in the Renewal, Reurbanization, and Regeneration of Inner-Hanoi

3.1 Renewal via Residentialization, Densification and Gentrification

Old industrial lands are often very convenient for residentialization. Enterprises holding the right to these "golden lands" know that they will be profitable, depending on the location, scale, and sensitivity of the land. The closer the land is to the center, the more favorable and valuable it becomes and the more it is targeted by the larger real estate enterprises. These enterprises must gentrify the projects, aiming to target customers in the middle and upper classes (i) in Hanoi in need of more convenient accommodation or more dwelling space, or (ii) in the adjoining provinces who want to immigrate to the city more easily through house ownership in favorable areas. This process of population changing is affected by increasing the standards, quality, and quantity of the dwelling units in order to ensure that the profit can offset the costs spent on land. On the other hand, living standard and population density in the renewal area are often much higher than the average of the surrounding areas and the city. The most obvious manifestation is the high density of high-rise buildings, considered "the Vietnamese version of compact cities". These residentialization projects in inner-Hanoi, with a limited number but very competitive advantages, have become an attractive commodity not only in use value but also in exchange value, consistent with judgments about the status and quality of housing in Hanoi (Hoang and Wakely 2000). The appearance of the new rich, along with valuable real estate, has brought the winds of change to inner-Hanoi in the form of the desirability of modern housing associated with high-end services. This shift can also be considered a successful renewal policy, thanks to turning brownfield areas into attractive residential land, creating a new threshold for desirable urban residential environment. This also raises a new question: whether a "new rich" community with different levels of living, placed alongside the existing urban communities, makes the city seriously fragmented and creates spatial, urban social rifts, and potential conflicts. (Fig. 4).

Fig. 4 Contrast between (traditional) low-rise houses in surrounding neighborhoods and modern 35-floor buildings in Vinhomes Royal City (*Source* Authors)

3.2 Reurbanization via (Re)localization of Central Lands and Privatization of Public Lands

In the period 1954–1986, as per its policy of restoring and promoting industrialization, a series of industrial enterprises was set up by the state. These enterprises became the "blue-eyed children" of the national economy and received priority investment from the country's resources, including urban lands. Large plots of land, located along main roads, were assigned to state-owned industrial enterprises. Though land use rights belonged to these industrial enterprises, the lands were in effect public estate, and the land was to be classified as central land (managed by central establishments of the government or ministries), or local land (managed by establishments under the municipality or provincial departments). As a result of having to share its land with central agencies, Hanoi was overloaded. Hanoi's urban renewal policies expressed the desire to overcome this problem though returning lands to the locality, creating opportunities and facilities to remake inner-Hanoi, and increasing a significant resource for the city through the localized lands. This transfer also supports the comment made in a World Bank report that since the 1990s, provinces in Vietnam have played a key role in the development process and autonomy, and in fact their role and resources, as compared to those of the central government, are increasingly expanded (World Bank 2011). This feature is essential in understanding the (re)urbanization process in Hanoi, especially after 2000, when localizing central land policies were promoted. In principle, the plots obtained would be received and used by the respective municipalities. However, in reality, the enterprises using these plots may reuse them for business and service purposes. Thus, there have been "smart" transfers from public use to private use by establishing new land use purposes according to the initiators of such enterprises. The emergence of real estate enterprises as the new landlords, through investment and use of public land for their commercial purposes, has shown the phenomenon of privatization, which seems to follow the general trend of Asian cities where historic urban centers represent compelling opportunities for public–private partnership investment projects that often multiply

many times over the development impact of each unit of government expenditure (Steinberg 2008). Thus, reurbanization of inner-Hanoi is expressed not only through a clear and conspicuous land-use conversion process such as urbanization, but also a delicate transfer of management and ownership of land due to the city's administrative specificity.

3.3 Regeneration via Modernization, Occidentalization and Re/De-Heritagization

Vietnam promotes the Marxist-Leninist philosophy in which the law of negativity is considered necessary. Negation, or the replacement of old things with new things, is the premise, condition, and motivation for development in Vietnam. Therefore, Vietnamese cities attach much importance to replacement associated with urban growth and development, as manifested in the demolition of old buildings and reconstruction of new, more modern, and more occidentalized ones in order to establish a different generation of architecture.

The more material replacement an urban area has, the more dynamic it is considered to be, which brings confidence and expectation of a new modern life, not only to the government but also to the people. In the period 1954–1986, when North Vietnam was fascinated with industrialization and modernization of the country, there were times when people overlooked historical values of traditional architecture because of the perception that such architecture was associated with backward images, hindering the image of the new socialist city. Since the 1990s, when the achievements of economic reforms were evident in urban life, modernization was reemphasized in line with importation of occidental cultural values and viewpoints as entailed by globalization. Also, the economic market put architectural heritage at risk of being once again demolished, this time for land with more economic value. The old industrial facilities in inner-Hanoi were witnesses of the city's early industrialization era and its idea of modernization with diminishing values of heritage (Mason 2008; Sjoholm 2016). The central government itself identified the risk faced by these facilities, acknowledging that they would be threatened in the process of urban renewal (Prime Minister of Vietnam 2015). However, without sturdy legal binding, this concern was outweighed by consideration of the real estate economic values. The common scenario for all renewal projects is to (re)start from scratch, which is more convenient for transplanting new modern architectures. Retaining old architecture will hinder the tendency to increase the density, building height, and floor-area ratio in the renewed plots. Now, in inner-Hanoi, more and more high-rise buildings are coming to the scene with modernized and occidentalized architecture (Fig. 5) that provides few clues for the people to imagine the region's history or to visualize the city's evolution over time and space. The city is getting more and more negation and losing its past: a particular way of regenerating for the future rather than promoting existing foundational values for development.

Fig. 5 Vinhomes Times City project: the changing skyline of Hanoi due to urban renewal (*Source* Authors)

4 Conclusion: (Re)making Hanoi on Hanoi

It is time for Hanoi to pay attention to the inherent needs of urban renewal and regeneration for planning and development of the city and the city-region: (re)making the city on the city (according to *faire la ville sur la ville* idea of Grumbach (1998)). The current urban environment has the potential for reusing and restructuring the inner-city landscapes. However, the urban renewal projects are characterized by a big gap between policy and practice, as exemplified by the appearance of a new high-rise building belt in inner-Hanoi to replace the old industrial belt. Reurbanization and residentialization, expressed through the conversion of urban non-residential land to residential land, filled and destroyed the porous space in the inner city, exacerbating existing socioeconomic and spatial problems they were intended to ameliorate. Urban transformations require not only local initiatives and planning but also deployment of social and economic tools and regeneration principles to redevelop distressed areas or deprived neighborhoods. What has taken place in recent years in inner-Hanoi has been renewal rather than regeneration, given its physical rather than economic or social nature, its exclusive design, and its limited impact on addressing existing needs.

Though reurbanization with gentrification has been going on for more than ten years in inner-Hanoi, it is still in the beginning and spontaneous stage, not based on theoretical or practical principles of (re)organizing urban space. This problem leads to discretion in implementation that corresponds to the different projects of different

developers due to the lack of, on the one hand, a specific urban regulation on the reuse of old industrial facilities in Hanoi and on the other hand, an appropriate way of dealing with industrial heritage in urban areas based on accurate recognition and objective assessment of its material and immaterial values. Even if those heritage values are not convincing enough to be kept, the government has not set out specific principles for residentialization. In other words, instead of controlling the general direction to harmonize the interests of different actors, city government is letting the private sector propose appropriate solutions for each project case according to their desires, which can lead to irrationality in the general urban context. This issue also confuses experts and managers because of not knowing how to comment when it is impossible to achieve a win–win for all actors. In other words, the acceptance of one's interests sacrifices the interests of the others.

The time has come for Hanoi and other Vietnamese cities to start thinking about initiating more sustainable and comprehensive development planning strategies instead of focusing on individual urban renewal projects. Since officially becoming UNESCO's Creative Cities Network in 2019, Creative Cities has become one of the bases for Hanoi's new development plans and strategies. With the orientation of urban regeneration and development on a cultural basis, the government has shown a thorough approach to industrial heritage through various creative spaces contests, emphasizing the systematic transformation. Is it the beginning of actual (new) urban regeneration in the inner-city of Hanoi?

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Local Government Decision-Making and Public Participation in District 8, Ho Chi Minh City: Do We Know What Works?

Ha Minh Tri, Tran Hoang Nam, Nguyen Mai Trung, and Le Dinh Minh Tri

Abstract Public participation is a core component of democratic governance. The Government of Vietnam has encouraged and promoted public participation, especially at local levels to enhance the government's transparency and accountability. Common issues that required public participation in District 8 include environmental cleaning, clearance, resettlement and compensation, construction of new public works, and development planning. This chapter reviews the degree to which local citizens are involved in local government decisions in District 8 of Ho Chi Minh City, Vietnam. The study conducted for this chapter used a questionnaire-based survey to collect data from local citizens participating in their local government decision-making processes. Data were collected from a sample of 640 local citizens across 16 wards in District 8 using a convenience sampling method. The survey also examined the perceptions of citizens about these initiatives, and the expectations of greater empowerment for citizens. The key findings indicate that citizens most desire to be involved in local government decision-making through participation from individuals, small groups, and large scale community organizations. Increased public participation was also found to benefit city planning, create an informed community consensus, and lead to committed community development.

Keywords Decision-making · Ho Chi Minh City · Local government · Public participation · Vietnam

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1 Introduction

Public participation is "the process by which public concerns, needs, and values are incorporated into governmental and corporate decision making" (Creighton 2005). Public participation has been recognized for quite a long time to be critical in local government planning and decision-making for a variety of reasons (Arnstein 1969; Tri and Thuy 2021; King et al. 1998; Yang and Pandey 2011). Not only does public participation lend a sense of democratic legitimacy to local government, but it also combines the skills, knowledge, and experience of the public to formulate better ideas and make more informed decisions. In the context of planning and local democracy, government accountability can be enhanced and trust in the government can be improved via public participation (Fakolade and Coblentz 1981; Wang and Wan Wart 2007; Yang and Pandey 2011). More importantly, public priorities can be addressed (Nabatchi 2012) and the effectiveness of public policy-making can be improved (King et al. 1998). It is sensible for the government to know what the public wants and needs as it tries to ensure that public expectations or interests are met and taken into account when decisions are being made (King et al. 1998; Michels and De Graaf 2010; Van Speier 2009).

Participation is crucial for legitimacy, as it is fundamental to the democratic process. Participation also promotes decision-making by engaging a wide range of participants and providing a more holistic approach to social issues (Wang and Wan Wart 2007). Many government decisions can be better informed, and their information base can be more credible if the interested and affected parties are appropriately and effectively involved (Stern and Fineberg 2003).

However, public participation hardly achieves its target, for example, in attracting citizen commitments and responsibility for dealing with public issues, especially in contemporary societies (Lando 1999). The challenge to achieving this target can be traced to the inefficiency of participatory practices. Interests in public participation research have increased over time in different domains, including (1) law-making (Gillespie 2008), (2) culture and tourism (Lask and Herold 2004), (3) marine reserve management (Tran et al. 2012), and (4) citizen participation in city governance (Hòa and Garcia-Zamor 2017; Kwak 2019; Nguyen et al. 2015). Despite an increased interest in enhancing public participation, additional research is needed, especially in the realm of local government decision-making that improves the ability of local government to work effectively.

Along similar lines, the Government of Vietnam has constantly sought to improve governance, including the implementation of increased public participation, as it is considered to be a critical component for sustainable development in Vietnam (UNDP 2012; WB 2010, 2012). Promoting authentic public participation, however, is not an easy task (Baiocchi 2003; Handley and Howell-Moroney 2010). On the one hand, one of the major barriers to authentic participation is the negative attitude that many government officials have toward public participation (Nguyen et al. 2015). Officials fear that public participation could increase conflict in the political system, increase problems with government policy-making (Yang 2005), and decrease governmental

effectiveness. Other issues include officials' unwillingness to share power (Yang and Callahan 2007), the lack of resources, and overwhelming responsibilities (Nguyen et al. 2015).

On the other hand, barriers for substantive participation come from citizens as well (Nguyen et al. 2015). Lack of competence, skills, expertise, and commitment are commonly cited reasons for limiting public participation in government decision-making. Repeat/frequent participants often try to promote their own agendas, and therefore, are not necessarily representative of the entire community (Mahjabeen et al. 2009; Yang 2005; Yang and Callahan 2007). This study set out to explore what works in the context of public participation in local government decision-making in District 8, a district with the high speed urbanization of Ho Chi Minh City (HCMC).

1.1 Overview of District 8

District 8 is comprised of 16 wards and houses over 400,000 citizens. It encompasses an area of 1917 ha, with 45 km of canals dividing the area into islands. District 8 has a special location, sandwiched between the so-called old town (including districts 5 and 6) and "new town" called South Saigon[1] (including district 7), driven by speedy urbanization, economic growth, and transport development.

Before 1975, the suburban area of Saigon-China town was a main storage area of warehouses and yards for transiting foods and foodstuffs from the southwestern region to the inner city. Most of the population is poor and working, mainly practicing knitting, and loading and unloading in warehouses and yards. Although located near the center of Saigon and China town, District 8 is isolated by two large canals, namely Tau Hu and Kenh Doi. This has limited road traffic, affecting the urbanization speed of the District. Infrastructure investment in the previous years was at a low rate. The road traffic system remains temporarily patchy. Other technical infrastructure systems such as water supply, electricity, drainage, post and telecommunications networks, etc., remain at a low and incomplete level (Fig. 1).

In general, District 8 citizens are characterized as suffering economic hardship and having a low level of educational attainment. On the one hand, District 8 citizens pay attention to real life issues such as planning, clearance, flood control, resettlement, and compensation. However, their participation rate is somehow limited due to economic hardship that have left them struggling, without a full understanding of law or access to information. While the rapid rate of urbanization in District 8 requires common agreement from the local citizens, the government, and other stakeholders, district and ward officials have limited time, resources, social skills, and expertise to properly facilitate authentic public participation and achieve effective decision-making. There seems to be the consensus that cities in Vietnam have grown faster than their governance capacity (Quertamp and de Miras 2012).

[1] Saigon is renamed Ho Chi Minh City after reunion in 1975.

Fig. 1 District 8 and its iconic Y bridge (*Source* I Tour Vietnam [https://www.itourvn.com])

2 Rationale for Public Participation

Public participation is characterized as involving citizens in administrative functions and decision-making, accomplished by the use of various processes or structures and engagement in decision-making in different functional areas (Tri and Thuy 2021; Renn et al. 1993). Such processes are likely to include public hearings, citizens' committees, citizen focus groups, community meetings, and trade chamber meetings (Carson 2008).

Specific functional areas will include services usually provided by the government, such as public safety, transport, urban planning, socio-economic development planning, and budgeting. Public participation takes shape through decision-making processes such as setting goals, defining objectives, monitoring, and evaluation. Involvement in decision-making is often seen as a measure of "authentic" involvement or the scope of individual participation (Sanoff 2000).

The goal of participatory activities is to involve local citizens in the process of decision-making. Public participation is the mechanism by which socio-economic decision-making combines the public's interests, desires, and values. It is a two-way communication and interaction with the overall objective of better public-supported decisions (Creighton 2005). For example, the Government of Vietnam has recognized the need for local involvement and emphasized the role of public participation in socio-economic development planning (SEDP) and urban planning for development solutions (NAV 2007). As ward governments are not autonomous, it is therefore important to consider how they are influenced by changes in national policies and programs.

Public participation may be direct or indirect involvement in formulating and evaluating organizational priorities, SEDP and urban planning, quality of service, administrative policies, and overall results. In order to participate, citizens must first

feel confident that they can do so. Are they aware of all relevant processes and capable of doing what is needed to participate? For example, do citizens believe that they have adequate information and understand the basic issue to be addressed, find the public hearing, and make appropriate comments? Next, citizens must think that they have a chance of success. This means that if they make comments at a public hearing, they feel that their comments are likely to be considered. Finally, citizens must value the reward. That is, citizens are unlikely to spend their time participating in local government unless achieving success provides them with a major individual or communal benefit (Wang and Wan Wart 2007). The next section discusses the methodology.

3 Methodology

This study was conducted in District 8, HCMC. The study adopted a cross-sectional survey design (Trochim and Donnelly 2001). Data were collected using a survey questionnaire which was adopted from the Office of the Deputy Prime Minister, England (ODPM 2002). This instrument particularly measures the practice of public participation combining variables of public participation initiatives, purpose of community involvement, implementation problems, and benefits of the initiatives; and we found this instrument appropriate to our context. ODPM surveyed local authorities whereas our survey is aimed at citizens (Manaf et al. 2016; ODPM 2002). Responses were coded on a two-point scale as yes and no. Convenience sampling was used, and the sample size was 640 participants spread over 16 wards in District 8. Each ward received 40 questionnaires.

The survey questionnaire was piloted with a small group ($n = 10$) before data collection (Ha 2022). The aim of this pilot test was to evaluate whether survey questions were properly designed with respect to sentence length, wording, phrasing, or special terms (Colton and Covert 2015), thereby establishing the construct validity of the instrument (Shadish et al. 2002). The survey questionnaires were distributed in person to 640 citizens at their homes between August and September 2019, and the research team received 524 responses corresponding to an 81.9% response rate. This high response rate reduced the likelihood of response bias (Colton and Covert 2015). Respondents were local citizens in District 8. Residential group leaders assisted in data collection.

4 Findings

The survey compiled data to map different views of citizens on public participation. Three primary headings were provided, including (1) Reasons for involvement, (2) Type of involvement, and (3) Benefits and costs of involvement. The following tables present the extent and type of public participation.

4.1 Reasons for Involvement

Table 1 shows the results of the citizens' willingness to engage in public participation. It showed that most citizens believed participation offered input ($n = 211$) and helped to resolve problems ($n = 184$). It meant public participation could transform citizens' views on issues and services impacting local governments. Each ward government was required to allow the public to express its opinions on local government programs, and yet few ($n = 109$) thought that participation was about meeting legal requirements. Likewise, there was relatively little involvement of the local citizens ($n = 107$) and increased awareness of the substantial local community engagement ($n = 125$).

As presented in Table 2, lack of time was the main issue keeping citizens from getting involved in various activities promoted by the ward government ($n = 229$). These activities included environmental cleaning, picking up trash in public places and canals, and proper waste disposal. As a limiting factor in public participation, this is consistent with other studies on time (King et al. 1998). Lack of participation by other community members also led citizens to opt out of active participation. Resource constraints were a concern as well ($n = 117$). Other factors did not seem daunting, however, apart from the lack of time.

Table 1 What purpose do you think participation serves?

Purpose of involvement	Yes		No	
	Frequency	%	Frequency	%
Meet the provisions of the law	109	20.9	415	79.1
Identifying the best problem-solving strategy	184	35.9	340	64.1
Give/receive feedback from citizens	211	40.3	313	59.7
Increasing awareness of the needs of local community involvement	125	23.8	399	76.2
To get the best results in an issue	109	20.9	415	79.1
Develop and empower local communities	107	20.4	417	79.6

(*Source* Authors, 2020)

Table 2 What are the main problems limiting you from greater involvement?

Problem of involvement	Yes		No	
	Frequency	%	Frequency	%
Lack of support from government officials	89	17.0	435	83.0
Lack of involvement of local citizens	173	33.0	491	67.0
Lack of resources (e.g., financial, labor, equipment)	117	22.3	407	77.7
Lack of time	229	43.7	295	56.3

(*Source* Authors, 2020)

Table 3 Reasons for not getting involved with the community

Not want to get involved	Yes		No	
	Frequency	%	Frequency	%
Issues required immediate decision	69	13.1	455	86.9
Issues that are difficult to achieve in the community	81	15.5	443	84.5
Raise the issue of fear/outrage	71	13.6	453	86.4

(*Source* Authors, 2020)

Table 3 reflects the views of the respondents on some topics that may prevent them from communicating with their local authorities. The results appeared to indicate that none of the factors were too big of a deterrent, confirming the findings from Table 2.

4.2 The Types of Involvement

Table 4 shows that local citizens make use of traditional participation types, including personal involvement ($n = 198$) and group involvement ($n = 195$). Personal involvement included taking a survey every time the ward governments introduced a new public work, providing comments on community agendas, or planting flowers (e.g., moss rose) in front of houses to beautify the scenery. Group involvement included environmental cleaning on public places such as parks, garbage pick-up, providing reflections on SEDP reports, or participating in monthly community meetings. Fewer citizens were involved with mass organizations in activities, for example, blood donation, youth summer activities, or regular health checking for women. Women's Union and Youth Union are active mass organizations in District 8. Local citizens seemed to agree, as indicated in Table 4, that they primarily dealt with ward governments through personal, group, and mass organization involvement rather than through social media. Some citizens took part in meetings both for personal reasons, i.e., economic motivations, public interests, and the good of their larger community, i.e., urban planning initiatives and comments on SEDP reports. In general, local citizens were more interested in the issues that mattered most to them personally (Fig. 2).

Table 4 The types of involvement by local citizens

The types of involvement by local people	Yes		No	
	Frequency	%	Frequency	%
Personal involvement	198	37.8	326	62.2
Group involvement	195	37.2	323	62.8
Mass organization involvement	106	20.2	418	79.8
Social media (e.g., Facebook, Twitter, blog, email)	0	0	524	100

(*Source* Authors, 2020)

Fig. 2 Participation in environmental cleaning of a public place in district 8 (*Source* Authors, 2020)

4.3 Benefits and Costs of Involvement

The principal advantage achieved by these services was public awareness ($n = 206$) based on the survey (see Table 5). This resulted from the involvement of ward government initiatives that helped citizens to understand local government problems and improve their knowledge and experience. Planning improvements were perceived to be of less interest ($n = 143$).

Table 6 shows the opinions of residents on the local government's unintended impact. There were some concerns that public participation would raise community expectations ($n = 119$), slow decision-making ($n = 79$), lead to dominance by one large or dominant group ($n = 89$), and lead to too many public complaints ($n = 84$). Such concerns are consistent with other inquiries (e.g., Lowndes et al. 2001a).

Table 7 reflects the understanding of the effect of public involvement on the local government's final decision. The survey found that many respondents ($n = 183$) accepted that the public had no direct influence or little influence ($n = 191$) and that local governments made the final decisions. More significantly, a significant minority ($n = 99$) of respondents thought that involvement could have a substantial impact

Table 5 What are the benefits of greater engagement?

Involvement initiatives	Yes		No	
	Frequency	%	Frequency	%
Improvement of planning	143	27.2	381	72.8
Achievement of community consensus and commitment	206	39.3	318	60.7
Increase community awareness	206	39.3	318	60.7
To enhance community development	150	28.6	374	71.4

(*Source* Authors, 2020)

Table 6 How harmful can community engagement efforts be to local government?

Involvement that can be harmful	Yes		No	
	Frequency	%	Frequency	%
Slow the decision-making	79	15.1	445	84.9
Increase the level of community expectations	119	22.8	405	77.2
The addition of workload	74	14.1	450	85.9
Large group/dominant control over small community voice	89	16.9	435	83.1
Increasing conflict of interest in the community	59	11.2	465	88.8
Too many public complaints	84	16.0	440	84.0

(*Source* Authors, 2020)

Table 7 Impact of community participation on decision-making

Impact on decision-making	Yes		No	
	Frequency	%	Frequency	%
No direct influence	183	35.0	341	65.0
Little influence	191	36.4	333	63.6
Less influence	135	25.7	389	74.3
Greatly influence	99	18.9	425	81.2

(*Source* Authors, 2020)

on local governments' decision-making process. This is, however, contrary to the ODPM report, which found that 70% of local governments claim that participation measures are "always" or "fairly" effective in the final decision-making process (Fig. 3).

5 Discussion

This study explores the level of involvement of local citizens in planning decisions made by their local governments. The findings reinforce the idea that citizens need to communicate with their local governments and not only as service consumers (see Tri and Son 2021; Tri and Thuy 2021; Lowndes et al. 2001a, b). The results show that the approaches for actively engaging the public have been effective in many ways, ranging from raising awareness, to collective decision-making, to community development (Arnstein 1969; Connor 1988). The results clearly suggest that conventional forms of participation, such as social, collective, and community association, are widely used by the community. Such involvement aims to provide feedback and define problem-solving. Meanwhile, the reasons given for low participation in decision-making point to a lack of time. The important benefits of this involvement

Fig. 3 Reflections on SEDP report in ward 10, district 8 (*Source* Authors, 2020)

are an understanding of the environment and better decision-making. Nonetheless, too much intervention appears unwelcome for local government where it will raise expectations of the public and delay decision-making. Therefore, respondents believe that public involvement does not directly affect or influence the final decision of the local government, which is in line with other research (Michels and De Graaf 2010, 2017).

Though citizens have rights as articulated by the Ordinance on Exercise of Democracy in Communes, Wards and Townships (NAV 2007), they also have duties. They must take responsibility for ensuring the effective operations of local government. They must respect the rights of local governments with regard to other communities, comply with by-laws, and collaborate with officials who carry out their legitimate roles. Ultimately, public participation has the power to influence communities by empowering local citizens in local government decision-making processes. Nonetheless, as indicated in Table 1, it is not perceived as being particularly critical as a purpose of involvement to develop and empower local communities. At the same time, most respondents do not want to involve themselves in the local issues. As regards public participation, local governments regularly use community meetings with local citizens as one of the key communication channels.

Overall, the results clearly demonstrate that citizens believe they have the right to contribute to the decision-making processes of the local government. It is also the case that citizens are more likely to be aware of the importance of participation in local government activities. Common to all was a desire to strengthen the interaction and relationship between the local government and the public in order to make

the government more accountable and responsive to local needs. It is the authentic involvement, and not symbolic involvement from the public to generate improved governmental decision-making that directly affects the citizens' lives. This means that participation can allow the local governments to properly allocate resources and provide services where they are needed most, and that they can be tailored to local needs. In addition, such participation increases the probability that citizens are more committed, responsible, and accepted to the government's policies and decisions, which in turn saves cost and time (Lundberg and Hysing 2016; Ngo et al. 2019; Nguyen et al. 2015). Thus, participation is a key element as an effective instrument or mechanism for promoting decision-making. It is also a tool for reaching shared consensus and decisions which are commonly accepted by the citizens.

In line with previous research (e.g., Son 2021; Tri and Thuy 2021; Manaf et al. 2016), our results suggest that it is essential to note that not always does public participation lead to all agreeing on the decision. The aim of public participation is to allow the public to express their views, and the government to consider them when making the decision. Often the authority needs to make a decision which is in the broader community's interest but which may be controversial with certain members of the local community. Local governments play a critical role in providing information, facilitating public participation, and meeting citizen needs.

6 Concluding Remarks

While a positive relationship exists between public participation and an effective, efficient, and legitimate government, it is essential to interpret this claim with caution. At the same time, there has been a trade-off between process effectiveness and public participation. The government always aims for the motto "government of the people, for the people, and by the people." Thorough understanding of what works in local government decision-making can be useful for local governments to improve their work, satisfy citizen needs, and therefore, enhance transparency and accountability. The main findings show that participation by individual, group, and mass organization but not by social media are the common forms of participation that local citizens desire to be involved in local government decision-making. Greater public participation also brings benefits in terms of improved planning, community consensus, and commitment, and community development. The findings also imply that there is room for enhancing of public participation in District 8, HCMC as regards decision-making by local government.

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Agricultural Transformation Towards Urbanization: A Study of the Peri-Urban Area in Da Lat City, Vietnam

Dieu Nguyen Thi Minh

Abstract Some cities in developing countries are currently experiencing a maelstrom of rapid, uncontrolled urban sprawl. While some of the peri-urban regions are transition zones between urban areas and natural forest areas, most of them comprise farm areas with various agricultural activities. The geographical characteristics of peri-urban areas, including the availability of vast agricultural land, have advantages for sustainable development, mainly when incremental increases in conservation are considered the key to sustainability. The transformation of agriculture, based on land conversion, and the shift in profitability, can become a significant issue in sustainable development discourse. Conversion of prime agricultural land into other forms and strong investment in commercial activities bring about changes in community perception. Based on evidence from the local community, this chapter aims to address the issue of the transformation of land and agricultural activities. The chapter also defines how all of the transformations contribute to and are affected by the urbanization process. Research is conducted in Da Lat city, where the government promotes the implementation of "city in the forest, forest in the city" and high-quality tourism. After reviewing the urbanization process from the perspectives of planning policies, the chapter briefly outlines some of the unique features of agricultural development. It also reflects the perceptions of selected key local stakeholders that emerged through interviews and questionnaires. By looking into a local community with real involvement in this transformation process, the study is expected to offer some requirements for possible planning approaches with an eye toward sustainable development.

Keywords Agricultural transformation · Urbanization · Land conversion · Agritourism · Conservation

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1 Introduction

The pressure of land demand and economic re-distribution from the fast growth of urbanization leads to gaps between areas. The peri-urban areas of a city are engaged in agriculture activities, while the center focuses on services or tourism sectors. Generally, economic, social, and cultural transformations determine the connection between these areas (Tacoli 2003). In the context of industrialization and rapid urbanization of Vietnam, the majority of land in peri-urban areas has been converted for residential and commercial uses. Besides, the economic contribution of the agricultural sector to GPD rates is shrinking, and their role gradually declined by just 3% in 2019, according to national statistics. Da Lat city also faces the same situation. The land, social changes, and environmental degradation caused by the urbanization process are inevitable. Suffering a high rate of urbanization, 52% (Vietnamese Prime Minister 2014), Da Lat city, according to the Ministry of Agriculture and Rural Development report in June 2019, has lost over 50% percent of its total agricultural land and forest land within the last ten years. As a result, this transformation brings both positive and negative impacts on the peri-urban area. No doubt that rapid urbanization has created new markets for agricultural production so that their economic value aligns positively with higher productivity. Consequently, the income for farmers is also upgraded due to technology services development.

On the other hand, land conversion is considered the most urgent issue. Land plots of agriculture and forest have been converted into artificial land for human resettlement. Peri-urban areas also face an increase in greenhouses that destroy the natural and cultural landscape. The government of Da Lat city has tried to save the agricultural land and the forest by reorienting according to their branding slogan, "City in the Forest, Forest in the city." As a tourism city, Da Lat city is oriented to prioritize ecotourism (Vietnamese Prime Minister 2014). The rise in agritourism has enabled farming households to participate in the urban economy from their own farmlands. This new trend is less harmful to the local landscape and, at the same time, can upgrade the living standards for local farmers.

The objective of this study is to emphasize the way that urbanization affects agriculture in terms of land loss and economic transformation. After that, the appropriate solution, from the closer look taken in the specific peri-urban area, will be discussed. The first objective is to describe the characteristics of agricultural transformation in the peri-urban area. This provides a foundational understanding of the role and function of peri-urban areas in the city center, covering economic, socio-cultural, and environmental sectors. Secondly, the potential for, as well as issues related to land cover and economic improvement of agricultural transformation, are identified. Knowledge about local life and the benefits from agritourism investment are also examined and described. Socio-economic statistical data and policies from the government, public information, and community confirmation are used as evidence for the loss of agricultural land. Government data provides the trend of land use without showing spatial detail patterns, so mapped urbanization-related agricultural land loss is used instead. Following that, models of and criteria for agritourism are

considered together to explore further implications. Agritourism done intentionally has the potential to reduce the impacts of agricultural land conversion and preserve current landscapes.

The spatial change focuses on the characteristic of the study area through land covering and economic terms. The evidence is collected from key stakeholders, including farmers, local people, and suppliers. Their ideas about the potentials and obstacles for agricultural investment and their expectations are highlighted. Different stakeholders also suggest the requirements of tourism integration and appropriate ways to use agricultural resources.

This study is organized into six sections. The chapter outline is mentioned in the first section, the second section describes the study area, the methodology is laid out in Sect. 3, and the main research findings are summarized in Sect. 4. Suggestions and recommendations are in the final sections.

2 Study Area

2.1 Location

Da Lat city is an agricultural and tourism city (Vietnamese Prime Minister 2014). Ward 7 is in the North Valley and is located 8 km from the city center. This peri-urban area captures natural and cultural values, and has the typical agricultural landscape of a city. Human interactions in this area mainly occur during agricultural activities (Fig. 1).

The focus area for research includes the gate between the city center and the peri-urban areas of the North Valley, which is planned in the city's vision to function as a high-tech agriculture area (Figs. 2 and 3).

The study area has a special connection with surrounding areas (Fig. 4).

2.2 General Overview of the Study Area

The agricultural transformation is vital to the community because of its impacts on area forming and gentrification. Local resources benefit the local community and provide ecological values and cultural values during different periods. According to the master plan of Ernest Hebrard, since 1923 (Fig. 5), the north valley of Da Lat city occupied a system of open space and agricultural land with the aims of natural topography and conservation.

The case study was chosen based on the resettlement of local people, general location, and evident transformation under the urbanization process.

This area has a transitional landscape between the urban core and the majestic northern forest and agricultural zone. Nowadays, this area is considered as the belt

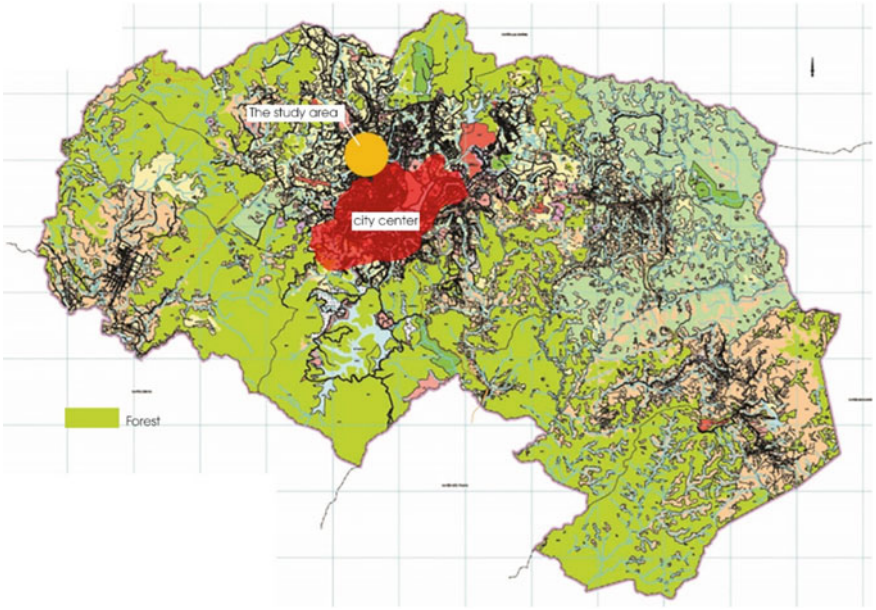

Fig. 1 Location of ward 7 in Da Lat city's land use plan (2014) (Department of Natural Resources and Environment of Lam Dong province 2020)

Fig. 2 Focus area to study

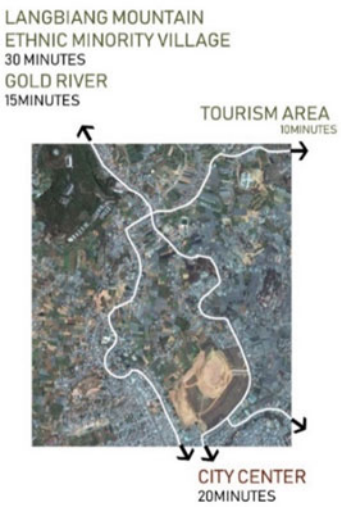

Fig. 3 Study area in connection with the surrounding area (Author)

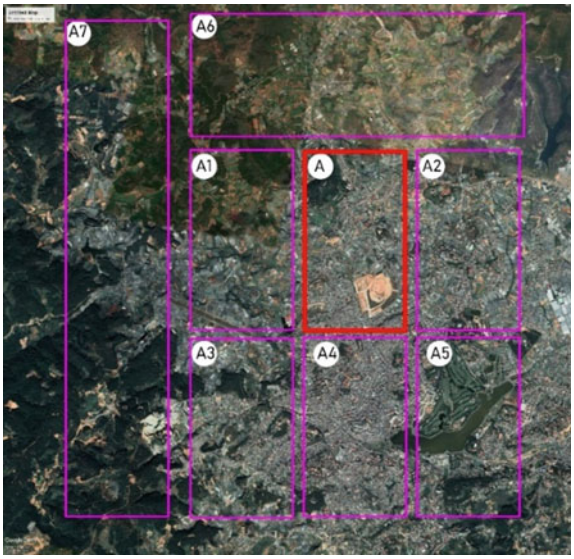

Fig. 4 The function of the study area with surrounding areas. A1: residential area with agricultural land and half of the site belongs to the army. A2: individual and spontaneous garden tourism activities and services. A3: agricultural lands are replaced for services/commercial development. A4–A5: city center area with commercial activities. A6–A7: 20% of residence mixed over 30% agriculture and about 50% of forest land (Vietnamese Prime Minister 2014)

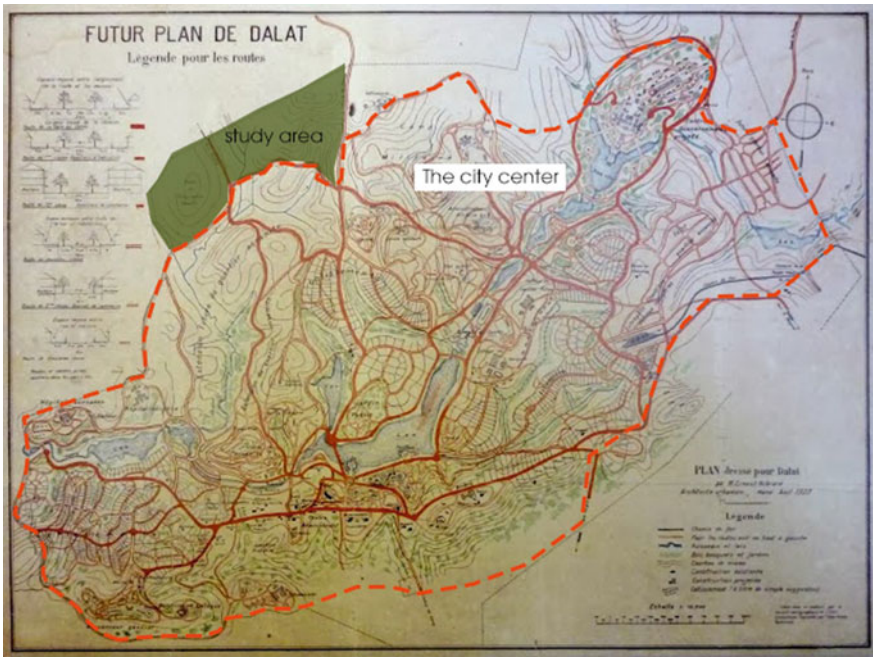

Fig. 5 The study area in the master plan of Ernest Hebrard in 1923 (Tranconghoa 2013)

between the urban area and the non-urban area. Besides the landscape transaction, rural and urban activities overlap. The study area's natural ecosystem is defined with natural flows combining bumpy pine hills and pine forest valleys. Natural factors link with the agricultural landscape. Hence, the study area seems to be a gate through which to enter the North, non-urban area. Although urban sprawl led to the encroachment of water surface, green space, and agricultural areas in recent years, urbanization has also yielded advantages in making connection paths through improved road systems. Through that, the living standards and farm values are improved. (Kuethe et al. 2011) When the infrastructure is upgraded, some parts of agriculture shift into services, particularly tourism. Then commercial buildings are gradually, and sometimes spontaneously, integrated.

This study area was also ideal because it is a long-term community. The families of Da Lat city mainly work as farmers, as they have for many generations, and contribute to the massive agricultural production of the city. Different from other areas, local people discovered and settled in this area before 1940, from the beginning of city development. Local people came from the same village from the middle cities of Viet Nam. The agricultural lands directly connect to lakes and hills and create a diverse typology. In the beginning, the main economic activity was traditional agriculture. The agricultural land and natural landscape continued to occupy the major areas until recently. Over the past ten years, the area has been reportedly suffering significant gentrification due to the increase of greenhouses and the remodified agricultural

land plots. Besides, the fluctuation of the real estate market in Da Lat city leads to uncontrolled and high real estate values in many parts of the peri-urban area. This condition leads to the conversion of prime agricultural lands.

Under the urbanization process, the study area is evolving, followed by tourism encouragement policies in the city. Some residents have started investing in services with small accommodations or restaurants. Policies from authorities have had some success in this area; it has proved the potential to form an ecotourism zone with appropriate control. The agricultural activities promise to turn the way of making a living into non-agricultural activities. On the other hand, these activities lead to pressure on the environment (Levia 1999).

3 Methodology

3.1 Data Collection

This study aims to describe and analyze the status of agriculture development through land conversion issues, economic contributions from tourism integration, and landscape degradation (Levia 1999). Following these objectives, based on some key stakeholders' views, future development tendencies will be explored. Some issues between plans and reality will be clarified. To approach the research objectives, quantitative and qualitative methods are employed. Through observation, the general situation of the investigated site is explored, including the distribution of agricultural areas, essential services, and relative stakeholders. The qualitative and quantitative research methods are conducted to change the study area's physical structure and socio-eco sectors. Most of the data is collected from the semi-structured interviews, questionnaires, and group discussion. In total, 75 samples were carried out (Table 1).

Table 1 Table of samples for interview

Stakeholders	Number	Criteria
Local government	2	Construction manager Agricultural manager
Farmer	16	Local people Long-term working experience
Resident	16	Local people Not farmers
Agritourism Company	6	Developed and starting up based on agriculture
Tourist	35	Experienced agritourism
Total	75	

The interview was conducted among the local government; farmers, residents, and companies helped record life stories within the urbanization process. This shows the associations between farm households and businesses. (Tew and Barbieri 2012). Then, all of the information was complied with the geoimages to show the agricultural land encroachment. The interview aims to uncover the development of agriculture through land use transformation and human settlement, as well as their impacts on the local community. Additionally, the tourism integration from the government strategy was evaluated as the new way for sustainable development (Table 2). Their sharing and experiences also enhance the future development trends and determine the factors that impact agricultural land conversion, socio-economic rearrangement, and environmental degradation. The tourist interview helps to list and evaluate the requirement for agriculture and tourism integration.

Table 2 Information to interview

	Development of agriculture (focus on land use, economic, and human settlement)	Integration of tourism	Degradation of natural landscape
Local government	Evaluate the status through the change of: – Land use and land plot – Economic (income) – Settlement – Agriculture: application of technology in agriculture, support from government under the urbanization process	Understanding of agritourism: – Trend – Cost – Potentials – Challenges – Support from government Influences of tourism on daily life	Perception about environmental issues Influences of agriculture and tourism to local landscape
Farmer			
Resident			
Farmers have been invested in tourism	Evaluate the status through the change of: – land use and land plot – settlement – application of technology in agriculture under the urbanization process	Evaluate potential and challenges of tourism integration – Local connection – Motivation – hange of income – Management: tourist activities, – Labors, time – Environment and landscape – Importance – Tourism demand	
Agritourism Company			
Tourist		Understanding of agritourism Basic requirements	Environment and landscape importance

3.2 Data Analysis

Geoimage analysis highlights the expansion and land covering transformation based on clarifying the proportion of converted agricultural land into the construction site and greenhouses. Opinions from groups of farmers, residents, and suppliers were integrated to get common perspectives and differences. The information involves the value of the benefits to the economy, environment, and society provided by agritourism. The ability of stakeholders and their expectations also are described. These pieces of information help to uncover the urgency of the land transformation process, to state the benefits of agritourism in balancing local development and conservation, and to minimize the gaps in terms of authorities' policies and planning with actual demand.

From tourist perspectives, tourism requirements are scored through satisfaction factors. These factors are listed by the user's demand. The core of this section is finding indicators that affect a visitor's choice if they are interested in agriculture (Brown et al. 2007). These factors are compared with the current status of the area to find out the current status of core issues in the local area. The environmental factor is also mentioned and evaluated. The basic requirements would be systemized as a recommendation for further tourism development while natural landscape conservation remains a top priority.

4 Result

4.1 Benefits of Tourism Integration

The infrastructure in the study area has been upgraded since 2000. In the previous record from the local government, over 60% of the population was involved in agriculture (Farmers Association Ward 7 2018). Although high-tech agriculture made a slight push on the industry as a whole, it is clear that farming is in the low-income part of the city (average 5 billion/month) from local investment. The reason for this situation is that technology applications are spontaneous, and do not encompass whole areas, and thus, have not made a significant change for study areas. The local community realizes that the market in Vietnam has not brought advantages for farmers. The first issue is that farmers do not have priority in controlling their income. It means that their role in the value chain of agricultural products is not significant.

At the beginning of the production process, farmers must pay for input materials themselves. Their revenue mainly depends on retailers or a middleman. They do not sell directly to customers. Hence, the value, which the farmer received, is deficient and unstable. Their income doesn't solely depend on the weather, quality of seeds sales, and demand of the market, so there should be a new way to approach "selling what we have, finding or making our selling market, [and making full] use of our own potential." The next issue is lacking the right strategies to improve the value

chain of agriculture products. In recent years, customers' requirements have changed annually. The farmers still do not understand or stay abreast of updated information, so their supply chain does not meet demand.

Nearly half of interviewed farmers realized that farmers' perceptions lead to the overload in the supply chain and overload in other sectors. In particular, all farmers grow one type of flower during Tet holidays and push the price relatively high while the demand is stable, or even as it declines year by year. All goods are transported to big cities simultaneously, and not only cause pressure on the demand market but also make other logistics difficult to manage. It was recorded that the number of agriculture products that need to integrate with technology increases 10% per year on average (Farmers Association Ward 7 2018). The income of farmer households experiences a slight change from an average of 5 billion VND to 8 billion/2000 m^2 per year. This number is not attractive enough for young laborers to keep working in agriculture, so they shift to work in non-agricultural jobs. The transformation of agriculture leads to the restructuring of occupation (Sznajder et al. 2009).

In Da Lat city, natural landscape is one of the greatest resources for sustainable development compared to other cities, and tourism has been recognized as one of the major sectors for providing employment opportunities. The city government considers the area as the most significant vegetable production area of the city, combining developing tourism as long-term. From these strategies, in the perception of farmers, agritourism can create a new market for their products, and therefore, the value of agricultural products are higher. If farmland is invested in developing agritourism, the net income of farmers will be reformative (Sznajder et al. 2009). In a report from tourism news in 2015 and from the interview, most of the farms are free to visit, and only one farmer collects fees for all activities. 23 gardeners charge a certain amount for specific activities or from selling agricultural products. Environmental protection is not awarded as the long-term development by residents. This shows that the gardeners have not really benefited from tourism activities based on local potential. The main reasons are the infrastructure for tourism is insufficient compared to the tourists' demand and the policies for construction and conservation are lacking. From the perspective of agritourism companies, domestic, and foreign tourists are interested in agritourism because of the need for a natural feeling. To encourage tourism and service development, each ward or location has to modify a suitable model which the natural landscape as a core for investment. The combination and corporation among farmer households with forest conservation must be set. Also, it should propose zoning agritourism areas and determine necessary facilities that need to be adapted (Potthoff 1991). Agritourism is a place where environment and landscape are highlighted as values when the benefits of the local community are improved.

This chapter perceives that agritourism development in this area is essential to (1) widen the consumer market for agricultural products; (2) generate additional income for farmers/landowners; (3) create motivation to improve quality local products and living; and (4) mitigate the construction proportion. The integration of tourism promises the upgrading of living standards through income and profit management.

4.2 Land Covering Issues on Land Transactions and Environmental Impacts

Due to the urban sprawl that lacks effective control, the landscape patterns of the area have changed in both the North and South direction (Fig. 6). The agricultural land is gradually replaced by construction land, and the forest is occupied for cultivation and settlement.

However, The Copernicus Global Land Service (CGLS) provides a series of bio-geophysical products concerned with the status and evolution of the land surface. This data shows clearly and is in proportion with the expansion of human settlement and cultivation. These activities threaten the natural forest area.

The existing and planned urban expansion planned by the government retain the same center boundary. However, according to the government statistics in 2010 and 2018 (Table 2), it is clear that the residential land in both urban and rural areas increased significantly, which led to the establishment of peri-urban areas. This situation is visualized in the land surface in the Landsat data (Fig. 7). The North forest has encroached for cultivation and residence. In Ward 7, the authority said that although the residential land rises gradually, the services and infrastructure of the area do not adapt to the area's demand. Large forest land is occupied for agricultural and residential purposes.

In the study area, the spatial pattern of urbanization-related agricultural land loss has been considered to encroach upon natural land. The maps below show the encroachment of ecosystems and natural agricultural land loss from 2006 until the present (Fig. 8).

Since 2006, the area has suffered an explosion of urban issues. Until now, natural agriculture land was replaced by two main activities: construction and greenhouses. In interviews with the local community, it was found that the house quality in this area improved since the road system was completed. However, until 2008, after the area's planning was announced, the transformation of agricultural land into construction land increased. Tired of the low-income associated with farm work, most of the young laborers in the study area moved to big cities for job opportunities, whereas

Fig. 6 Under the rapid urban sprawl, the boundary of the city center is unchanged (Satellite image of Da Lat city)

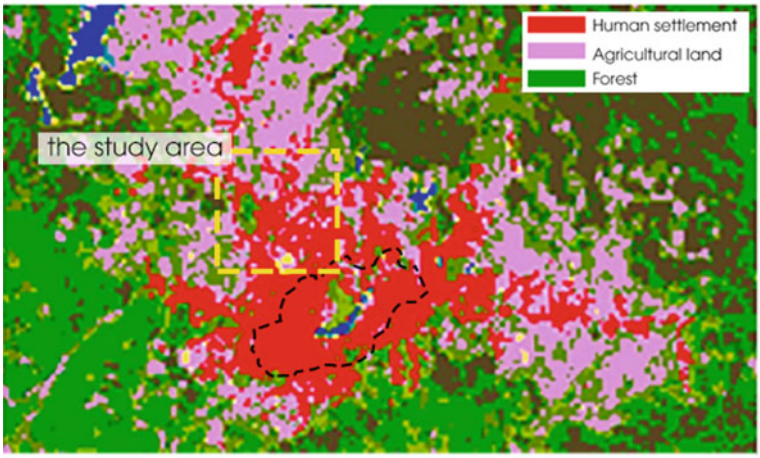

Fig. 7 The urbanization through the land surface (The Copernicus Global Land Service (CGLS) 2018) connect with a map of current land use and the plan from 1923

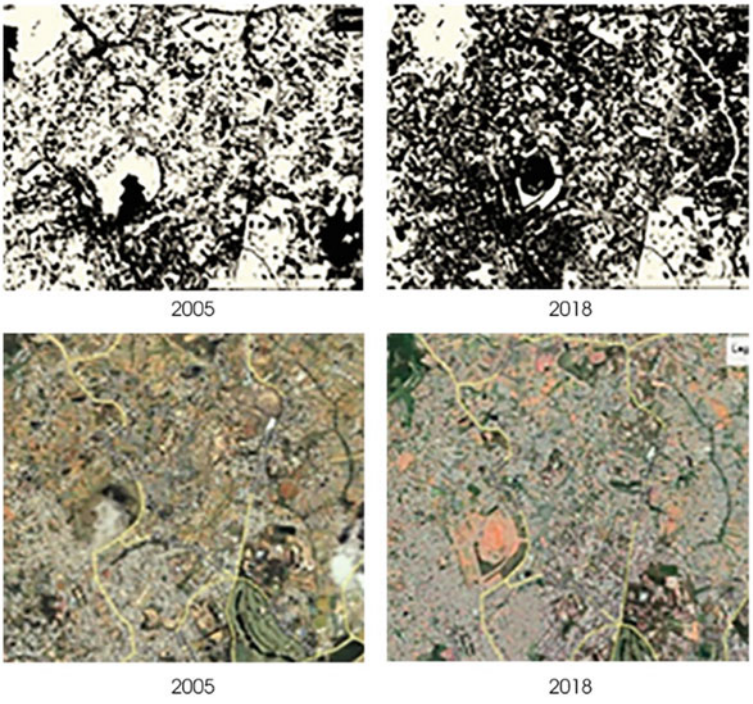

Fig. 8 The solid spaces reveal construction land and the void spaces reveal agricultural land and green land

the area still captured vast agricultural land. Others migrated from other locations, buying the property or renting the land for farm work and settlement. This trend has perpetuated in earnest since 2010. Although it brings money into the community, the side effects are worthy of discussion.

The fragmentation of farmland occurs in the landscape at the regional scale, and also becomes clear when analyzing land parcel division. The highlighted issue is that it is normal to buy and sell agricultural land. If the construction is not approved, the owner must find other ways to deal with the government to get a certificate. This phenomenon also leads to uncontrolled urban expansion as well as a rise in property prices. Four years ago, the price of 1 m^2 of agricultural land in Da Lat was about 3 million VND, after converting to construction land and increasing four times (Quoc Dung 2019).

Along with the tendency to encourage agricultural tourism in Da Lat for three years, the price of agricultural land and suburban areas soared. In the past, Da Lat real estate was only vibrant with a radius of 3–4 km from the center of the city; now, this extends to surrounding suburban areas. This situation, without control, pushes the appearance of high-density populations by replacing the natural spaces. Experiencing negative impacts from unofficial changing land use also reveals a gap between the government plan and the reality of life within the city. The city's plan converts agricultural land into land for the green park with estimated land for construction increasing in value. It seems that the city is shifting the pressure about population density from the city center to the peri-urban area.

Land covered by construction and greenhouses account for about 60% of the total agricultural land. The greenhouse effects would set the alarm for climate change and the quality of the living environment for this area. It is recorded that there is 306 ha of greenhouses in the study area, which occupy about 30% of productive land. The space for the greenhouses has been increased five times in around five years (Farmers Association Ward 7 2018). The greenhouses are developing freely and aggressively, disrupting Da Lat's planning, landscape, and ecological environment. The growing area of the greenhouse has created ivory-white patches that overwhelm the natural green of the pine forest and natural greenery.

Over 50% of residents and local farmers who own the greenhouses realized the environmental issues from greenhouses, yet they have to integrate greenhouses for protecting the quality of crops to ensure living expenses. This highlights the role of government in technology application in agriculture. Besides, there is still a lack of planning and regulation on limiting greenhouses to avoid encroachment of forests and natural agriculture. For specific areas, there should be a functional plan presenting the linkage between construction and ecosystems with an appropriate developing index.

4.3 The Gaps Between Local Status and Tourism Development Through Perceptions of Local Community and Tourists

In the survey, when 100 tourists were asked what they know about agritourism, only about 35 respondents had spent time on agritourism activities. Visitors who had experiences with agritourism accepted that they chose a place because of special factors including scenery, landscape, and local food, which are relative to farming activities (Fig. 9).

Tourists spent time in agritourism places because these activities helped them to stay close to nature, particularly the feeling of being surrounded by green and having a clearer understanding of a farmer's lifestyle. However, they spent no more than half of a day exploring green spaces, because there are non-attractive yet sufficient services such as restaurants. According to local investors, there have been many accommodations in areas, but the majority are ignoring the farming factors and natural factors, which are potentials of the area. That is why tourists prefer to spend their time in the city center or other areas. While the preservation of farms land and natural landscape is a way to attract tourists, the recognition of agritourism delivering environmental benefits are not widely mentioned. Farmers, residents, and local suppliers have similar perceptions of the potential to develop agritourism in the study area, with special consideration of the transportation and farm activities. Urbanization motivates the study area to upgrade infrastructure and improving community connections. However, due to the background of long-term agricultural development, many smallholder farmers and non-farmers have a high attitude toward agritourism, and most of them operate their farm with difficulties in acquiring financial or technical support. The investors state that agritourism is selling emotions and services, which agricultural change can optimize. Agritourism should be considered as a way for long-term development rather than just a hot trend development. In details, the investors highlight the need for cooperation between farmers and suppliers or corporation between farmers and farmers. Because suppliers have capital and farmers own huge natural and agricultural values, sharing and support each other will minimize competition in

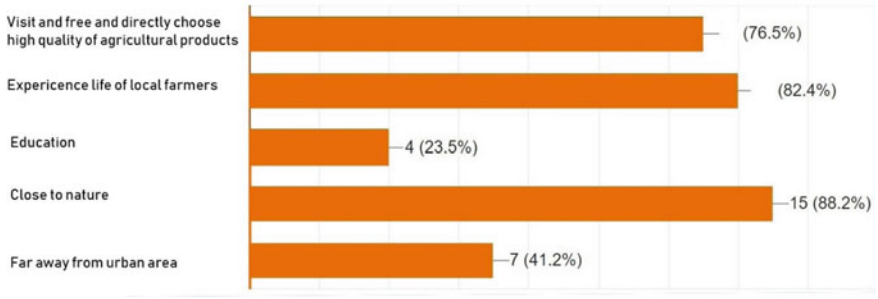

Fig. 9 Attractive factors of agritourism activities from tourists

the area and tourism products could be developed with higher quality. This contract can make agritourism more successful, yet it is still not recognized by farmers. Local farmers, residents, and investors realize that agritourism developed many years ago, yet at that time, it just develops in the form of a combination between accommodation services and small-scale gardens for tourists to visit. To develop agritourism effectively, the local environmental benefits would need to mitigate the construction proportion as well as create the eco-attraction for farmlands.

5 Discussion

5.1 Agriculture Integrates Tourism (Socio-Eco-Benefits and Challenges)

Understanding the temporary characteristics of agriculture in Da Lat city, the study area captures the potential to develop tourism, including new locations, natural resources, and human resources. Agritourism has developed strongly, and has become popular and attractive in the last five years, so this type of tourism is in the process of completed and expanded on a city-scale (Government of Da Lat city 2018). Developed agritourism space in Da Lat city has received positive feedback. At the same time, agricultural production is reported to enhance both quality and quantity (Farmers Association Ward 7 2018). Agritourism improves the quality of life in the community by adding value to income. Time spending on agriculture shares with non-farm activities; the farmer can control the value chain of their products (Sznajder et al. 2009). Despite the fact that agritourism is the new trend for the area, it is recognized as an effective way to create a corporation for the local community, especially young people. Because of landowner characteristics, gardens from different families can be associated. Agritourism is also an effective way to preserve the landscape by reducing selling and transferring agricultural land. Agritourism helps to conserve agricultural land and still ensures higher incomes for farmers.

5.2 Policies and Planning for Land Transformation and Environment

As mentioned, areas have the potential to invest in agritourism. The attraction and identity of an area lies in the integration of multiple layers, including social, local culture, and landscape. Although agritourism had been labeled as a primary task for sustainable development in the future strategies of the city, there is no agricultural policy or tourism policy about criteria, or a legitimate way of changing land function to support farmers. Construction and investment services for agricultural land are

essential for agritourism. (Tew and Barbieri 2012). Basic requirements for tourism must be considered appropriate with the area context (Tables 3, 4 and Fig. 10).

The collected data shows the importance of different services. Their roles are evaluated with a lower score compared with landscape and agricultural products. If the area wants to develop agritourism, basic services, including accommodation facilities, have to be invested in. However, to mitigate the encroachment on the natural and agricultural space, there would be criteria to limit construction. In reality, there are no policies or detailed guidelines for this situation. Besides, legislations dedicated to farm tourism, co-existence of quality certifications, and skills of farm operators, especially in terms of marketing knowledge, are still lacking. It is hard for investors to force the plan for investing in agritourism. The agricultural department of the area would need to specify detailed orientation, and provide not only ideas for implementation, but also a training course. In the future, the government must define precise indicators to limit the area taken up by greenhouses and encourage the right of farmers when they want to invest in services building on agricultural land.

From the economic viewpoint, finance is the most considerable problem. To be a success with agritourism, farmers or investors need colossal capital. (Boudy 1991) Farm tourism has been recognized as a form of sustainable development for less developed areas, yet the invested area has to face adverse effects from

Table 3 Data of population and land use transformation (Department of Lam Dong Province Statistics 2018)

Year	Population rate		Residential land		Agricultural land	Forest
	Urban-Peri	Rural	Urban-peri-urban	Rural		
2010	38,00	62,00	3.115,4	5.352,6	316.386,1	582.728,0
2018	39,82	60,18	3.669,34	8.924,03	367.404,35	539.570,00

Table 4 Important factors contribute to an agritourism place in the perception of tourists

Factors	Score	Level of important
Quiet/peaceful space	4.6	1
Agricultural products	4.1	2
Landscape	4.1	3
Accommodation	4	4
Food services	3.9	5
Price	3.8	6
Support services	3.7	7
Transport/location	3.6	8
Attitude	3.6	9
Interaction with local people	3.3	10
Distance	2.9	11

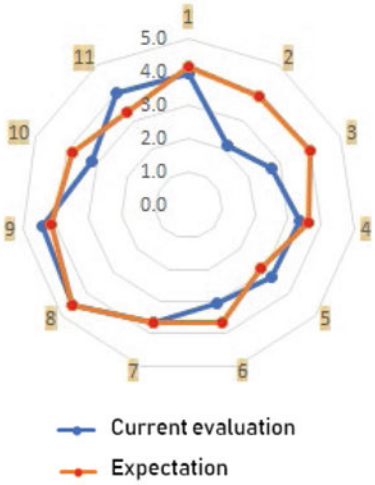

Fig. 10 Comparing existed and expected important factors for agritourism development. 1. Agricultural product, 2. food services, 3. accommodation, 4. location/transportation, 5. distance, 6. agricultural activities, 7. attitudes of services, 8. quiet/peace space, 9. natural landscape, 10. price, 11. interaction with local farmers

the appearance of the greenhouse. The environmentally friendly nature of farmland has led to farmers being recognized as guardians of the landscape or "environmental architects "(Roberts and Hall 2001). Hence, farm tourism development has to deal in parallel with environmental issues. The awareness of local people about environmental protection, especially reducing the greenhouse areas, needs to be changed. In the environmental view, integrating agriculture and its activities with urban greening programs would reduce urban pollution and urban heat, and offer recreation opportunities to improve the quality of life for all urban residents (Nelson 1992).

6 Conclusion

Agricultural transformation in this study contributes to the change in land use, especially in regard to urban expansion. (Batisani and Yarnal 2009) In the study area, this process happens without control, and the sustainable living of the community is ignored. Integrating tourism with agriculture is one way to enhance living quality and provide economic benefits for the local community. Agritourism is the new method for tightening urban–rural partnerships through the flow of people and needed materials, agricultural product promotion, and taking advantage of existing public services. In terms of the local economy, social-cultural links and environmental synergies would be enhanced across the area settlements. (Hegarty and Przezborska 2005).

Urban encroachment onto farmland poses landscape and regional sustainability challenges, especially in densely populated, rapidly urbanizing areas. In the policy

discourse addressing this challenge, a controversy has arisen regarding which urbanization mode (i.e., prioritizing the development of larger cities or smaller cities) could minimize the negative impacts on food security. We found that urban growth of larger cities consumed smaller quantity and lower quality farmland when accommodating a certain amount of urban population. This finding contrasts with the common belief that urban growth of larger cities will hinder a larger quantity of and higher quality farmland.

In terms of the local status of development, agritourism is suitable for small-scale farms and reflects the links between agricultural produce and tourism. The first positive effect from tourism activities is the creation of a local image for agricultural products. Agritourism is a form of tourism that would undoubtedly lead to complementing other forms of tourism as well as engaging environmental protection. The combination of praxis agri with tourism reveals recreational activities that citizens will enjoy in an agricultural/farm setting (Przezbórska and Scrimgeour 2009). Therefore, during the strategic planning phase of developing the city for agritourism businesses, land values increase, and less agricultural and forest land is converted. Creative destruction and destructive creation are considered two types of land degradation. (Johnson and Lewis 1995). The land transformation to increase the coefficient of other activities is creative destruction. This type of degradation can ensure sustainable changes, because of the benefits to surrounding areas. This process can be called the reproduce (Johnson and Lewis 1995). Agritourism investment without change to the character of the land promises long-term sustainability.

The proposal for agritourism goes with landscape conservation, which encourages giving back to nature with low construction space and a low marketing budget. Besides that, the naturally beautiful landscape becomes a place for the community. The agricultural products market widens, and at the same time, the quality of life of the local community gets better. This space provides intangible services and physical products. The area is different from other areas because it is a gateway to rural spaces that are closed to the forest, so the area is suitable for a low number of tourists of all ages. This finding should spur further research on this topic, particularly for corporations. The city has to pay more attention to cultural landscape preservation and livable community via agritourism networks in different parts of the city. The government also must have building regulations with construction indexes on farmland to ensure essential services that adapt to the requirement of tourists, yet balance the proportion of natural and agricultural land.

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Urban Flooding in the Context of Climate Change in Ho Chi Minh City: A Case Study of Nha Be District

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Abstract Located by Nha Be River and within 30 km of the South China Sea, the Nha Be District is one of the outer districts of Ho Chi Minh City that has suffered severe urban flooding. For a comprehensive understanding of urban flooding in this district within the larger context of global climate change, this quantitative study aims to describe the frequency, intensity, and impacts of floods on the locals as well as summarize multi-scale responses. In surveying 210 households in the Nha Be District, and by conducting 14 in-depth interviews with community representatives and land management officers, the study found that rapid urbanization and climate variability in the last ten years have contributed to the complexity of flooding in this area, which is characterized by low-lying terrain and an interlocking waterway system. Among the surveyed households, half of them have frequently faced flooding throughout the year, and 39.4% of them have been impacted at one time. Flood intensity is variable, with the average depth at approximately 20 cm. Since flooding has negatively influenced living quality, commuting, and housing quality, several solutions have been implemented by homeowners, the community, and the local government to cope with the growing impacts of flooding. Despite certain approaches taken by different stakeholders, it is critical to propose further approaches for dealing with urban flooding in Nha Be District. These approaches might take into account the solutions relating to flood-proof housing and urban areas in response to urban flooding in the context of climate change.

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Keywords Urban flood · Housing · Climate change · Nha Be district · Ho Chi Minh City

1 Introduction

Located by Nha Be River and within 30 km from the South China Sea, Nha Be District is one of the outer districts of Ho Chi Minh City (HCMC) that has undergone severe urban flooding caused by multiple factors such as its topography (Asian Development Bank 2010; Tran TN 2011), a large and growing impervious area due to urban expansion (Vietnam Climate Adaptation Partnership 2013), and so on. In the context of climate change, Nha Be is highly vulnerable to sea-level rise, tides from rivers, and ground subsidence (Nguyen 2016). It is necessary to understand the frequency, intensity, and impacts of the floods on living quality, commuting, and housing quality for residents, as well as the solutions implemented by homeowners, the community, and the local government. On that basis, the following research proposes solutions for how best to adapt to climate change and flooding.

This paper summarizes certain findings from a quantitative study on the frequency, intensity, and impacts of floods on the locals and local housing, as well as the multi-scale responses from various stakeholders. Among the methods, a survey was used to collect data from one town and six communes (wards) of Nha Be District with the participation of 30 households in each ward. The research objectives are to understand urban flooding in Nha Be District in the context of climate change and support further suggestions and recommendations for this urban area. Also, this research aims to help communities and local authorities take initiative and adapt to climate change and urban flooding.

2 Study Area

Located in the southeast of HCMC, Nha Be District spreads out over an area of 100 km^2 and includes one town (Nha Be) and six wards (Hiep Phuoc, Long Thoi, Nhon Duc, Phu Xuan, Phuoc Kien, and Phuoc Loc). Among them, Nha Be Town is the administration and business center that is the most urbanized. Situated near several industrial zones, export processing zones, and on the main gate to the city, Nha Be, Hiep Phuoc, Phuoc Kien, and Phu Xuan are the most populated areas in the district.

Due to its topography, this district consists of low-lying terrain that partly helps drain water out of the city center (Tran TN 2014). However, the recent rapid urbanization has transformed this outer district significantly, reducing its capacity for water storage and drainage. Since its infrastructure has not been well developed, the development of Nha Be has resulted in several issues for the district, including flood inundation. This entire district is estimated to be at risk of flooding due to the backfill projects along Sai Gon, Dong Nai, and Soai Rap River (Bui and Nguyen

2015). Additionally, due to the various impacts of climate change, housing in Nha Be District has suffered, seriously threatening people's safety and quality of life. Within the district, the most intense flooding has been recorded in the neighborhoods located along Le Van Luong, Huynh Tan Phat, and Nguyen Binh Street (Ngo et al. 2019; Vietnam Climate Adaptation Partnerships 2013).

Due to these impacts, several projects have been implemented involving flood reduction and mitigation efforts at multiple scales. Besides the efforts from the government, people living in Nha Be District have used various approaches to respond to floods. However, due to the mentioned topographic characteristics, the complexity of climate change, flooding, and other factors, still threatens harmful damage to the area.

3 Methodology

Data was collected by questionnaire and in-depth interviews conducted in one town and six communes (wards) of Nha Be District. The questionnaire was structured with four main parts (See Appendix). Part 1 aimed to collect the background information of respondents who imply their knowledge of the studied area, their houses, the flood situation, and their desires. Part 2 asks for their housing details relating to physical attributes such as, construction, renovation, and their evaluation of the house condition as it relates to their accommodation demands. Part 3 consists of questions regarding flood situations with information about frequency, intensity, sea-level rise, causes, and effects. Part 4 includes concerns about the previous solutions suggested by multi-stakeholders at housing and neighborhood scales. This study focuses on analyzing the results of Part 3 and 4 and uses the information attained from Part 1 and 2 for reference if necessary. The in-depth interviews mainly discussed the actions taken by the local governments, through the perspectives of community representatives and land management officers, to deal with floods over time. There were 210 survey respondents from households and 14 in-depth interviews from community representatives and land management officers at the mentioned administration units. Regarding the sampling size, Nha Be District's population is about 76,985 people (According to the data of the 2019 Census). The sampling size is calculated with a confidence level of 93%, and the tolerance is within 7%. The number of questionnaires is calculated by the formula for calculating sample size as follows:

$$n = \frac{N}{1 + N * e^2}$$

Note:

n: the number of units of the sample population.

N: the number of general units ($N = 76{,}985$).

e: the tolerance.

The tolerance (e) was chosen is 7%, the result for $n = 203.5$ samples. Rounded out 210 samples for one town and six communes (wards) of Nha Be District.

Besides a questionnaire, a guided observation was also used to record the related information in the survey by taking photos.

Data evaluation and analysis were implemented by descriptive statistical methods with support from IBM SPSS software (Ngo 2020). Multiple percentage calculation was mainly used to process data from the questionnaire that included a percentage of identical answers among the sample size and accumulative percentage.

4 Results

4.1 Frequency and Intensity

The findings in Fig. 4 show that flooding is a phenomenon that has been occurring in all wards of Nha Be District for more than ten years. In general, approximately 50% of the surveyed population reported that floods frequently take place in Nha Be District, while nearly half of the respondents just experienced floods at a specific time of the year, mainly during the rainy season. In addition, the study found that there are differences in flood frequency in different wards. Figure 4 provides the whole picture of floods taking place in Nha Be District; in which Nha Be town, which has the highest rate of urbanization, has the most frequent flooding (86.2%), followed by Nhon Duc, Phuoc Kien, and Phuoc Loc (57.2%, 55.6%, and 52%, respectively). Flooding happens more frequently in the rainy season, especially in Hiep Phuoc and Long Thoi, where flooding was found in approximately 80% of the surveyed households. Although flooding was reported by only 14.3% and 8% of respondents in Nhon Duc and Phu Xuan as an abnormal event, it still raises a concern about the capacity of drainage in such areas in case heavier rain comes in the years to come.

With regards to flood status, generally, there is a variation of flood depth among the surveyed households; the average depth is recorded at 23.72 cm. Some households are experiencing serious 70 cm-deep floods. Specifically, flooding severely occurs in the wards with a high urbanization rate, namely, Nha Be and Phuoc Kien with 29.7 cm and 26 cm in depth, respectively, followed by Nhon Duc (20.8 cm), Phu Xuan (17.6 cm), and Long Thoi (17.1 cm). The smallest flood depth was found in Hiep Phuoc and Phuoc Loc with roughly 15 cm (Fig. 5).

There is no doubt that there is a strong association between the rising sea levels and flooding. In this chapter, exploring the perception of households regarding sea level was included to examine not only the view of the locals to the climate variation, but also their knowledge about sea-level rise in relation to flooding issues in such areas. Generally, 57.15% of the surveyed households have perceived water variation as abnormal, while 30% and 11.9% of them see a slight increase and significant rise, respectively, in flooding over the last 10 years (2009–2019). There is a variation of

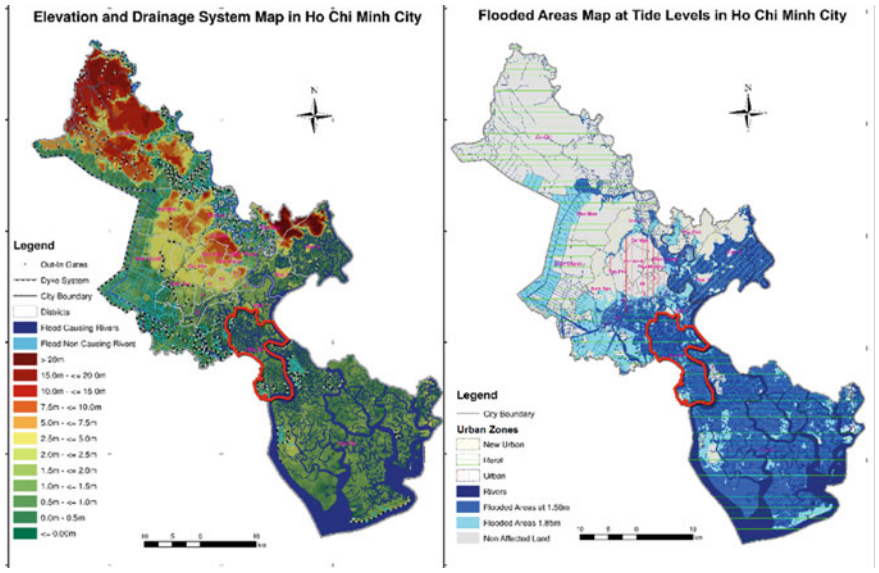


Fig. 1 Studied area (the red marked zone) in the maps of elevation and the drainage system (left) and flooded areas at tide levels (right) in Ho Chi Minh City (Tran TN 2014)

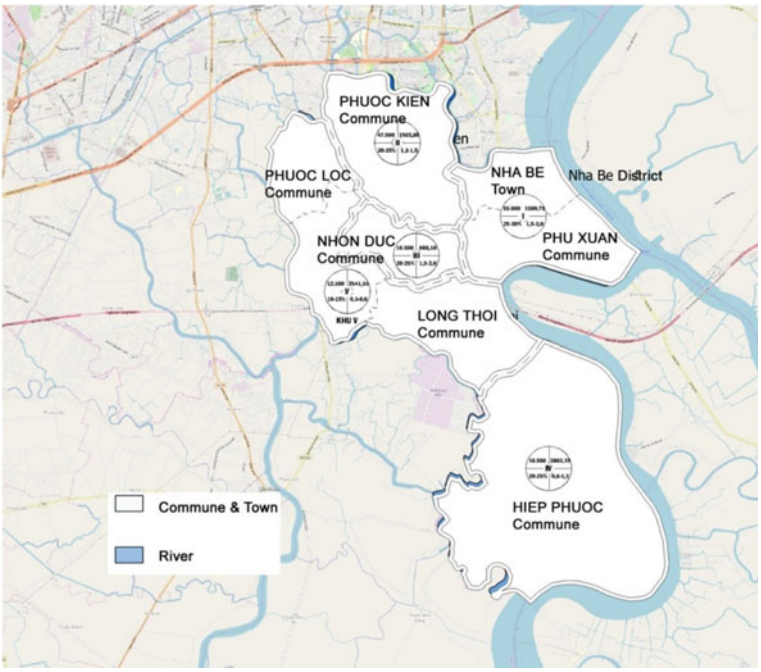


Fig. 2 Nha Be District map which shows a town and six communes (wards) (*Source* This figure is created by the first author, 2019)

Fig. 3 Housing was eroded in Nhon Duc Ward, Nha Be District (Authors, 2019)

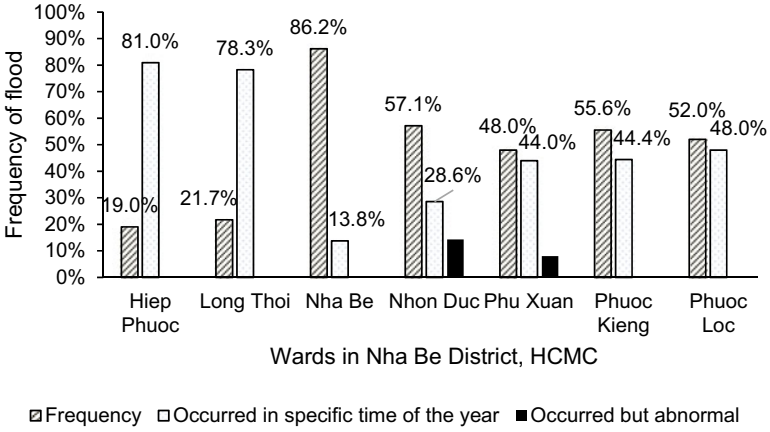


Fig. 4 Frequency of flood occurring in Nha Be District (Authors, 2019)

perceptions of residents' viewpoint among the wards of Nha Be District (Fig. 6). Inhabitants living in Nha Be Town, Nhon Duc, Phu Xuan, Phuoc Kieng, and Phuoc Loc are aware of the water variation from sea-level rise over time, which is reflected by the results in more than 50% of the surveys.

Characterized by a complex waterway system, Nha Be District respondents stated that flooding was mostly due to tides and heavy rains, as their frequencies are 43.5 and 31.9% among all causes, while the operation of water drainage system accounts for only 15.4%. Sea-level rise and landslides, along with dams, are the other rare causes, with roughly 3% of frequency (Table 1).

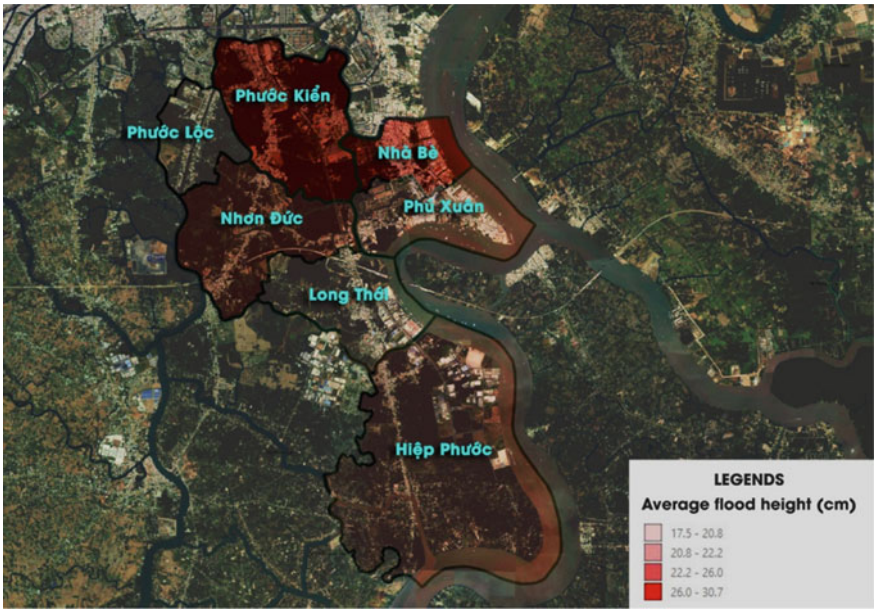


Fig. 5 Intensity of flooding reflected by the flood depth (Authors, 2019)

Intensity	N.	%
Slight increase	63	30
Slight decrease	2	0,95
Significant increase	25	11,9
Abnormal (sea level	120	57,15
Total	**210**	**100**

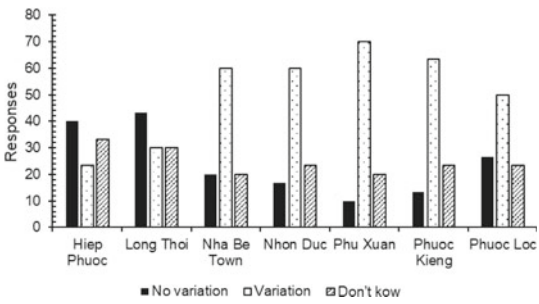


Fig. 6 Fluctuation of sea-level rise by year, taken from residents' viewpoints between 2009 and 2019 (Authors, 2019)

4.2 Impacts

Flooding has negative impacts on several aspects of the studied area. 30.5% of respondents found the effects of floods on traffic, namely making it inconvenient in commuting. A similar number of people (approximately 25%) saw damage to housing and a reduction in their quality of life caused by the seasonal floods. Noticeably, despite a small percentage of the flooding impacts, negative impacts on local

Table 1 Causes of flood in Nha Be District (Authors, 2019)

Items	N	Percentage over the sample (%)
Heavy rainfall	110	31.9
Tide	150	43.5
Sea-level rise	12	3.5
Low efficiency in water drainage system	53	15.4
Landslides	11	3.2
No dam	7	2.0
Others	2	0.6
Total	345	100.0

Table 2 Impact of floods on residents in Nha Be District (Authors, 2019)

Items	N	Percentage over options (%)	Percentage over sample (%)
No impact	29	8.3	16.2
Land loss (household along the waterway)	13	3.7	7.3
Housing damage	88	25.1	49.2
Negative impacts on business (house along the main road)	28	8.0	15.5
Traffic difficulties (traffic jam, vehicle damage, etc.)	107	30.5	59.8
Quality of life (activities, environment, health, etc.)	85	24.2	47.5
Others	1	0.3	0.6
Total	351	100.0	196.1

Note The result was calculated from a multiple-choice question

business and land loss should be taken into account in flood response and adaptation, especially for the houses located by the main roads and along the river. Figure 7 shows that the houses situated in Le Van Luong Street are considerably vulnerable to be re-flooded because most of them are small retailers and are just slightly higher than the main road elevation.

4.3 Solutions

To cope with flooding, there are many possible solutions (Table 3). Raising the ground level of the houses is the most referenced household-based solution among inhabitants, accounting for 53.7% of responses. However, nearly 37% of households

Fig. 7 House with business activity located on the main road in Nha Be District (*Source* This photo was taken by the first author, 2019)

suggested no solution in Nha Be District. A reason for this may be the dominance of low-income households that have limited to no financial capacity to apply renovation techniques. Only 0.5% of the respondents have applied concrete-based reinforcement. Some households have still coped with flooding with temporary measures such as leveling up furniture and investing in individual pumps for their self-drainage.

Local governments have taken certain measures to counteract the negative impacts of flooding as well. Based on in-depth interviews with community leaders, because of severe floods taking place on Huynh Tan Phat Street (from the joint with Tran Xuan Soan Street to Phu Xuan Bridge), the local government, with contributions from the residents, has upgraded alleys, namely 1716, 1806, and 1897. This project

Table 3 Selective solutions to cope with floods in Nha Be District (Authors, 2019)

Items	N	Percentage over sample (%)
Do nothing	69	36.8
Level up the ground floor	101	53.7
Built with concrete base	1	0.5
Floating house	0	0
Resettle to high-level floor	0	0
Other	17	9.0
Total	188	100

Note The result was calculated from a multiple-choice question

has partly reduced the flooding issue in the area. Plus, the local government has adopted soft measures such as cleaning sluice and sewage frequently, contributing to the increased efficiency of waterway function, especially when tides and rain take place. This includes dredging the Ba Lao Canal to foster drainage of water during high tide. However, with limited financial resources, the local government has been challenged by the efficiency of the drainage system, which is still poorly aligned between the main roads and narrow alleys. Thus, the participation and engagement of the community are important mechanisms for coping with climate change in Nha Be District. In this way, the effort to raise awareness via communication, propaganda of environmental protection, and trainings has been carried out.

5 Discussion and Conclusion

The study found, conclusively, that flooding has impacted multiple aspects of Nha Be District. Without early protection, it harms the existence of the community in the future. The findings reflect the frequency, intensity, and causes of flooding from the perspectives of the residents, which may contribute to further assessment and analysis of the flood risk in the area. However, to propose appropriate approaches for combating floods, more analysis and mitigation strategies are suggested, i.e., mapping, modeling, and simulation as well as further questionnaires for the area. All of these strategies, as well as those used in this study, can help residents deal with the complexity of climate change.

In conclusion, the study finds that floods occur all around Nha Be District, with the highest intensity and frequency recorded in Nha Be Town. Respectively, tide, precipitation, inadequate drainage systems, and sea-level rise are considered the primary causes of flooding. For people living in the district, floods have negatively impacted traffic and housing conditions as well as their quality of life. In response to the floods, the government has leveled up certain roads and improved the drainage system, while survey respondents prefer to elevate the floors in their homes. Since these measures are still limited, the findings of this chapter imply a need for further actions to deal with flooding in this area. These measures can be proposed and carried out from multiple stakeholders at various scales. Further strategies are recommended to integrate top-down with bottom-up and short-term with long-term solutions. Besides a discussion on flood impact measures, this chapter also contributes to the flood risk assessment, which may support the government in finding proper approaches for this area at the district level. The findings of the chapter can be used as a source of reference for other areas with a similar context in topographic and socio-economic features, such as the other coastal cities, in the developing countries in South and Southeast Asia.

Acknowledgements A portion of the research for this paper was conducted by Le-Minh Ngo, which was made possible by a 2018–2020 Ho Chi Minh City Department of Science and Technology Grant. Le-Minh Ngo also wishes to thank Ton Duc Thang University for hosting the research activities, and to the students and lecturers who participated in the research.

Appendix A—Questionnaire Form and Sample Survey Results

Sheet code:Kindly check and confirm the edit made in the tables, since empty cells are not allowed in tables. Amend if neccessary.Please delete these empty cells. Clearly they were used to record a reference number, but that becomes unclear when placed here - george

Questionnaire Form

For Residents in NHA Be and Can Gio District, Hochiminh City

Dear Mr/Ms,

I am a member of a research team from Ton Duc Thang University. We are collecting information to serve the research project assessment of the impact of flooding due to climate change on housing in Nha Be, Can Gio (HCMC), and propose planning and architectural solutions to respond. Please take a few minutes to read and answer this questionnaire by placing an X in ☐ of the answers you choose. The information you provide will be very important for the study of the topic and are committed to keeping it confidential, only for scientific research purposes. Thank you very much!

Investigator: ……

Respondent: ……

Respondent's phone number: ……

Address: ……..

Survey time: from ……., to ……., ……

A. RESPONDENT'S INFORMATION

A1: Gender: 1. ☐ Male 2. ☐Female

A2: Year of birth: ……

A3. You are:

1. ☐ Head of household
2. ☐ Parent of household head
3. ☐ Children of household head
4. ☐ Other (specify): ……

A4. Current accommodation:

A5. How many years have you lived and worked here?…….

A6. Reside planning in the future?

1. ☐ Continue to live and work here
2. ☐ Intend to move to another place to live and work
3. ☐ Other (specify): ……

A7. What is your FAMILY's level of participation in community activities (neighborhood, residential areas)? (may include other people in the household)

1. ☐ Regularly
2. ☐ Occasionally
3. ☐ Never
4. ☐ Other (specify): ……

B. CURRENT HOUSING INFORMATION:

B1. Features of the current location of the house:

1. ☐ Townhouse without yard, close to traffic road
2. ☐ Townhouse with yard, close to traffic road
3. ☐ House in a residential cluster with a shared yard
4. ☐ House located far away from the traffic road
5. ☐ Other: ……

B2. Please indicate and rate your current housing suitability according to the following criteria:

B3. What is the main material of the house's foundation: (Choose multiple answers if any, write % and take pictures)

1. ☐ Reinforced concrete
2. ☐ Brick/stone
3. ☐ Wood
4. ☐ Ground floor
5. ☐ Other: ……

B4. What is the main material of the wall covering the house: (Choose multiple answers if any, write % and take pictures)

1. ☐ Reinforced concrete
2. ☐ Brick/stone
3. ☐ Wood, metal
4. ☐ Fence, linoleum, plywood,…
5. ☐ Other:.……

B5. What is the main material of the roof of the house: (Choose multiple answers if any, write % and take pictures)

1. ☐ Reinforced concrete
2. ☐ Tile
3. ☐ Roofing sheets (cement, metal…)
4. ☐ Leaves, straw, oil paper
5. ☐ Other: ……

B6. Life expectancy of the current house

Built in: ……(year).

Number of renovations: ……..…

Renovated in *(most recent year first)*: (1): …….; (2): ……..; (3):

C. Land/Housing Condition With the Impact of Sea Level Rising

C1. Is there a flood situation where you are living, and how often does it happen?

1. ☐ Yes—happens often → go to C2
2. ☐ Yes—happens from time to time → go to C2
3. ☐ Yes—happens abnormally → go to C2
4. ☐ No → go to C7

C2. What is the average level of flooding (if any) in recent times? (cm) (recommended to record flood history in detail)

C2.1. Level of flooding in the most recent year: ……. cm (compared to the floor)

C3. How does sea-level rise change year by year?

1. ☐ No volatility → go to C4
2. ☐ With volatility → go to C3.b.
3. ☐ Unknown → go to C4

C3.b. Volatility of sea-level rise year by year:

1. ☐ Slightly increase
2. ☐ Slightly decrease
3. ☐ Strongly increase
4. ☐ Strongly decrease
5. ☐ Abnormal and can't be predicted

C4. According to you, what is the reason for the flooding? (Choose multiple answers)

1. ☐ Prolonged heavy rain
2. ☐ High tide
3. ☐ Sea-level rise
4. ☐ The drainage system does not work effectively
5. ☐ Ground subsidence
6. ☐ No dyke and sea barrier
7. ☐ Other: ……
   ……

C5. How does flooding and sea-level rise AFFECT your life? (Choose multiple answers)

1. ☐ No effect
2. ☐ Loss of residential land (For houses close to canals)
3. ☐ House damage
4. ☐ Jobs, shops (For houses close to the road/highway)
5. ☐ Traffic difficulties (traffic jams, cars stalled…)
6. ☐ Quality of life (Entertainment, sports, environment, diseases, bacteria, ...)

C6. What did you do to PREVENT flooding? (Choose multiple answers)

1. ☐ Nothing
2. ☐ Landfilling, raising the foundation of the house
3. ☐ Build house on piles
4. ☐ Build a floating house
5. ☐ Move to a higher place

C7. If sea-level rise (invasion, landslide) causes loss of living space and economic activities, what will you do?

1. ☐ Move to other places → go to C7.1.
2. ☐ Stay there and find a way to fix it → go to C7.2.
3. ☐ Unsure, seek for advice → go to C7.3.
4. ☐ Other……

C7.1. If moving, I will:

1. ☐ Temporarily rent elsewhere and will be back go to part D.
2. ☐ Stay somewhere else → go to part D.

C.7.2. I would fix it by:

1. ☐ Repairing the house → go to C.7.2.1.a and b
2. ☐ Build a new house → go to C7.2.2.
3. ☐ Other:……

C.7.2.1. a. How I will repair my house, including: (Choose multiple answers)

1. ☐ Raise the foundation
2. ☐ Build embankments, barriers
3. ☐ Other: ……

C7.2.1.b. Financial ability to repair house:

1. ☐ Below 50 million VND
2. ☐ From 50 to 100 million VND
3. ☐ From 100 to 200 million VND
4. ☐ More than 200 million VND

C7.2.2. Financial ability to build a new house:

1. ☐ Below 200 million VND
2. ☐ From 200 to 500 million VND
3. ☐ From 500 million to 1 billion VND

C7.3. The consultant is: (Choose multiple answers)

1. ☐ Family, relatives, friends
2. ☐ People with experience in renovating and building houses in flooded areas due to sea-level rise
3. ☐ Government

Knowledge/Personal Opinion on the Situation of Sea-Level Rise

D1. What information/instructions have you been given/instructed by local authorities on measures to prevent flooding for houses and residential land?

1. ☐ No instructions/notifications
2. ☐ Already informed/instructed
3. ☐ Unknown

D2. What support have you received from local authorities to prevent flooding for houses and residential land?

1. ☐ No support
2. ☐ Already supported *(financial, technical,…)*
3. ☐ Other: ……

D.3. Do you know/see any solutions for housing that are resistant to flooding caused by climate change?

1. ☐ Don't know
2. ☐ Know → go to D.3.1. and D.3.2.

D.3.1. Please list your solutions:

D.3.2. From where do you know the solutions?

1. ☐ Already have experience using these solutions
2. ☐ Have seen other people in the area use these solutions
3. ☐ On the media (TV, newspaper, radio,…)
4. ☐ Other: ……

D3. Do you have any suggestions to solve the current flood problem caused by climate change for housing?

……

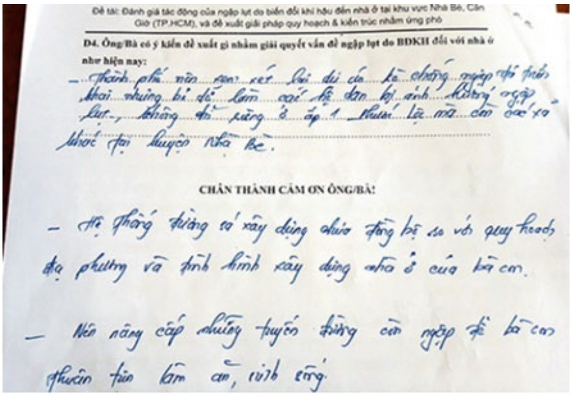
THANK YOU!

Appendix B

Figs. 8, 9, 10, 11, 12 and 13.

Fig. 8 In-depth interview conducted in a ward of Nha Be District (*Source* This photo was taken by the first author, 2019)

Fig. 9 Interview's group at Nhon Duc Ward People's Committee, Nha Be District, September 2019



Đề tài: Đánh giá tác động của ngập lụt do biến đổi khí hậu đến nhà ở tại khu vực Nhà Bè, Cần Giờ (TP.HCM), và đề xuất giải pháp quy hoạch & kiến trúc nhằm ứng phó

D4. Ông/Bà có ý kiến đề xuất gì nhằm giải quyết vấn đề ngập lụt do BĐKH đối với nhà ở như hiện nay:

CHÂN THÀNH CẢM ƠN ÔNG/BÀ!

– Hệ thống đường sá xây dựng chưa đồng bộ so với quy hoạch địa phương và tình hình xây dựng nhà ở của bà con.

– Nên nâng cấp những tuyến đường còn ngập để bà con thuận tiện làm ăn, sinh sống.

Fig. 10 Examples of questionnaire surveys results displaying in depth detail, 2019

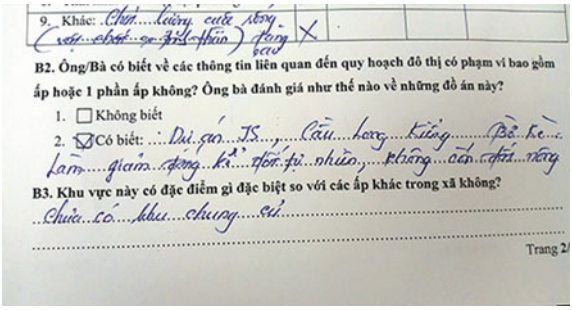


Fig. 11 Examples of questionnaire surveys results displaying further detail, 2019

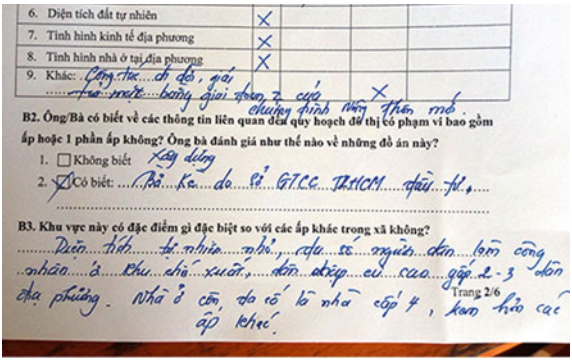


Fig. 12 Additional Examples of questionnaire surveys results, 2019

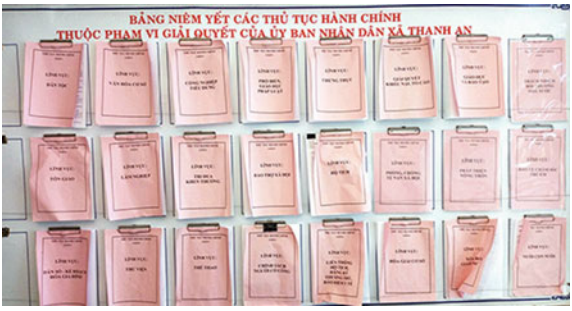


Fig. 13 Information board at Thanh An Commune People's Committee, 2019 (*Source* This photo was taken by the first author, 2019)

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Vulnerability and Flood Risk Analysis for Urban Areas—A Case Study of Ho Chi Minh City

Pham Van Song, Bui Thi Minh Ha, and La Vinh Trung

Abstract Along with rapid growth, urban flooding has become a widespread phenomenon and a major concern for Ho Chi Minh City (HCMC) in recent years. This chapter aims to present a review of current approaches to sustainable flood management in context of the HCMC. Three major elements related to potential damages from flooding, namely, vulnerability, exposure, and risk, are discussed, and the interaction between hazard, vulnerability, and exposure, indicative of the risk level of urban areas, is examined. Using information gained from a combination of methods such as data-based analyses, on-site investigation, and questionnaire surveys, risk maps with different scenarios, in combination with hazard, vulnerability, and exposure maps, are constructed for HCMC, and a framework for flood risk management in a river system connected to the city is proposed. This study recognizes the potential for interaction between the engineering-based approaches and those based on land-use planning and socioeconomic vulnerability. The chapter also assesses how current challenges relate to an agenda for interdisciplinary risk management science and contend that science-based decision-making can contribute much to risk management in the context of urban flooding in vulnerable Asian cities such as HCMC.

Keywords Urban flood risk · Risk management · Flood vulnerability · Flood damage · Urban resilience

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https://doi.org/10.1007/978-981-19-8726-7_20

1 Introduction

Urban flooding is a serious and growing development challenge, particularly for the residents of rapidly expanding towns and cities in developing countries. Against the backdrop of demographic growth, urbanization trends, and climate change, the causes of floods are shifting, and their impacts are accelerating (Jha et al. 2012). Vulnerability-based approaches and risk analysis are widely used for flood management nowadays. Flood vulnerability, a function of the character, magnitude, and rate of climate variation to which a system is exposed, its sensitivity, and its adaptive capacity, contributes in a major way to the management of urban flood disaster (Balica et al. 2012, 2009). Given this wide range, the difficulty of flood disaster control and the corresponding uncertainties, flood disaster vulnerability estimation has also become the central issue of international urban hydrology and scientific damage research. Exactly how to assess the flood disaster vulnerability is key to implementing flood management practices in cities (Costas et al. 2017).

In recent years, urban flooding has become a widespread phenomenon and a major concern in Ho Chi Minh City, one that has been accompanying the city's rapid growth (Tran et al. 2018; Vanderlinden et al. 2017). This chapter presents a method to measure the flood vulnerability and risk in Ho Chi Minh city. Three major elements related to the potential flood damages are discussed: vulnerability, exposure, and risk. The interaction between the hazard, vulnerability, and exposure indicates the risk level of the urban area. Using the information from collected datasets, on-site investigation, and questionnaire surveys, the risk maps with different scenarios are built in a combination of hazard, vulnerability, and exposure maps. Based on the risk maps analysis, a framework for flood risk management in the Dong Nai–Sai Gon river system focusing on Ho Chi Minh City is proposed.

2 Materials and Methods

Researchers' notions of vulnerability have changed over the past two decades, and consequently, there have been several attempts to define and capture what is meant by the term. Normally, vulnerability in this context can be defined as the diminished capacity of an individual or group to anticipate, cope with, resist, and recover from the impact of a natural or man-made hazard (Balica et al. 2012, 2009; Le Ngoc Tuan 2017). Flood vulnerability is considered in the study of the Flood Vulnerability Index (FVI) as the extent of harm that can be expected under certain conditions of exposure, susceptibility, and resilience (Balica et al. 2012; Tran et al. 2018; Vanderlinden et al. 2017). The main objective of flood vulnerability assessment is to inform decision-makers or specific stakeholders about options for adapting to the impact of flooding hazards (Balica et al. 2009). The need for vulnerability analysis is noted in scientific literature, and the concept includes natural vulnerability, social vulnerability, and

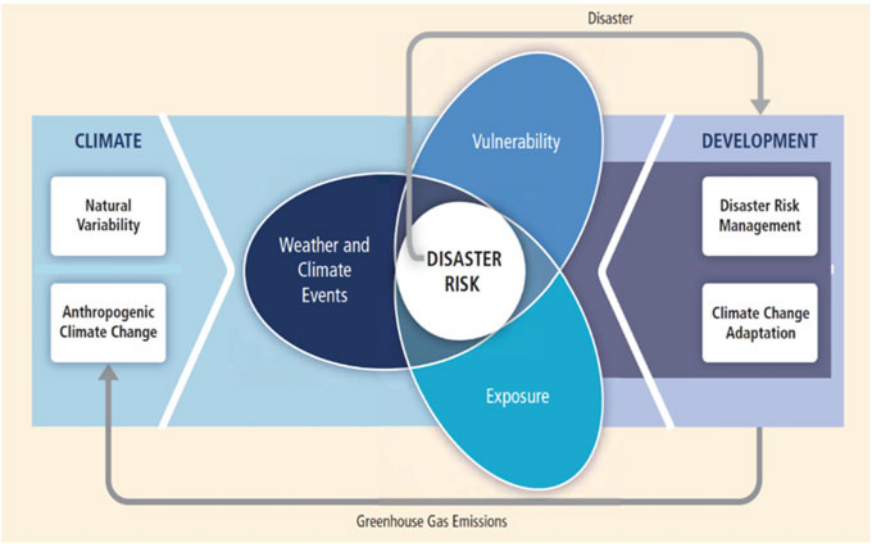

Fig. 1 Schematic diagram of disaster risk (IPCC, Field et al. 2012)

economic vulnerability. Exposure is considered as the presence of people, livelihoods, environmental services and resources, infrastructure, or economic, social, or cultural assets in places that could be adversely affected by flooding. Flood risk is defined as a combination of separate components: flood hazard, exposure, and vulnerability, as shown in the following Eq. (1).

$$\text{Flood risk} = \text{Flood hazard} \times \text{Exposure} \times \text{Vulnerability} \quad (1)$$

The flood risk indicated on the risk map has been combined with a hazard map, exposure map, and vulnerability map (Bui et al. 2017). A schematic diagram of disaster risk is shown in Fig. 1.

Hazard map: A hazard is an event or a process that is perceived as a threat. The hazard map is a background map to establish the exposure map, vulnerability map, and risk map. A hazard map, typically developed with GIS, relies on the results of the 1D and 2D hydrodynamic models. The hazard maps show the flooding location and depth. The process for building a hazard map is shown in Fig. 2.

Exposure map: Flood exposure takes into consideration the people, as well as all other components, including infrastructure, resources, environmental services, or economic, cultural, and social assets, in the flooded area or in areas that could potentially be affected by flooding. An exposure map was established from the collected survey data in combination with flooding maps (IPCC, Field et al. 2012).

Vulnerability assessment: The methods used to establish the vulnerability map are based on field investigation and interviews, in combination with data analysis and

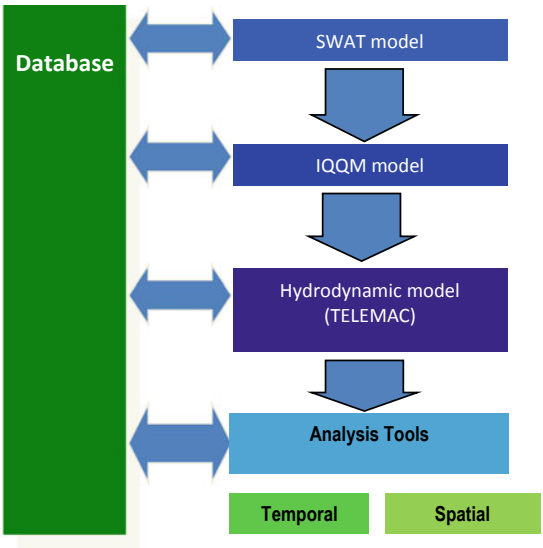

Fig. 2 The process for building a hazard map

GIS techniques to convert numerical data to a digital map. The structure of the vulnerability assessment tool includes a set of Vulnerability Indexes (VI), baseline maps, an information collection tool, and data analysis and assessment tools. VI includes quantitative and qualitative indexes in two typical areas (one rural and one urban). Baseline maps include maps for population, land use, social attributes, and infrastructure. Information collection tools include questionnaires based on quantitative and qualitative vulnerability index sets for officials of local wards, communes, and enterprises. Data analysis and assessment tools consist of data analysis software (Excel, PSPP) and mathematical tools used to analyze the VI, such as the formula for Gini coefficient calculation.

3 Analysis, Results and Discussion

3.1 Study Area and Dataset

The vulnerability-based approach was applied in the case study of Ho Chi Minh City. The study area covers all the Sai Gon–Dong Nai river basin with five provinces: Dong Nai, Tay Ninh, Binh Dương, Binh Phuoc, and Ho Chi Minh City. Ho Chi Minh City (HCMC) currently has nineteen urban districts and five rural districts with an area of 2095.01 km^2, a population of 7.995 million inhabitants, and an average population density of 3401 people/km^2. HCMC is the economic center of Vietnam and accounts for a large proportion of Vietnam's economy [3, 10].

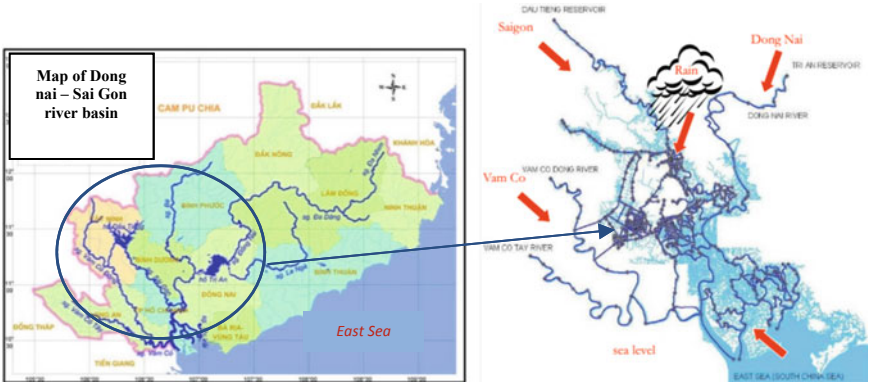

Fig. 3 Dong Nai–Sai Gon river system and Ho Chi Minh city

HCMC lies downstream to the Dong Nai–Sai Gon river systems; therefore, it has a diverse network of rivers and canals with a density of 3.38 km/km^2. Although the city is located between two big rivers named Sai Gon River and Vam Co Dong River, it is influenced more by the Dong Nai river system (Fig. 3).

Originating from the Lam Vien plateau, the Dong Nai River has a large basin (approximately 45,000 km^2). With the average flow of 20–500 m^3/s, it is the main source of freshwater in the city, providing 15 billion m^3 of water to residents. Sai Gon River originates from Hon Quan and flows through Thu Dau Mot. The length of the river that flows through the territory of the city is 80 km. It has an average flow of 54 m^3/s with a width of 225–370 m and the depth of 20 m (Pham et al. 2013; Truong et al. 2018). In contrast, the water flow of Vam Co Dong River is relatively small; it is connected with Vam Co Tay River and Dong Thap province by many tributary rivers and canals.

Thanks to its favorable natural conditions, HCMC has become an important traffic hub for Vietnam and Southeast Asia, including roads, railways, waterways, and airways. Due to rapid population growth, inadequate and poorly functioning infrastructure and low public awareness, HCMC is now challenged by environmental pollution, the causes of which include direct discharge from untreated wastewater to canals, creeks, and rivers. In recent years, HCMC has been significantly flooded, especially during the rainy season from June to November and during flood-tides between September and December. Flooding in HCMC is caused by high-intensity rainfall, flood tides, poor effectiveness of wastewater drainage systems in rural areas, inefficient operation of reservoirs, and land subsidence due to groundwater withdrawal. The occurrence of heavy rainfall events has been increasing in recent centuries. Wastewater and stormwater drainage systems of HCMC have been downgraded and overloaded during heavy rainfall events, while those systems have not yet been constructed in many places in the city. As a result, flooding due to high rainfall intensity has been frequent. High tides in the East Sea obstruct water flow of the upstream river and the urban drainage to the sea, causing flash floods. On top

of improving the drainage capacity of canals and sewer systems in central areas of the city to combat flooding caused by frequent high-intensity rainfall, HCMC is also challenged with an inflow of the East Sea to the canal system. This inflow causes an increase in the water level in canals and obstructs its flow from the city center to the Sai Gon–Dong Nai river system, especially during high tides. For our analyses, the total Dong Nai–Sai Gon river system is divided into five basins including La Nga, Dong Nai, Be, Sai Gon, and Vam Co Dong river basin (Pham et al. 2013; Truong et al. 2018).

Location-based estimation of flood risk in urban areas supports flood disaster management operations, particularly those of mitigation and response. Essentially, the estimated risk is managed by taking measures to reduce the exposure and vulnerability of identified elements to the flood hazard.

The study analyses are based on the following dataset:

- Hydrological data: Rainfall data from 40 gauges in the basin, water level and discharge data from 10 gauges and the sea.
- Dong Nai–Sai Gon river system administrative boundaries.
- Dong Nai–Sai Gon river watershed including the topographical data, a cross-section of rivers and canals, climate data, etc.
- Land cover, classified data derived by WorldView-2 satellite imagery, ground pixel size 2 m × 2 m.
- Digital elevation model (DEM)–provincial tiled dataset, ground pixel size 10 m × 10 m with 32-bit pixel depth.
- Census tract boundaries, vector polygonal data, Statistics Vietnam.
- Demographics data—Tabular data, Census 2016, Statistics Vietnam.

All data were in (or converted to) the raster format with a ground resolution of 10 m × 10 m. This was based on the resolution of the DEM data. Spatial Reference: UTM Zone 48.

3.2 Scenarios

Based on the main reasons for flooding in the study area in the recent years, five scenarios have been chosen for the risk analysis:

Scenario 1 (Flooding + High tide): In November 2008, Dau Tieng Reservoir flooded about 600 m^3/s in several hours, and there was heavy rain at the same time causing inundation in the suburb and the city.

Scenario 2 (Heavy rain + High tide): A heavy rain on July 21, 2009, lasted 4 h, causing severe flooding in the city. The rainfall measured from 13:30 to 15:00 was 82 mm, and the total rainfall of the whole day was 100 mm. With the high tide, rainwater could not be drained away and caused dike breaks at 40 points in HCMC. Many places were flooded over 1 m.

Scenario 3 (High tide): The high tide lasted for 3 days (November 7, 8, 9, 2010) causing severe flooding including District 8, Binh Thanh District, Thu Duc, and Hoc Mon district.

Scenario 4: Sea-level rise 25 cm. Phuoc Hoa Reservoir discharges about 300 m^3/s; Tri An Reservoir discharges about 800 m^3/s.

Scenario 5 (Extreme scenario): Heavy rain with a frequency of 1%, Dau Tieng Reservoir discharges about 1662 m^3/s (with flood frequency of 0.1%); Phuoc Hoa Reservoir discharges about 300 m^3/s; Tri An Reservoir discharges about 1800 m^3/s, and the tidal boundary is high, with 1.54 m and climate change with a sea-level rise of 25 cm.

3.3 Hazard and Exposure Map

Hazard maps (flood maps) were established by a numerical simulation method for flooding in depth and inundation duration. Numerical model TELEMAC 2D is used to simulate the flow regime of the river system. Module PostTelemac is applied to build the inundation depth maps, inundation duration maps. TELEMAC is short for the open TELEMAC-MASCARET system, a well-tested, high fidelity CFD software product developed and supported by Laboratoire National d'Hydraulique et Environnement (LNHE), France. One of the strong points of TELEMAC is a fast simulation tool for 2D modeling of sophisticated river systems (Bui et al. 2017).

The numerical model grids cover: (a) from behind the Dau Tieng dam on the Sai Gon River; (b) behind the Tri An dam on the Dong Nai river; (c) from Be river to the Phuoc Hoa dam; (d) from behind Can Dang hydrological station on Vam Co Dong river; (e) on the Vam Co Tay river from Moc Hoa to the East Sea. In general, the model area covers from the reservoirs on the Sai Gon and Dong Nai rivers and upstream boundary points of the Vam Co Dong and Vam Co Tay rivers and runs to the East Sea. The model was extended about 50 km to the East Sea to calculate the wave propagation.

The horizontal model area covers from Vam Co River to Dong Nai River, including the major river basins of Vam Co Tay, Vam Co Dong, Sai Gon, Dong Nai, Soai Rap, Long Tau, Rach Tra, Nhieu Loc-Thi Nge, Kenh Te canals, etc. (shown in Fig. 4). Exposure can be understood as the values that are present at the location where floods can occur. These values can be goods, infrastructure, cultural heritage, agricultural fields, and people [5]. An exposure map is created in combination with multiple layers of background maps, such as those detailing population, goods, and flooding. Background maps with this information are defined as follows:

- Layer 1: maps of population density and land use (housing, industrial areas, commercial area, park, greenery area, waterway, agriculture, forestry, transport infrastructure)
- Layer 2: maps of cultural heritage

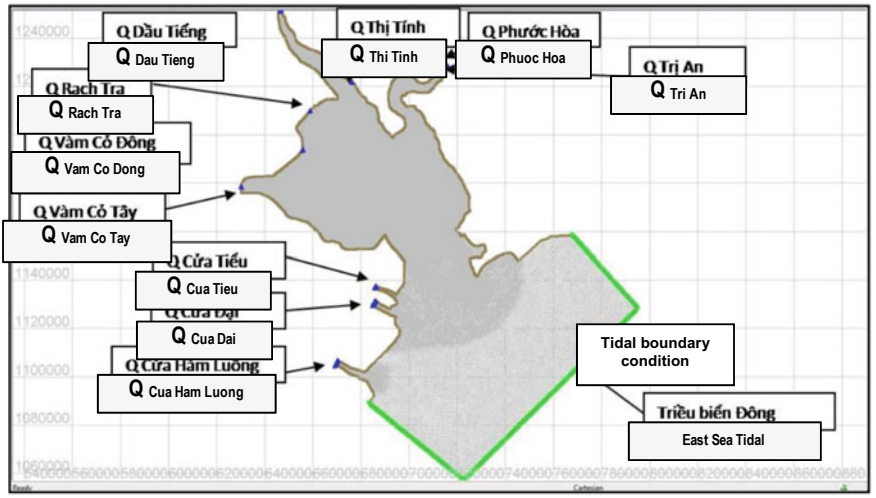

Fig. 4 Schematic of 2D numerical hydrodynamic model

- Layer 3: maps of important infrastructure, such as hospitals, schools, prisons, commissions, markets, railway stations, airports, bus stops, and ports.

To establish the exposure maps, the central location of each object (construction or architecture) is shown on the map. These locations need to be spatially referenced and given a coordinate system that can be converted to a coordinate system of maps showing flood characteristics. Based on this coordinate system, the objects will be determined in areas of the flooding characteristics. Different color levels on the maps describe the exposure levels of objects. In this study, exposure is classified into three levels: low, medium, and high, corresponding to two characteristics of flood: depth and duration (see Table 1). The exposure maps were developed with 100 surveyed wards and communes in rural and urban areas in Dong Nai river basin, including the HCMC area (see Fig. 5). This map shows the impact of flooding onward and communes in the study area.

Table 1 Exposure levels

	Depth			Duration		
	High	Medium	Low	High	Medium	Low
Value	>0.5 m	0.2–0.5 m	0–0.2 m	>14 h	6–14 h	1–6 h
Value code	3	2	1	3	2	1

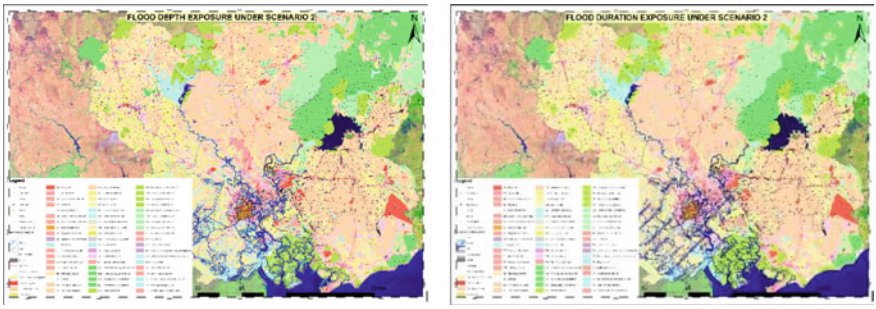

Fig. 5 Exposure maps under scenario 2

Table 2 Vulnerability levels based on the survey data

Vulnerability level	Value (The higher the value, the more vulnerable)	Name of legend in the maps
Very high level	5	High vulnerability
High level	4	Medium high vulnerability
Medium level	3	Medium vulnerability
Low level	2	Medium low vulnerability
No harm	1	Low vulnerability

3.4 Vulnerability Assessment

A vulnerability index (VI), based on literature review and theoretical and empirical survey, was built to assess the vulnerability to flooding. Three areas combined with the questionnaires are defined to survey in urban, industrial, and rural areas. Through the VI and collective data, the questionnaires have been specifically designed for the survey to get the data for the vulnerability map. The data obtained from these vulnerability indexes are expected to show the vulnerability level of people and property in terms of flooding risk. This data have been analyzed and transferred to the GIS maps. The vulnerability levels based on the survey data for each index group are classified into five levels (Table 2). Subsequently, the vulnerability map is classified into five vulnerability index groups (Table 3): economic vulnerability, infrastructure vulnerability, housing vulnerability, social vulnerability, and demographic vulnerability. The vulnerability maps are shown in Fig. 6.

3.5 Risk Analysis

As introduced in the previous section, flood risks are understood as negative impacts on the territory, regions, people, social life, social activities, and economic activities

Table 3 Vulnerability index components urban area

Vulnerability	Index	Sources	Quantitative/qualitative
Economic vulnerability	The percentage of people who have a household registration but still have to rent a house	Collective data	Quantitative
	Education: the number of people who have not finished high school	Collective data	Quantitative
Infrastructure vulnerability	% alleys made of soil/gravel	Survey	Quantitative
	% alleys with no drainage system	Survey	Quantitative
Housing vulnerability	% low quality housing	Collective data	Quantitative
	Average data about housing type/person	Collective data	Quantitative
Social vulnerability	Gini coefficient (inequality coefficient in housing ownership)	Collective data	Quantitative
	Conflict level	Survey	Qualitative
	Access to power	Survey	Qualitative
Demographic vulnerability	Education index: number of people who have not finished high school	Collective data	Quantitative
	Age	Collective data	Quantitative
	% immigrants	Collective data	Quantitative
	Gender	Collective data	Quantitative

Table 4 Flood risk level

Flood risk level		Vulnerability level				
		5	4	3	2	1
Exposure level	3	Extremely high	Extremely high	High	High	High
	2	High	High	High	Low	Low
	1	Low	Low	Low	Low	Low

of a given region. As defined with the following formula, flood risk in this study is calculated using a three-part equation of hazard, exposure, and vulnerability. Hazard risks are considered in terms of five scenarios. Exposure is considered from the dual perspectives of depth and duration of inundation. And finally, vulnerability is represented by an aggregation of five vulnerability index groups. The flood risk formula is calculated as follows:

$$\text{Flood risk} = \text{Hazard(5 scenarios)} \times \text{Exposure(inundation depth}$$

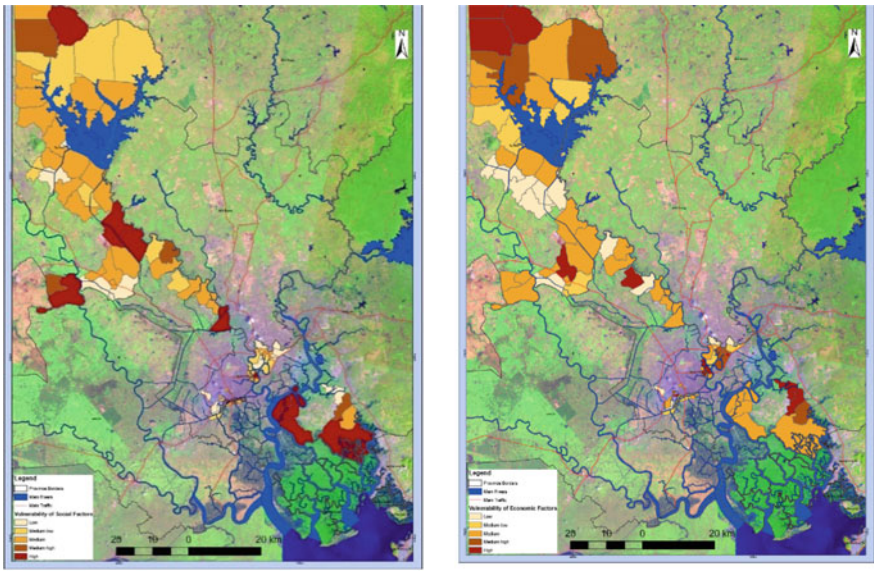

Fig. 6 Vulnerability maps of social (left) and economic (right) factors

+inundation duration) × Vulnerability (5 indexes)

By combining three different levels in exposure maps (high, medium, and low depth and duration) with five different levels in vulnerability maps, we have three different levels in flood risk maps. For example: Vulnerability = 4 or 5 and Exposure = 3: Extremely high flood risk, Vulnerability = 4 or 5 and Exposure = 2: High flood risk, Vulnerability = 4 or 5 and Exposure = 1: Low flood risk

The whole assessment area has a total area of 401,094 ha and is divided into ten sub-regions in which the Ho Chi Minh City is classified into three sub-regions: Northern HCMC (Zone 1: Cu Chi and Hoc Mon district), Southern HCMC (Zone 2: Can Gio district), and Central HCMC (Zone 3).

The results indicate that with Scenario 5, 46% total area is flooded with depth >0.5 m causing 50% area of Central HCMC flooded with depth >0.5 m (see Table 5). Some areas are under extremely high risk in terms of economic and demographic factors.

Flood risk maps are analyzed into areas of *low, high,* and *very high*-risk levels for five factors (social, economic, demographic, infrastructure, and housing) (see Fig. 7). There are two ways to analyze risk areas based on the risk maps.

Based on the majority flooded area (>50% of the total flooded area) of the risk levels for each factor in the sub-region to assess the risk level:

- Very high-risk area >50% of total risk area: **Very high risk**
- Very high-risk area <50% of total risk area and Very high-risk area + High-risk area >50% of total risk area: **High risk**

Table 5 Flooding areas in HCMC under scenarios 2 and 5

Area	Flooding area (ha)							
	Scenario 2				Scenario 5			
Flood depth (m)	No flood	<0.2	0.2–0.5	>0.5	No flood	<0.2	0.2–0.5	>0.5
Zone 1	15,502	7056	5112	7660	15,858	3386	3048	13,038
Zone 3	25,351	20,409	13,144	23,947	22,413	9421	10,086	40,929
Zone 2	1519	16,475	15,564	22,404	719	1070	4,873	49,300

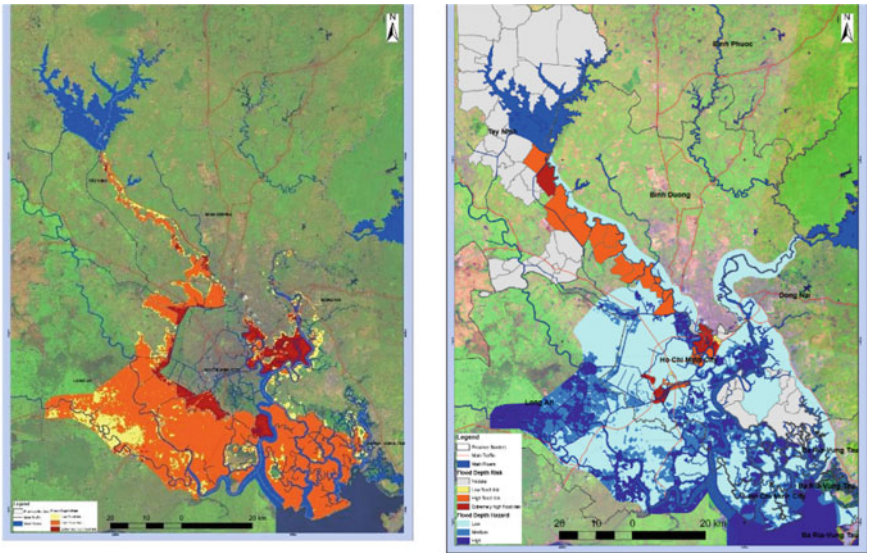

Fig. 7 Flood depth risk maps to infrastructure deficit under Scenario 5 (left) and 2 (right)

- Low-risk area >50% of total risk area: **Low risk**.

The results of the flood risk of HCMC under Scenario 5 are integrated in Table 6.

Table 6 Flood risk of HCMC under Scenario 5

Areas	Scenario 5				
	Social	Economic	Demographic	Infrastructure	Housing
Zone 1	H	H	H	H	H
Zone 3	H	H	H	VH	H
Zone 2	H	H	VH	H	H

(*Note* H: High risk, VH: Very high risk)

4 Conclusions

In this chapter, the vulnerability-based framework for flood hazard and flood risk assessment was successfully applied to HCMC, which in the recent years has experienced significant flooding, especially during the rainy seasons from June to November and during flood tides between September and December. Flood risks in this study are understood as negative impacts on the territory, regions, people, social life, and economic activities. They are considered as a combination of three elements: flood (potential damages) hazard, vulnerability, and exposure. Flood hazard calculation is implemented in the hydrodynamic model of the whole basin. Exposure maps are established from the collected survey data in combination with hazard flood maps.

Three different levels of flood risk maps have been developed by overlapping five scenarios of the hazard maps, exposure maps, and vulnerability maps with five indexes. The research results of the HCMC case study show that under certain circumstances (Scenarios #5 and #2), there are very high and high levels of flood risk in the Central and the Southern parts of the city, respectively. Based on the assessment of flood vulnerability and risk, feasible measures can be proposed for each indicator or criterion toward developing planning and management strategies for minimizing flood risks in HCMC and other comparable urban areas.

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Climate Migrants in the Dhaka Metropolitan Region: The Process of Livelihood Adaptation

Nurul Islam Nazem, A. Q. M. Mahbub, and Md. Anwar Hossain

Abstract Bangladesh is one of the most vulnerable countries in the world to the impact of climate change, evidence of which seems to be present all over the country. The cities and towns also face severe impacts. Dhaka, the capital of Bangladesh and one of the largest metropolitan regions in the world, is facing many adverse impacts of climate change, both directly and indirectly. Dhaka accommodates many internally displaced populations, along with other impacts from climatic hazards. From this perspective, the present research aims to explore the context of migration to Dhaka due to climate change and environmentally induced problems, as well as the adaptation strategies of the migrants as they arrive at the city. This study is based on primary data collected from a large census of 12,078 migrant households in the Dhaka Metropolitan Region. Around 20.9 percent of these households were identified as having left their place of origin due to climate change-induced factors. A random sample of 553 households was selected from this sub-group of "climate change-induced migrants" (climate migrants*)* for a sample survey in the final phase of the analysis. Our study revealed that immediately after migration, the majority of the mostly unskilled jobs found by this group was in the informal sector although, over time, the migrants tried to upgrade to more skilled sectors. More than two-thirds of the surveyed households enhanced their income after a prolonged stay in the city although some failed to reach their pre-migration level of income. The study findings reveal that despite a lack of institutional support, Dhaka City remains the major destination point for climate migrants and that the city ultimately accommodates them, enabling them to earn livelihoods in their adopted metropolitan environment. Our research hopes to draw attention to the multifaceted issues connected to climate change-induced migration to the big cities, where a well-coordinated approach is needed to address them.

Keywords Climate change · Environmental disaster · Migration · Adaptation · Climate migrants · Dhaka metropolitan region

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1 Introduction

Climate change is a harsh reality, and its impact is one of the biggest challenges for developing countries, where it is extremely difficult to deal with the consequences of climate change and environmental disaster, due mainly to limited capacity. However, despite limited institutional measures from authorities, the people, who are the most vulnerable to climate change effects, often take individual initiatives and set their own adaptation strategies. Migration to cities for seeking fortune is one such effective and individualized strategy adopted by displaced and vulnerable people, the so-called "climate change-induced migrants." Since the term "climate migrants" has been used interchangeably with "climate change-induced migrants," we use "climate migrants" in the rest of the paper.

The relationship between climate change and migration is often thought to be deterministic, and it is assumed that people living in climate-vulnerable areas would be displaced (Édes, Gemenne, Hill, & Reckien 2012). Studies show that the relationship between climate change and migration is complex and controlled by socio-economic and political drivers (Albo & Alscher 2011; Jäger, Frühmann, Grünberger, & Vag 2009). Black et al. (2011) tried to conceptualize a framework for climate-induced migration (Fig. 1). They argued that there are numerous factors that influence a person or family in their decision to migrate. These factors are so closely associated and interrelated that it makes little sense to consider any of them in isolation. They argue that environmental or climate change drivers affect all the socio-economic and political drivers that are associated with vulnerable people's migration and livelihood. Finally, household circumstances, political characteristics, and intervening obstacles and facilitators influence the decision to migrate or to stay. The migration can be temporary or permanent, planned or forced, local or international.

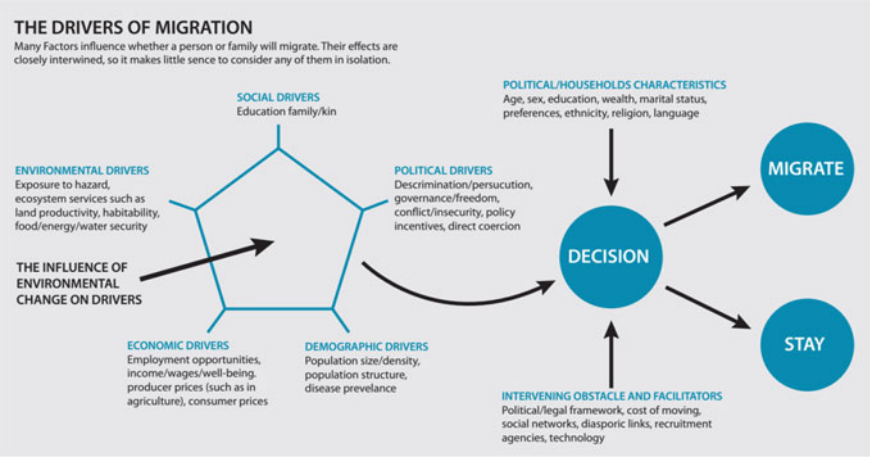

Fig. 1 Conceptual framework for climate-induced migration. *Source* Black et al. (2011)

Recent studies clearly show that people are being displaced from climate-vulnerable areas, especially from coastal and flood-prone areas (Édes et al. 2012). The primary destinations for these displaced people are big cities where they can get easy access to diversified opportunities to recover from the shocks. The process of migration is socially embedded (Thieme 2006) and depends on and creates social networks (Vertovec 2002). In the destination areas, such networks guide migrants to access specific places and jobs (Sharma et al. 2015)**.** However, leaving their place of origin does not always reduce the vulnerabilities of the affected people as hoped, as they start a new struggle to secure income, shelter, and livelihoods in a new urban environment.

Although there have been a significant number of studies that explored the causes and consequences of climate change and adaptation measures at the local level, there is still a gap in our understanding as to how climate migrants adapt to a new environment and develop livelihood strategies at the destination. Moreover, we do not know who the people are and which institutions in the cities support the migrants in finding jobs and settling down. Considering these gaps and to better understand the adaptation process of this group of migrants, the present study was formulated to focus at the destination end, namely, Dhaka City, the capital and largest city of Bangladesh.

More specifically, the present paper, derived from a larger study, aims to focus on (a) the procedure of identifying climate migrants from among all migrants, (b) their livelihood adaptation process, especially how they manage to survive in the new urban environment, and (c) the impact of migration on their economic condition.

2 Climate Change and Migration in Bangladesh

Bangladesh is one of the countries most vulnerable to climate change due to its geophysical and socio-economic circumstances (Siddiqui & Hossain 2019). Low-lying floodplains of the country can easily bear the brunt of severe flooding due to extreme rainfall in the upstream regions or glacial melting in the Himalayas. In addition, intrusion of salinity into the coastal areas due to probable sea-level rise, or riverbank erosion followed by an overflow in the rivers, may also cause severe vulnerability. Moreover, socio-economic conditions, especially poverty in coastal areas, dependency on land for livelihoods, high dependency rate, and inequality, make the country and the people more vulnerable to climatic disasters.

Bangladesh has already experienced the consequences of climate change. Each year, a significant number of people are being affected by climatic disasters. Depending on their social and economic circumstances, many of them are forced to leave their places of origin, while many also stay back. Dhaka City alone receives nearly half a million people as migrants each year, of which at least one-fifth are climate migrants (Ishtiaque & Nazem 2017), and there is evidence that such migration is gradually increasing. The challenges at the urban end are huge. It is not easy to cope with the situation in cities. Studies show how these people face economic and

environmental challenges in context of Bangladesh (e.g., Afsar 2000, 2003; Siddiqui 2003). It is, however, necessary to assess how climate migrants cope with challenges in the cities they select as their final destination points.

Literature on growth and migration argues that people prefer to move to places where economic opportunity is higher (Harris & Todaro 1970; Todaro 1969; Zhang 2002). Irrespective of the difficulties inherent in the adaptation process in securing a livelihood, moving to such places is common. Such a mechanism for deciding on adestination has been found to be typical of all types of migrants. Many researchers argue that regardless of the reason for migration—whether they are pushed out of rural areas due to economic issues or due to reasons such as climatic vulnerability—the capital city of Dhaka is the primary destination for migrants in Bangladesh. The Dhaka megacity has received more than 56 percent of all lifetime migrants in Bangladesh (Jones et al. 2016). Recent patterns indicate that the megacity has received about 58 percent of the country's recent migrants (Jones et al. 2016). Ishtiaque and Nazem (2017) found that in the slums of Dhaka, about 19% migrants are climate induced. The city becomes an attractive destination because it holds the largest industrial, commercial, and services agglomeration in the country. Moreover, it also provides a significant number of informal opportunities (Jones et al. 2016).

3 Method and Data

3.1 Working Definition of Climate Migrants

In general, climate migrants are considered a subset of environmental migrants and defined as the "persons or groups of persons who, for compelling reasons of sudden or progressive changes in the environment as a result of climate change that adversely affect their lives or living conditions, are obliged to leave their habitual homes, or choose to do so, either temporarily or permanently, and who move either within their country or abroad" (IOM 2007) as cited in Kniveton et al. (2008). In this study, we considered those migrants as climate migrants who were directly or indirectly affected by climate change-induced disasters and who considered such an effect as one of the key causes of displacement. In our study, we considered flood, drought, cyclone, tornado, riverbank erosion, salinity, tidal surges, and coastal waterlogging as climatic disasters.

3.2 Methods and Sources of Data

This is an empirical study based on primary data. Dhaka Metropolitan Region (DMR) was selected as the study area as most of the migrants congregate in the capital city, Dhaka, a fast-growing metropolis of 16 million population. It was a challenge to

identify the climate migrants from the study area and to conduct a detailed study on their adaptation process in the city. A three-step process was followed to serve these dual purposes, the first two of which involved selection of respondents (the climate migrants).

First, potential locations within the city with high possibility of finding a significant number of migrants were identified. Based on the existing literature, it was assumed that areas characterized by more informal settlements, dense urban settings, rapid growth, and high concentration of labor-intensive industries have a higher potentiality to accommodate more migrants. As the census units are very large and not uniform in size (in terms of area), for the field survey, we used a grid-based approach overlaying satellite images. The entire study area was divided into 1,067 rectangular grids; each grid covered an area of 400 acres (each grid represented a ground dimension of 1540 m X 1040 m in an A4 size paper at a scale of 1:6000). It facilitated easy comprehension of the area both physically and from satellite images. Then, from the satellite images, the major land covers and locations of informal settlements were identified. Finally, the spatial data layers of population density, population growth rate, and house-structure type were placed as layers on the grid. Combining all these layers, we identified 443 grids (out of the total of 1067 grids) to use in a survey of climate migrants.

Secondly, a structured questionnaire was used to conduct the household-level survey (Appendix). The main goal of the survey was to make a list of migrants and the causes of their migration in order to identify the proportion of migrants in the study area whose moves were induced by climate change. The questionnaire also included items on respondent characteristics such as education level, current occupations, and income level. According to the scope of the research project, the target was to list about twelve thousand migrants in those 443 grids; we succeeded in identifying 12,047 migrant households (with an average of 27.2 migrant households in each grid). Finally, based on the survey, 2527 climate migrants, constituting about 21% of the total migrants, were identified, and their residential addresses and contact numbers were collected. Figure 2 shows the location of the climate migrants in the study area.

Thirdly, to understand the adaptation process of climate migrants in the city, we constructed a detailed questionnaire for conducting a sample survey. The sample size was calculated based on (a) the total number of climate migrants in the first phase of the survey (2,527 households), (b) 40% assumed prevalence indicators, (c) 4% margin of error and (d) 95% confidence level. Considering the above four criteria, the calculated sample size was 468. Assuming 10 percent non-response, the sample size became around 515. Finally, we collected data from 553 climate migrant households. The sample households were selected randomly. Table 1 shows the distribution of samples by sub-region in the Dhaka Metropolitan Region. The questionnaire was designed to collect the impact of climate disasters at their place of origin, as well as the migration process and adaptation process in the city. Moreover, we also collected socio-economic information on the migrants both at their places of origin and destination.

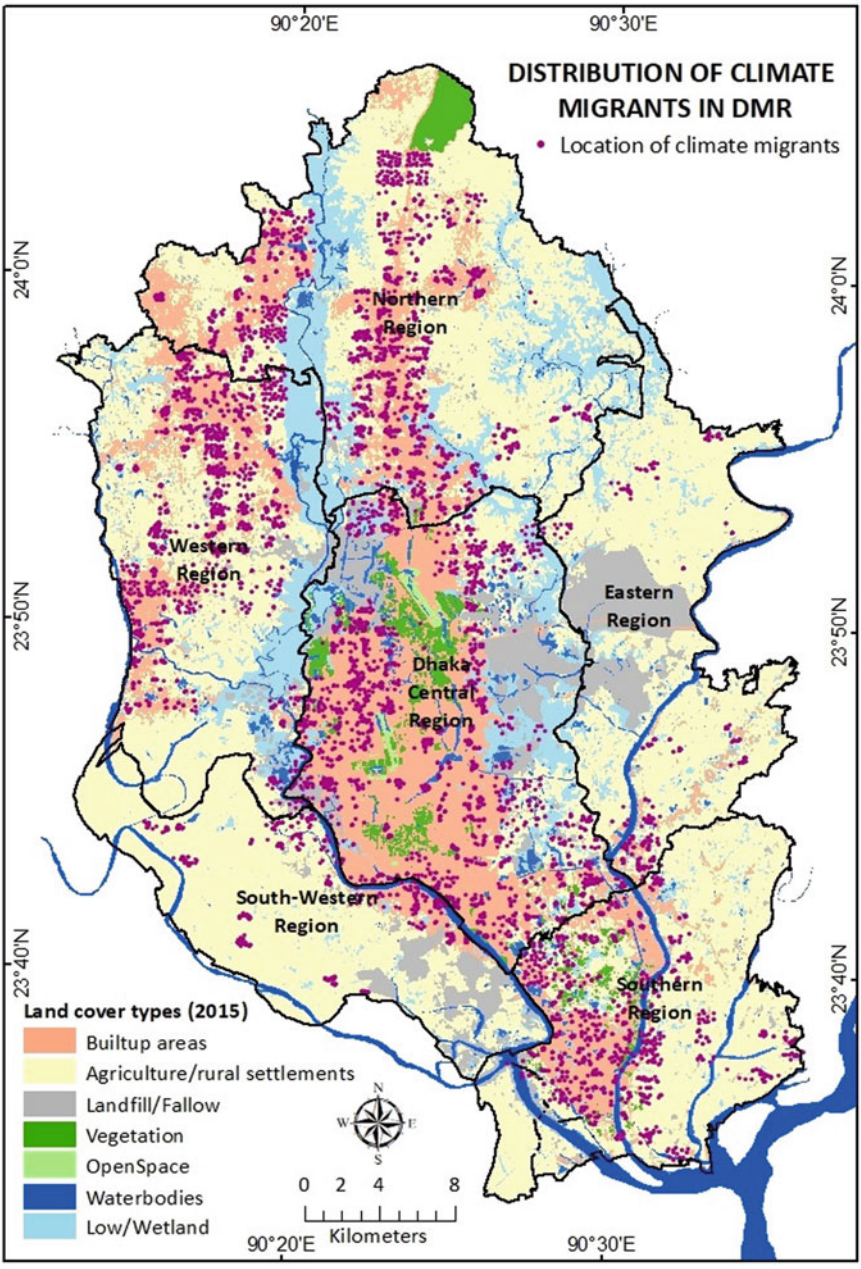

Fig. 2 Location of climate migrant households in the DMA

Table 1 Disstriution of samples by sub-regions in the DMR

Region name	Total migrants	Climate migrants	Sample size	% of climate migrants
Dhaka central region	4620	985	227	23.0
Eastern region	513	78	20	25.6
Northern region	2642	561	131	23.4
Southern region	1659	424	87	20.5
Southwestern region	547	100	16	16.0
Western region	2097	379	72	19.0
Dhaka metropolitan region (total)	12,078	2527	553	21.9

4 Findings and Discussions

This was a large sample survey on climate migration, covering a variety of issues and problems. In this paper, however, only one aspect, the migrants' economic adaptation process, is analyzed.

4.1 Climatic Disasters that Affected the Migrants at Their Places of Origin

The results of the study show that among six major types of disasters, more than 77% of the respondents were affected by riverbank erosion at their place of origin, followed by flood and cyclone (Table 2). All the migrants lost their assets fully or partially. Thus, all were considered victims of climate-induced disasters. Besides direct effects such as displacement, there were households that were affected indirectly by disasters such as having to sell off their assets to recover from disaster-induced loss or before leaving their place of origin. More than half (55%) of the households lost their land completely. About 80% of households (79.7%) lost their agricultural land, and 93.4% lost their homestead gardens (Table 3 and Fig. 3). It was also found that 89% of the migrant families lost livestock and poultry. For some families, livestock and poultry were their only asset and means of livelihood. Thus, the loss of livestock and poultry influenced many households to migrate for alternative livelihood strategies.

Land is a crucial resource for any household in Bangladesh. The study shows that while only 13.74% of the households did not own land before migration, the proportion of landless increased about five-fold after migration. Among all climate-induced disasters, riverbank erosion was the most devastating. However, more than three-fourths of cyclone-affected people reported that they lost their house during the disaster (Table 4).

Table 2 Number and percentage of affected respondents by type of climate-induced disaster

Disaster type	No. of respondents affected	Percentages
Riverbank erosion	426	77.03
Flood	216	39.06
Cyclone	79	14.29
Waterlogging	21	3.80
Drought	8	1.45
Salinity	3	0.54

* Multiple responses counted

Table 3 Number of households that owned and lost property and assets at place of origin before and after migration

Type	No. of HH owned resources			Percentage of HH owned resources		
	Before	After	Loss	Before	After	Loss
Total	477	197	280	86.3	35.6	58.7
Homestead	453	200	253	81.9	36.2	55.8
Agriculture	305	62	243	55.2	11.2	79.7
Garden	76	5	71	13.7	0.9	93.4
Livestock	172	19	153	31.1	3.4	89.0
Poultry	186	21	165	33.6	3.8	88.7

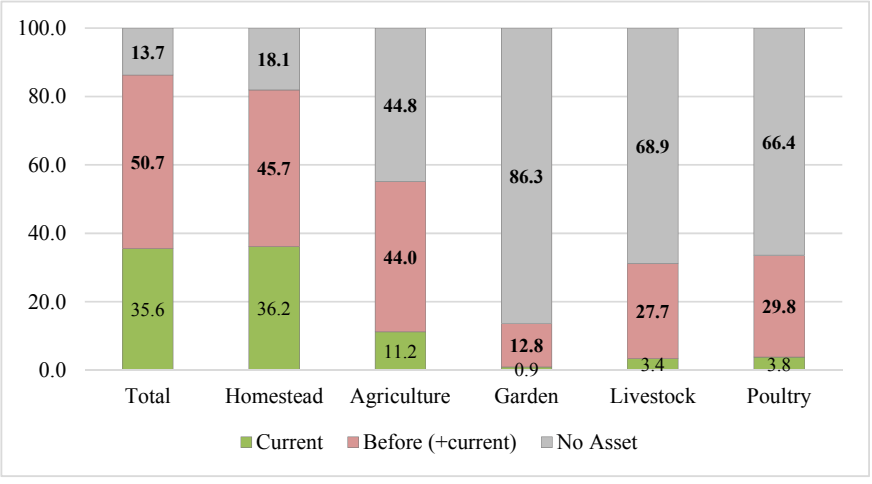

Fig. 3 Proportion of households that lost assets during disaster or after migration at their place of origin

Table 4 Loss and damages to the resource by disaster type

Types of loss	Riverbank erosion (n = 426)	Flood (n = 216)	Cyclone/Storm (n = 79)	Waterlogging (n = 21)	Drought (n = 8)	Salinity (n = 3)
Homestead land	84.3	36.6	21.5	9.5	37.5	0.0
Agricultural land/Crops	54.2	51.4	22.8	9.5	100.0	66.7
Perennial Trees/Pond	14.8	9.3	12.7	4.8	12.5	0.0
Houses	33.8	25.9	78.5	14.3	0.0	0.0
Cattle	10.6	13.4	10.1	0.0	0.0	0.0
Poultry	13.1	18.1	7.6	0.0	12.5	0.0

* Multiple responses counted

4.2 Process of Migration

Our study shows that migrants do not move without precise information about available opportunities at the destination. About 80% of climate migrants had prior information about Dhaka, their destination. Also, all of these households were able to manage the costs of migration and of settling down in the city. They received information about the destination from relatives, friends, and neighbors (Table 5). Only, about 15.2% of the migrants did not have information from any secured sources except hearsay. Only, 5% of the migrants collected the information on their own. The migrants moved to Dhaka either alone or with all or some of their family members. Our study revealed that most of the climate migrants either moved with their entire family (49.7) or by themselves (33.1%), while 11.4% made the move with their spouse. Only, 5.6% of the migrants took part of their family with them when they moved.

After migration, the main challenges for the migrants were to settle down in the new area and adapt to the city life and its environment, which differ significantly from their places of origin. The study found that human agency plays a crucial role

Table 5 Sources of information about the DMR as a migration destination

Source of information	No. of respondents	% of respondents
Self	28	5.06
Relative	245	44.3
Friend	44	7.96
Neighbor	88	15.91
Hearsay	84	15.19
Family member	64	11.57
Total	**553**	**100.00**

Table 6 Sources of help to settle down in the destination city after migration (multiple responses counted)

Sources of help	No. of respondents	% of respondents
Friend	60	10.85
Relative	330	59.67
Neighbor	97	17.54
NGOs	2	0.36
City Corporation	0	0.00
Government	0	0.00
Others	85	15.37

in this process of settling down in the new environment (Table 6). About 60% of the migrants received help from relatives after coming to Dhaka, followed by neighbors (17.54%) and friends (10.85%). This help involved both direct and indirect support to the new migrants in providing shelter, occasional offerings of food, and getting work, mainly from informal sector activities. Only, two of the respondents got help from NGOs, but those also got help from relatives. In our study, we did not find any evidence of institutional support for new migrants in the city.

4.3 Economic Adaptation of Migrants in the City

Economic adaptation of climate migrants in the city starts with searching for a job and securing a reasonable livelihood through a permanent source of income. This takes quite a long time, and the process is very tedious and hard. In comparison to other migrants, the climate migrants are comparatively less skilled and less educated. Thus, secure and technical jobs are not easily available to them. Most new migrants enter the informal sector, which is relatively easy for them to get into, but not very easy for them to survive in the long run. In most cases, they have to decide on an activity that can serve their first necessity, a reasonable income, to be able to live in the city. In such cases, the job might not match their choice or their pre-migration skill set or education. As they enter a new job in a new setting, they usually remain under pressure just to survive. Over time, once they receive the minimum income required for survival in the city, they are in a better position to look for jobs or work based on their skills, experience, and personal choices.

Sources of help finding a first job in Dhaka. Searching for and securing a job in a new environment of the city without getting help from others is almost impossible. New migrants get help from friends, neighbors, and relatives who have been in the city for quite some time. The personal network plays an important role in securing a first job in the destination city (Table 7). About 82% of climate migrants in our sample survey sought help from family members, friends, relatives, and neighbors to find a job, while a small minority managed to find jobs by their own effort.

Table 7 Sources of help in finding a job in Dhaka metropolitan region

Sources of help	No. of respondents	% of respondents
Self	98	17.75
Relative	233	42.21
Friend	65	11.78
Neighbor	97	17.57
Family member	59	10.69
Total	552	100.00
No data	1	

The immediate occupation of migrants after migrating to Dhaka. The study shows that the informal job sector in Dhaka, with a large variety of available activities, is the largest source of jobs for migrants. The present study shows that after migration to Dhaka, about 21% of the migrants worked informally as industrial workers, followed by unskilled laborers (18.63%), hawkers (13.20%), skilled laborers (9.40%), private sector employees (6.15%), and transport workers (4.52%) (Fig. 4). The study also shows that about 8.7% were involved in small trade and business activities, also in the informal sectors, and about 7.8% were found to be self-employed. As mentioned above, the migrants usually get low-skilled and low-productive sector jobs immediately after migration, as access to these jobs is easier than access to the skilled and high-productive sector jobs. However, after securing their first job to maintain their living cost in the city, the migrants then start to explore better opportunities that are more suitable to their interests and skills.

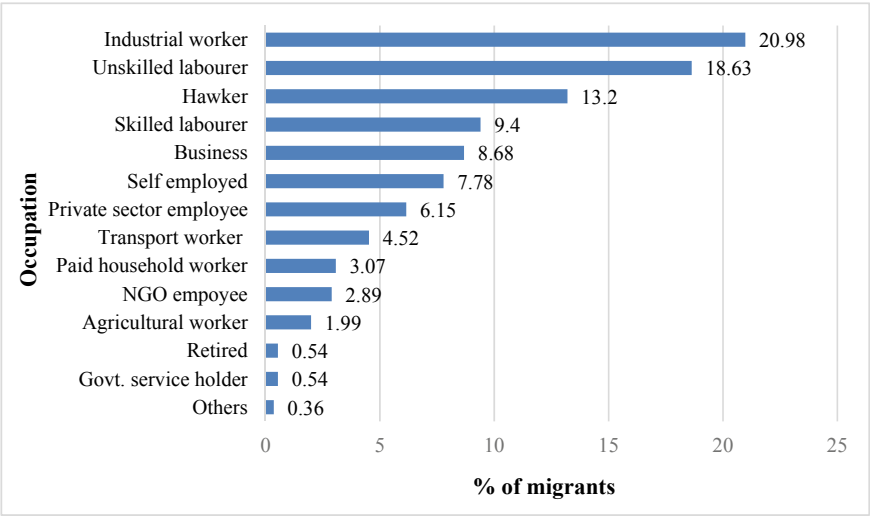

Fig. 4 Occupational pattern of migrants immediately after migration to DMR

Our study shows that about 38.5% of respondents changed their occupation during their stay at Dhaka City, as reflected in the proportional changes in the overall occupational structure. As Table 8 shows, although the largest proportion of migrants continued to work as industrial and unskilled workers, the share that did so decreased, while the proportion of transport workers, skilled laborers, and workers in business, as well as the self-employed, showed an increase.

The occupational transformation can be better understood by a simple index. We calculated a change index of the sectors by calculating the ratio of the number of current employment and past employment in any sector (Table 8). A ratio less than 1 indicates the sector is losing jobs; 1 indicates no change, and greater than 1 indicates the sector is gaining jobs. We found that index scores for hawkers, unskilled workers, industrial workers, and paid household workers were less than 1.00, which suggests that over time, migrants prefer to leave these sectors. The score was found to be lowest for hawkers, which may mean that while some migrants initially work as

Table 8 Occupational transformation pattern among the migrants

Occupation sectors	First occupation		Current occupation		Transformation index (final/first)
	No. of migrants	% of migrants	No. of migrants	% of migrants	
Agricultural work (AW)	11	1.99	8	1.45	0.73
Business (BU)	48	8.68	66	11.93	1.38
Govt. service (GS)	3	0.54	2	0.36	0.67
Hawker (HA)	73	13.20	33	5.97	0.45
Industrial worker (IW)	116	20.98	99	17.90	0.85
NGO service (NS)	16	2.89	11	1.99	0.69
Paid household work (PHW)	17	3.07	16	2.89	0.94
Private sector employee (PSE)	34	6.15	41	7.41	1.21
Self-employed (SE)	43	7.78	60	10.85	1.40
Skilled laborer (SL)	52	9.40	63	11.39	1.21
Transport worker (TW)	25	4.52	69	12.48	2.76
Unskilled laborer (UW)	103	18.63	70	12.66	0.68
Retired	3	0.54	3	0.54	1.00
Others (OT)	2	0.36	6	1.08	3.00
No Data (ND)	7	1.27	6	1.08	0.86
Total	**553**	**100.00**	**553**	**100.00**	**1.00**

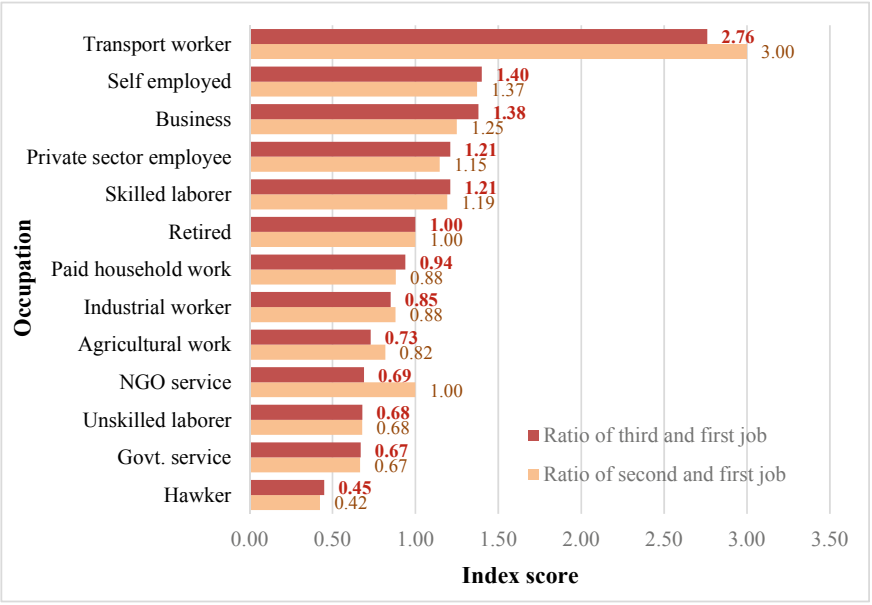

Fig. 5 Occupational transformation index of climate change migrants

hawkers because it requires minimum investment and is easy to start, they do not prefer to be involved in this sector for a long time.

The index scores for the transport, self-employed, business, skilled work, and private sectors are found to be higher than 1.00, which means migrants are changing their occupations from other sectors to these sectors. The score is found to be very high for the transport sector. From Fig. 5, it can be observed that in the occupational transformation process, migrants appear to be more attracted to the skilled and business sectors.

Inter-sectoral dynamics of occupational change. Occupational mobility among the sectors was found to be common. However, a good number of migrants did not change their occupation during the period they stayed in the city. Table 9 shows that occupational mobility is high among hawkers and unskilled laborers. About 45% (30 out of 73) of the migrant hawkers were still doing the same work since coming to the city. The rest of them moved out from this sector and are currently involved mainly in the business and transport sectors as unskilled laborers. On the other hand, most of the unskilled workers moved out to be involved in the business, transport, skilled activity, and self-employed sectors. Table 8 shows a clear pattern of migrants moving out from unskilled and low-productive sectors to the skilled, technical, and high-productive sectors.

Interest in changing occupation as related to current occupation. When asked whether the migrants were satisfied with their current occupation or wanted to change, about 40.7% indicated an interest in changing their occupation in the future.

Table 9 Inter-sectoral movements of migrants during their stay in the DMR

Occupation	Total	AW	BU	GS	HA	IW	NW	PHW	PSE	SE	SL	TW	UL	OT	ND
Total	553	8	66	2	33	99	11	16	41	60	63	69	70	6	6
Agricultural work (AW)	11	6									1	2	2		
Business (BU)	48		28			3			4	1	2	7	1	2	
Govt. service (GS)	3			2					1						
Hawker (HA)	73		10		30	1			1	5	2	13	11		
Industrial worker (IW)	116	1	5		1	81		1	3	7	4	7	5	1	
NGO service (NS)	16		3			2	6			2	1	1	1		
Paid household work (PHW)	17		1					14	1			1			
Private sector employee (PSE)	34		4			1	1		22	2	1	1	1	1	
Self-employed (SE)	43		1			1			1	32	2	3	3		
Skilled laborer (SL)	52		2			4	1			1	43	1			
Transport worker (TW)	25		1		1	1	1			1	1	19			
Unskilled laborer (UW)	103	1	10		1	5	2	1	8	9	6	14	46		
Retired	2													2	
Others (OT)	7		1												6
No Data (ND)															

Table 10 Whether the migrants are interested in changing their profession, by current occupational pattern

Current occupation	Responses			% of yes
	No	Yes	Total	
Business	56	10	66	15.15
Hawker	17	16	33	48.48
Industrial worker	57	42	99	42.42
Others	4	1	5	20.00
Paid household work	8	8	16	50.00
Private sector employee	22	19	41	46.34
Self-employed	39	21	60	35.00
Skilled laborer	37	26	63	41.27
Transport worker	35	34	69	49.28
Unskilled laborer	32	38	70	54.29
Retired	3	0	3	0.00
Agricultural work	8	0	8	0.00
NGO service	3	8	11	72.73
Govt. service	2	0	2	0.00
Unemployed	1	0	1	0.00

Table 10 shows that the migrants currently involved in business or the self-employment sector are less interested in changing their profession. Thus, it can be argued that self-employed and business sectors are the most preferred professions among the migrants. They are willing to be involved in these sector in the long run. Among these migrants who wish to change their occupation, about three-fourths are interested in starting their own business, followed by jobs in the private sector (6.82%), government (4.55%), agriculture (4.5%), and transport sector (4.55%). About 1.82 percent were found to be willing to go abroad in the future (Table 11).

Migrants' level of income. One of the key questions of the study is whether migration to the city is a successful adaptation strategy for climate migrants. To understand the impact of migration on their livelihood or economic progress, the study compares the pre-migration income level of the migrants at their places of origin to income at the destination in their first job after migration. The average household income at the origin and destination is shown in Table 12. As the migration occurred at different times, we classified the migrants into five-year cohorts and generated income statistics for each cohort to reduce the temporal effects and ensure comparability. The table shows that for every cohort, the income level had increased significantly after migration. Respondents who migrated after 2010 had an average monthly income of BDT 6,671 (USD 83) before migration, which increased to BDT 9045 (USD 113) after migration at their first job. A similar pattern of increased income was also found in other cohorts. Thus, at first glance, it can be argued that economic adaptation through migration was more or less successful.

Table 11 Preferred professional sector for migrants who wish to change their profession in future

Sector of profession	No. of respondents	% of respondents
Business	164	74.55
Private/NGO jobs	15	6.82
Government job	10	4.55
Agriculture/Fishing/Animal husbandry	10	4.55
Driver	10	4.55
Self-employed	7	3.18
Going abroad	4	1.82
Total	**220**	**100**
No preference	**5**	

Table 12 Average income of respondents at their place of origin and immediately after migration, by time cohorts

Year	No of respondents	At origin	Immediately after migration
< 1981	56	3505	6414
1981–1985	19	4538	7852
1986–1990	81	4143	7524
1991–1995	43	4309	8011
1996–2000	72	5169	8641
2001–2005	76	5270	9778
2006–2010	93	6244	9402
> 2011	113	6509	9045
Total	**553**	**5437**	**8538**

However, when we evaluated the respondents individually, we found that the income of about 13% of respondents decreased (income ratio is less than 1) after migration (Table 13). Income increased up to two times for 42.3% of respondents and more than doubled for 44.9% of respondents. Then, we went deeper to analyze income after deducting housing cost. We found that when the migrants were in rural areas, they lived in their own houses or relatives' houses. They did not have to spend any of their income on rent. However, in the city, they had to spend a significant proportion of their income on rent. While Table 12 clearly indicates that migration helped the migrants to enhance their level of gross income, it is important to note that the available income after deducting housing costs may not be enhanced that much. We found that for about 30% of respondents, the post-deduction income falls short of their income in the rural areas before migration. Moreover, income was found to have more than doubled for only 18% of the respondents, which was about 45% before deduction of housing cost.

Satisfaction level with their current economic condition. A qualitative assessment was undertaken to assess whether migration as an adaptation strategy was a

Table 13 Income ratio before and after migration

Income ratio*	Actual income (341)	Post-Deduction income (263)
< 0.5	2.9	11.8
0.5–1.0	10.0	17.9
1.0–1.5	23.8	25.1
1.5–2.0	18.5	17.5
2.0–2.5	17.0	10.6
2.5–3.0	12.9	7.6
> 3.0	15.0	9.5
Grand Total	**100.0**	**100.0**

* Income ratio = income after migration/income before migration

success or not. The findings show that about 8.7% of the respondents think that they are (i.e., migration was) highly successful in their economic adaptation, while 35.1% think that they are moderately successful. More than half (51.7%) of respondents think that their economic condition has not changed much since migration, and about 4.3 percent think that they have failed to secure reasonable economic adaptation.

5 Conclusions

Rapid urbanization is a typical characteristic of developing countries. The reasons for such rapid growth of cities and towns are many, including the consequences of climate change. Climate change has been accelerating the rate by pushing people from climatically vulnerable rural areas to the cities. The study shows that more than one-fifth of the migrants came to Dhaka City due to climate change and environmental vulnerabilities. The process of migration involves social networks, easy connectivity, rural–urban linkages, and personal contacts in deciding to move and settle in the city. However, there is a difference between climate change-induced migrants and other types of migrants. Climate change-induced migrants are associated with huge land losses and rural push factors, whereas other migrants are only associated with push factors. The study reveals that about 59% of the households lost their land due to climate-induced disasters. Such losses and rural push factors together make them more desperate to migrate from their place of origin.

Some distinctive features of climate-induced migration were identified in our research. Half of climate migrants moved to the city with their entire family, which is hardly the case for other migrants. Because of the often unplanned and precipitious nature of their displacement following a natural disaster, climate migrants are more vulnerable than other migrants. They accept mainly low paid informal jobs. Climate migrants change their occupation and job more frequently compared to others. Their

average income is also lower than that of other migrants. Climate migrants' linkages to their original sites in rural areas are also limited. The reasons behind such characteristics of migrants may be the loss of homesteads and assets at their place of origin. The study also shows that informal and unskilled sectors provide most of the jobs for climatic migrants. However, over time, they try to find skilled jobs. The study shows that although migration to large urban centers helps them improve their earning and livelihoods, these migrants face severe challenges to survive at the destination and make a living in the city.

Although only about one-fifth of all migrants moved to Dhaka Metropolitan Region as climate migrants, this is a significant number in terms of population size of Dhaka, one of the most densely populated cities in the developing world. Their contribution to the city's economy has been documented in many studies, but they have not yet been able to attract the attention of city authorities for institutional help with their struggle for accommodation in the city. There should be some institutional support for these vulnerable people, such as affordable housing facilities and health and education support with easy access. Moreover, the city authorities could control rent hikes, provide electricity, cooking gas, potable water, etc., in areas where the migrants prefer to live.

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Part III
Fresh Looks and Alternative Perspectives

Multifaceted Ideas and Approaches: An Overview of Presented Papers

Le Thi Thu Huong

Abstract The ongoing urban transformation process in some Asian countries appears to be intensifying over the last two decades, and the negative effects of which are affecting urban livability and raising concerns about a sustainable urban future. In line with the shifting trends in the theoretical and planning paradigms in the Asian context, as discussed earlier in the volume, a tendency to search for more inclusive and innovative approaches to address the complex, inter-connected, and universal (yet contextual) issues facing Asian cities is becoming more evident in the literature. In this introductory chapter to Part III, I present a set of twelve studies, which in one form or another, reflect several aspects of these changing outlooks, including an integrative, trans-sectoral, and participatory planning focus, and attention to environmentally friendly 'green' infrastructure and amenities. About half of the contributions are more focused on the physical and practical aspects of urban livability, while the rest are more non-physical or conceptually oriented. However, despite the diversities in scale, context, topic, method, and focus of research, urban livability concerns, as well as the integrative focus of the sustainability principles, are either readily apparent or implicitly present in most papers. Overall, the contributions support the idea that the search for sustainably optimizing urban livability of the large cities and their hinterlands in Asia will require collaborative, integrative, and fresh approaches to addressing urban developmental issues.

Keywords Urban transformation · Sustainable livability · Green Infrastructure (GI) · Citizen participation · Green space · Planning approaches

1 Introduction

Around the second half of the twentieth century, some of the newly independent former colonies in Asia started showing signs of rapid urban growth, which, propelled by both the rural push and urban pull factors, resulted in high levels of population

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concentration in large cities (ADB-IDB 2014; Christiaensen et al. 2013). Population pressure and lack of resources in rural areas produced an effect that led the people to flock to the cities (Henderson 2002); people living in rural areas were also pulled to the city due to the prevailing mindset that cities are likely to offer a better standard of living than rural areas in terms of job opportunities, income, and social amenities such as health care and education (Jedwab et al. 2015). In this respect, these forces gradually became some of the most motivating elements to encourage urban expansion and rapid urban growth. At the same time, rapid industrialization and globalization, as well as the many national and regional planning and policy initiatives, added to the ongoing urban transformation processes, which appear to be intensifying over the last two decades.

Despite higher productivity in terms of economy of scale and increased opportunities for both employment and a better standard of living in the cities, the negative effects of the rapid urban growth, and population concentration are affecting livability and raising concerns about a sustainable urban future. The dramatic increase in population spilling over the surrounding areas of the cities, combined with other factors such as shortages of infrastructural capacities, and governance issues, mean that basic needs are remaining unmet for millions of people, and damages to the environment and ecosystems are continuing unabated. Coupled with the persistent challenges of climate change and the vulnerability of many of the regions to natural disasters, the risks for developmental gains to be rolled back are many (UN-ESCAP, 2017).

In the context of this urban transformation taking place in different regions of the South, Southeast, and East Asia, many cities are facing a multitude of intertwined issues that overlap the economic, social, and environmental/ecological domains, commonly conceptualized as the 'three pillars of sustainable development.' These issues are complex, contextual, and manifest at different scales, making it difficult to categorize or identify them. These may include consumption and production of energy, waste production and disposal, environmental pollution, climate change, loss of biodiversity, land-use change, management of natural resources, threats to public health, social exclusion, economic crisis, poverty, etc. As cities and their hinterlands keep growing and changing, and the associated urban-environmental problems become more challenging, addressing these interconnected, complex, and evolving issues affecting all aspects of the urban environment at macro, meso, and micro levels and strategizing for sustainable development, requires ongoing vigilance, and a contextually responsive, pragmatic, and integrative approach.

As observed in the Introduction (Part I), academic thinking on urbanization, especially the Asian urbanization paradigm, is changing in many ways. For example, the discourse on the evolving concept of *sustainability*[1] has been joined by one on urban

[1] Over the past several decades, the various elements of the concept of sustainability and their multiple semantic and other interpretations have undergone many changes, which some have divided into three historical periods, namely, the pre-Stockholm Conference period, the post-Stockholm Conference (1972) period up to the Rio Summit of 1992 which produced the Brundtland Commission Report, and the post-Brundtland period that continues to date. For an account of the evolution of the concept(s) related to sustainability (and/or sustainable development) and their many conceptual and definitional confusions, see, Klarin 2018; and Mebratu 1998. An insightful discussion on

livability, and despite all the debates and confusions surrounding the exact meaning of these concepts, they have made a noticeable impact on the urban planning conversation. According to some (e.g., Ruth and Franklin 2014), compared to the broad, diverse, and far-reaching temporal and spatial implications of the former (global and intergenerational), the 'here and now' (or 'about to be') focus of the latter may have made urban livability a more tangible and achievable target for urban planners and researchers.

Although the interpretations and applications of these changes are variable (and at times contested), a tendency toward adopting a more integrative outlook (than in the past) is evident in the rapidly growing literature on Asian urban development. This also includes an effort to bring together some of the basic elements (e.g., the three e's or the three pillars—economy-environment-equity) inherent in the sustainability concept, with the two basic elements of urban livability (Ruth and Franklin 2014), namely, the wants and needs of the residents and the biological/physical environment of the urban place they live in. The increasing focus on themes such as green space, open space, green infrastructure, and citizen—and stakeholder—engagement is directly related to the livability concept but is also relevant from the standpoint of creating a sustainable urban environment.

These shifts in thinking are also motivating the urban planners and researchers to come up with creative solutions to complex problems of urban living that incorporate at least some of the sustainability and livability principles and to holistically consider the many dimensions of urban infrastructure (e.g., hard and soft; brown, gray, green, and blue) in a cross-sectoral approach to urban-developmental planning. The Smart City concept, in its many variations, can perhaps be said to be one example of this conceptual development. However, as noted in the introduction to Part II, although the urban planning traditions (albeit viewed in the Western context) are changing, thus creating 'hybridized' approaches that can potentially be more integrative in their outlook and more attuned to the varied sustainability and livability concerns, it has been observed that the older traditions are rarely discarded but remain viable and operational at variable degrees across space and time. This is a challenge for urban planners worldwide, Asia being no exception.

2 Empirical Studies: An Overview

As should be apparent to the readers, in one form or another, the studies selected for this part of the volume reflect several aspects of the paradigm shifts noted above, as well as earlier in the volume. As for the content, despite the diversities in scale, context, topic, method, and focus of research, urban livability seems primarily at the heart of the papers presented here. And even though the concept of sustainability

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the origin and evolution of the three commonly accepted prongs of sustainability (e.g., the three pillars), and on the conflation of the terms of sustainability and sustainable development, and their implications, can be found in Purvis et al. (2018).

per se has been addressed in only a few of this collection of twelve papers, the integrative focus of the sustainability principles is readily apparent in most. Together, the papers exhibit a range of analytical and innovative approaches and ideas in the context of urban transformation taking place in different places in Asia, which, while very much contextual, shows potential for adaptability in other contexts, scales, and environments.

Because of the interrelated nature of the papers, grouping and presenting them in any particular order was somewhat subjective. Of the studies presented in this Part, Part 3, the first six are deemed more non-physical or conceptually oriented with a reflective stance on themes such as searching for a sustainability-resilience nexus, offering an example of a convivial city as an alternative form of urban living, and considering multiple facets of urban livability and smart city development in various city-hinterland scenarios. The focus of the remaining six papers is on more physical, practical, and overlapping aspects of urban livability, primarily related to urban amenities (e.g., open space, green space, green infrastructure, urban vegetation, urban mobility), and participatory approaches (e.g., stakeholder/citizen perception, knowledge, and engagement). Together, the focus of this group of papers can be said to be on examining creative solutions to livability issues already in practice in other places and offering ideas for adapting them into their own, and/or offering 'new' ideas toward improving the quality of their living environment.

One of the direct explorations of the concept of sustainability as mentioned above pertains to the article by Bourgoin and Linke ("Urban Sustainability and Urban Resilience Indicators: Preliminary Framework for a Methodology to Combine Both Approaches in a Common Indicator Set") in which they observe that the two discourses on urban sustainability (US) and urban resilience (UR), although both integral parts of urban literature, still lack an integrated approach to measuring their respective multi-dimensional measurement indicators. Taking water supply—'one of the most crucial cross-cutting issues'—as an example, they try to find some common grounds between the two and offer a more integrated conceptual framework. The Gandhian philosophy of a community-centered approach to sustainability is reflected in Butola's paper on the convivial city as an alternative to the 'city of consumers' ("Convivial Cities: Alternative to Cities of Consumers: An Exploratory Note") which presents 'an alternative development model' operationalized by teams of 'barefoot doctors and engineers,' products of the famed 'Barefoot College' in the town of Tilonia, India. In contrast to city-centered development and formal education, hands-on and inclusive education, local resource-based ecological planning (e.g., rainwater harvesting), self-sufficiency in alternative energy production (e.g., solar), female empowerment, and participatory decision-making are some of the basic tenets of this model.

Aspects of sustainable livelihood are at the heart of the paper by Le and Nguyen ("Assessing the Livelihood Capacity of Workers and Planning Orientation for Residential Areas Toward Sustainable Livelihood of Workers in Industrial Zones Around Hanoi, Vietnam") in which they take an integrative approach to assessing its quality in the context of workers living with unsatisfactory housing and working conditions and inadequate 'social integration' in five Industrial Zones in Hanoi. Based on the

five capitals (human, natural, social, financial, and physical) as per the sustainable livelihood framework of the UN, they develop a set of Livelihood Capacity indices (LCI) yielding a context-specific and integrative Sustainable Livelihood Index (SLI) and note its potential implications for planning.

The next two papers showcase research on specific aspects of urban livability in Vietnam, as well as Smart City development in the Philippines. Tran et al. ("Evolutionary Livability of New Urban Areas in Hanoi: From Plan(ning) to Market(ing)") examine changes in public perception of livability in two of the new urban areas or housing projects created about a decade apart. As per the authors, the difference between these models, representing two different planning ideologies, reflects a 'tendency' toward a 'new urbanism'—a more market-oriented approach to satisfying the clientele, as well as a difference in the focus on the physical vs. biological aspects of livability per the socioeconomic and demographic status of the residents. The study by Minh et al. ("Is Linh Dam Still a Livable New Town? How to Make It Work Well Again?") examines the changes in livability in one of the two 'new urban areas' targeted in the above research. Using field observations, perception surveys, and a multi-dimensional rating system, the authors' recommendations include bridging the gap between planning goals and practice, 'depopulating the urban area' in the long run, and offering a set of 'step by step' interim plans involving infrastructure, environment, and 'social stability' to improve (or restore) quality of life. A multi-dimensional and integrated approach to addressing aspects of urban quality of life is also at the heart of the next paper by Mendoza and Betia ("Future of Prospective Smart Cities Outside Metro Manila") on the prospect of smart city development in three spill-over regions outside Metro Manila. Their recommendations, based on both survey and secondary data and guided "…by Philippine's long-term vision for 2040 and [the] sustainable development pillars," include a focus on collaboration, non-fragmentation, and citizen engagement, as well as integration among the various infrastructural domains.

The growing interest in more ecologically/environmentally sound strategies, such as the use of green infrastructure (GI) as a viable and applicable alternate or partner to the conventional brown or gray infrastructural solutions, and the multifaceted benefits of open green spaces in the built environment of the crowded cities in Asia, is another sign of the emerging paradigm shifts toward more eco-friendly, cross-sectoral, participatory, and multifaceted approaches in urban planning in some Asian countries. Apart from the last paper in this collection on improving urban mobility, the next five papers reflect this interest.

Despite different approaches and scales of study, the two studies on GI application in the context of stormwater and flood management in Vietnam have this integrative, trans-sectoral, and participatory planning focus in common. As they note, despite general recognition of the usefulness and viability of GI as an alternate, complement, or supplement to the 'traditional engineering solutions' to stormwater management, urban flooding, and other water-related infrastructural developments, it is seldom used in Vietnam. An and Huong ("Review of a Green Infrastructure Approach in Urban Flood Management and Its Possible Application in Binh Duong Province") start with a review of the literature on the use of GI in urban flood

management in terms of its co-benefits and barriers, noting that despite its many benefits, the "practical utilization of GI in urban flood management is still overwhelmed by traditional gray infrastructure ….." They follow up with an exploration of potential GI application in one of the flood-prone provinces in Vietnam and propose a context-specific Urban GI Plan based on the 'principles' of 'green and gray integration,' 'green space networks,' 'multifunctionality,' and 'collaborative and participatory planning.' The study by Linh and Tu ("Stakeholder Analysis Framework and Ongoing System Review for the Possibility of Green Infrastructure Application to Hanoi Urban Stormwater Management") on Hanoi approaches this subject from the standpoint of the importance of stakeholders' perception in GI application, which per the authors, is under-researched. Their proposed strategies or approaches, based on their analysis of the status, interrelationships, and perception of the stakeholders, include 'active promotion of GI at all levels,' 'cross-linkages between groups of stakeholders' across sectors, integrating localized sectoral standards to a national standard, and a cost–benefit analysis to assuage common anxiety about application and maintenance cost of GI as compared to 'conventional solutions.'

The next three research studies focus on the open space/green space aspect of green infrastructural planning. In the first two, the authors variously note that land scarcity in the densely built environment of many Asian cities makes the 'conventional solution of seeking vacant land for developing green spaces' inapplicable, and that "it makes sense that strategies for the 'greening' of cities should consider not only all the available horizontal spaces but also the vertical ones." From this perspective, these two papers explore innovative ideas for utilizing unused or underused spaces under elevated road structures, and on vertical surfaces of building facades. In the context of the former, Huong and Kieu ("Open Space Use Under Elevated Road Infrastructure: Ho Chi Minh City, Vietnam and Bangkok, Thailand") focus on such spaces in Ho Chi Minh City, Vietnam, and Bangkok, Thailand, identifying opportunities for their renewal or development to optimize their potential benefits. Based on their findings that Ho Chi Minh City and Bangkok have many underutilized and unused open spaces under the elevated roadways and bridges with different forms, characteristics, and usages, the authors propose different conceptual solutions to make these spaces more functional, green, and revitalized from the standpoint of urban livability. Kieu and Schäfer ("Potentials for Vertical Gardening in Cities: A Case Study of Shophouse Facades in the Inner City of Da Nang, Vietnam") focus on the utility, potentials, and benefits of unused vertical spaces 'in the context of a small-scale neighborhood in a medium-size town' in Da Nang, Vietnam, but find its potential for application at larger scales promising. Their recommendations include 'contextualized feasibility studies' on logistical issues, plant typologies, potential barriers, and stakeholder preferences.

In this vein, optimizing the use of this precious commodity of urban land available for 'greening' is the focus of the next study by Nantavisai and Thaitakoo ("The Effect of Urban Vegetation Patterns on Land Surface Temperatures in the Bangkok Metropolitan Region"), who consider the relative efficacy of variously patterned patches of urban vegetation in lowering the land surface temperature (LST) in various parts of Bangkok. Based on their 'tentative' findings of definite but dissimilar benefits

gained from differently patterned and sized vegetation patches, the authors suggest further research and conclude that "the effect of vegetation spatial pattern on LST should be considered for urban environmental planning and green infrastructure policymaking to effectively reduce the … [LST in] urban areas" for improving urban livability.

The final paper, as noted above, is on urban mobility, indisputably a vital part of urban livability. On the premise that the powered two-wheelers (PTWs) sharing the roadway with automobiles are a 'dominant transportation mode' in Asian cities with the 'highest share of road accidents,' the study by Tuan et al. ("Enhancing Urban Mobility Through a Powered Two-Wheeler Lane System: An Empirical Study in Ho Chi Minh City") explores the idea of creating dedicated PTW lanes in context of Ho Chi Minh City, Vietnam, with potential adaptability to other cities. Based on field surveys and simulation models, the authors offer specific lane-design guidelines and environmental, economic, and safety criteria for the evaluation of a dedicated PTW lane system.

To conclude, the papers presented above have discussed several issues, such as flooding, energy consumption, livability, open spaces, mobility, infrastructure, and sustainability of urban settlements that influence developmental planning for Asian cities. Some authors have considered that the cities' spatial renovation and development can provide opportunities to address multiple environmental problems and risks. The above studies, including both non-physical and physical approaches, offer good examples of urban transformation processes and propose a variety of solutions from various perspectives. Although some of the solutions are at the conceptual stage, they can also be baselines for further research as feasibility studies, or as initial steps toward more detailed investigations. The studies show the diversity and complexity of urban transformation which is very much contextually dependent. As cities and their components keep growing and changing, the search for sustainably optimizing urban livability requires a more integrative and innovative approach to developmental planning.

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Urban Sustainability and Urban Resilience Indicators: Preliminary Framework for a Methodology to Combine Both Approaches in a Common Indicator Set

Audrey Bourgoin and Hans-Joachim Linke

Abstract Urban sustainability (US) and urban resilience (UR) are two of the main approaches commonly used by cities, urban policymakers, and scientists to adapt urban areas with future requirements. Indicator sets measuring multidisciplinary performance levels are fundamental to the evaluation of the status and progress of urban areas in the domains of either sustainability or resilience. Indicators enable us to agglomerate large amounts of complex and heterogeneous information in tangible and simplified values. The aim of this chapter is to establish an overview of the commonalities and differences between urban sustainability and urban resilience as well as between the topics and sectors valued by each perspective. It will then investigate the characteristics of different indicator sets used to assess the performance of the studied factors in the domains and sectors valued by either UR or US. This chapter also proposes a conceptual framework for defining possible intersections and combinations between the concepts of UR and US using the example of the water supply sector.

Keywords Urban resilience · Urban sustainability · Indicator · Water supply

1 Introduction

As climate change becomes more significant and perceptible by the year, cities are upping their efforts to adapt to it and its consequences. Two main tactics are commonly used to improve urban areas so they can meet the environmental challenges of the coming decades: urban sustainability and urban resilience. These are two of the main topics of UN Goal 11 for cities and communities under the 2030 Agenda for sustainable development: "make cities (...) inclusive, safe, resilient and sustainable" (United Nations 2015).

Sustainability and resilience are two closely related abilities that are often confused and conflated (Zhang and Li 2018). Sustainability is "the ability to be

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maintained at a steady level without exhausting natural resources or causing severe ecological damage" whereas resilience is "the ability of an ecosystem to return to its original state after being disturbed" (Collins English Dictionary 2020a, Collins English Dictionary 2020b). Both qualities are highly desirable in a city and overlap to some extent, but address different frameworks: while resilience is more oriented toward a clearly (timely) defined stress-factor or shock, sustainability looks toward a broader future without focusing on precise events.

Methodology

As urban sustainability (US) and urban resilience (UR) are closely associated as ways to improve urban space, this study first examines the definition and approaches of both concepts as presented by scientific publications, policymakers, or framework developers and assesses the extent to which the concepts overlap and deviate (in Sect. 2). Since both concepts encompass a multitude of topics and sectors, they can only be measured via indicator sets or indexes.

Three US and two UR indicator sets will be presented in Sects. 3 and 4, where a special focus will be placed on their specific approaches, their design, the categorizations they determined, and the way they are calculated. Section 5 is subsequently devoted to a comparative analysis of the presented indicator sets to identify major trends, with a focus on water supply to illustrate the main points. Because water supply is most critical for the continued existence of human settlements, this sector is the most suitable for illustratively comparing both concepts and their approaches. As the problems of water availability and its quality are once more coming full force to the global foreground (Hofste et al. 2019; Damania et al. 2019), the topic of water supply embodies one of the most crucial cross-cutting issues, which should be considered at its fair value in both concepts. Finally, a new conceptual framework will be drafted (in Sect. 6) to define possible intersections and combinations between the concepts of UR and US based on the example of the water supply sector. The conclusion (Sect. 7) summarizes the findings of this chapter and mentions the limits of the study as well as further, necessary research in the eyes of the authors.

2 Urban Sustainability and Urban Resilience

2.1 Urban Sustainability (US)

As per the nowadays-famous definition stated by the Brundtland Report, sustainable development is a "development that meets the needs of the present generation without compromising the ability of future generations to meet their own needs" (World Commission on Environment and Development 1987). The UNESCO further describes it as a future "in which a healthy environment, economic prosperity, and social justice are pursued simultaneously to ensure the well-being and quality of life of present and future generations. Education is crucial to attaining that future". This

description is nowadays summarized in the "3E" structure or "triple bottom line": environment, economy, and (social) equity.

It is also a balance between the improvements of the quality of people's lives and the preservation of the life-supporting systems that current and future humans as well as other species depend on. It should be noted that sustainability is a trans-dimensional concept, one that can be described as "both a destination and a journey" (Parliamentary Commissioner for the Environment 2004).

At the scale of a city or urban community, sustainability can be defined as the requirement to meet the inhabitants' needs without imposing unsustainable demand on local and global resources (Alberti 1996). Bulkeley defines urban sustainability through the policy problems on which action can be taken, such as "shelter, sanitation, waste, transport, and energy and the means through which it should be achieved" (Bulkeley 2006). A sustainable water supply system can provide its population with long-term, readily available water of good quality by, for instance, not over-withdrawing water from the local aquifers or water bodies and not polluting these aquifers and water bodies.

Some researchers propose a combination of three strategies to work toward sustainability: efficiency, consistency, and sufficiency. The efficiency strategy aims to achieve economic performance with the lowest possible use of materials and energy by improving the input–output ratio. The consistency strategy means to improve the environmentally compatible nature of material flows, technologies, and structures. The sufficiency strategy focuses on reducing burdensome consumption (Behrendt et al. 2016).

2.2 Urban Resilience (UR)

As resilience is the ability to overcome shocks, urban resilience is "the capacity of a city to survive, adapt, and grow no matter what kinds of chronic stresses and acute shocks they experience" (100 Resilient Cities 2018).

Chronic stresses, such as high unemployment, inefficient public transportation systems, endemic violence, and chronic food and water shortages weaken the fabric of a city's day-to-day life, creating a vicious cycle. Acute shocks are sudden, sharp events that threaten a city, such as earthquakes, floods, disease outbreaks, and terrorist attacks (100 Resilient Cities 2018).

A resilient water supply system can provide its population with water of good quality in case of a shock. It can still deliver water in case of an earthquake, industrial incident, or heatwave, thanks, for instance, to earthquake-resistant pipes or to a secured and sufficient quantity of non-polluted water.

The following seven qualities contribute to making a system resilient: flexible, redundant, robust, resourceful, reflective, inclusive, and integrated (Arup 2014):

- Flexible systems can change, evolve, and adapt in response to changing circumstances.

- Reflective systems accept the uncertainty and continuously adapt to it.
- Integration describes the consistency across different systems and scales.
- Robust systems can withstand shocks without significant failure of function.
- A resourceful organization can rapidly identify different ways to meet its goals or to restore functionality during a shock.
- Redundancy is spare capacity purposely created to absorb surges due to a shock. The diversity of ways to achieve a function can also be counted as redundancy.
- Inclusion is the ability to consult and incorporate different communities instead of focusing on the problems faced by one sector after another.

2.3 Common Grounds and Divergence

Whereas urban sustainability (US) aims to make cities livable in the long term, urban resilience (UR) focuses on the ability of the city to deliver services after a shock (Zhang and Li 2018). For instance, to guarantee a city a supply of drinking water, US would focus on ensuring the supply for the coming 10 years from a non-polluted water source. Like the local preserved groundwater table. This would occur through a desire to have a water withdrawal balanced with the aquifers' and water bodies' ability to replenish and by preserving the water supply from pollution sources. UR would, on the other hand, focus on the aim that water can still be distributed after an earthquake; the origin of water would be secondary as well as the water quality to some extent, as long as it is potable. UR would then see the construction of a new pipe to pump more or better water further away, just as relevant and effective as preserving the resources already exploited.

Resilience focuses strongly on disasters, crises, and risks. The aim is to overcome vulnerability. Sustainability aims to improve the lives of the people without depleting, destroying, exhausting, or generally damaging the environment or other resources (The Urban China Initiative 2010). While one focuses on what *to do* (or the ability a city should *gain*), the other focuses on what *not to do* (or what should be *preserved*). A city aiming to be both sustainable and resilient has to, therefore, improve its ability to face a shock but *cannot*/*should not* use all the resources at its disposal. Thence, it is a major challenge for each city to conciliate both approaches.

While the targets may be conflicting, it should however be noted, that both notions are based in part on common properties. Both approaches value flexible, reflective, integrated, resourceful, and inclusive systems and value efficiency.

However, redundancy, robustness, sufficiency, and consistency are characteristics that are not shared by the two concepts. Redundancy is typical of UR but should usually be avoided in US, as it sounds like a waste of resources. Robustness is a typical UR attribute but is not something inherently incorporated in US. Consistency and sufficiency principles, as they aim to a change of behavior, are not considered in any UR index.

It is however crucial to combine both concepts, as rational urban development can be achieved only when it is both resilient and sustainable (Zhang and Li 2018). A

sustainable city which is not resilient will struggle a great deal to overcome a shock, which will endanger its sustainability. That is why the International Organization for Standardization affirms that "Resilience is both a core component and an essential enabler of sustainable development" (ISO 37123:2019). The reverse is also true: a resilient city, which is not sustainable, will not have the means to maintain this resilience in the long term.

3 Urban Sustainability Indicators

There is a wide array of the literature either developing or studying urban sustainability indicators. Most of them are developed for a specific city or country. Some are based almost exclusively on the analysis of bibliographical information, others base their selection on expert interviews or benchmarks obtained from best practices (Hiremath et al. 2013).

Here are some of the main indexes developed for Asian cities or for global use.

3.1 Sustainability Index for Taipei

In 2006, the Taipei City Government supported the development of a **Sustainability index for Taipei** to analyze Taipei's overall progress toward sustainable development during period between 1994 and 2004. It was designed through a combination of literature review, workshops, and group discussions with professional scholars. The Sustainability index for Taipei is based on the "3E1I" framework, which provides its main dimensions of analysis: economy, equity (social), environment, and institution (including politics) dimensions. These four dimensions are then assessed through 51 individual indicators adapted to the socio-economic characteristic of Taipei City. The sustainability index is calculated for each of the four dimensions by equally weighting its indicators. The equal weighting method is also applied to these four dimensions to summarize them in one single value: the sustainability index, which gives the overall trend of SD for Taipei (Lee and Huang 2007).

3.2 China Urban Sustainability Index (USI)

The **China Urban Sustainability Index (USI)** is an index developed by the Urban China Initiative (UCI) and the McKinsey Global Institute (MGI) and was first published in a report in 2010. It was developed for developing countries and as such focuses on data readily available in developing economies and more relevant for them that they would be for developed countries. For instance, the index looks at

basic needs such as water availability. It is most especially tailored to the data available in China and is designed to measure relative performance over time of Chinese cities across a common set of sustainability categories. In 2010, the index measured a city's performance in five categories, seen as critical to sustainable development (The Urban China Initiative 2010): basic needs, resource efficiency, environmental health, built environment, and commitment to sustainability. In its 2012 evaluation for the year 2011, the index (USI 2011) evolved to focus on four broader categories: social sustainability, economic sustainability, environmental sustainability, and resource sustainability (The Urban China Initiative 2012)**.** The "government commitment" category was dropped because of the difficulty in measuring government spending on sustainability-related issues. Some indicators were also replaced due to inconsistent data quality. On its 2014 review of the state of the index in 2013, the Urban China Initiative decided to adapt its index (USI 2013) once more to emphasize the quality of life. It kept the four categories of the USI 2011 but added indicators like employment rate, pension, and healthcare coverage rates, making 23 indicators in total (The Urban China Initiative 2014). The latest revision of the index, the USI 2016, kept the same categories and indicators (The Urban China Initiative 2017).

3.3 International Standard for Sustainable Cities and Communities (ISO 37120:2018)

The International Organization for Standardization (ISO) published in 2014 (and revised in 2018) the ISO 37120-standard named "Sustainable cities and communities—Indicators for city services and quality of life". It defines and establishes methodologies for a set of indicators to enable any city, municipality, or local government to steer and measure the performance of its services and quality of life. This international standard enables a global comparison between cities of different size and location. The standard defines 19 sectors: economy, education, energy, environment and climate change, finance, governance, health, housing, population and social conditions, recreation, safety, solid waste, sport and culture, telecommunication, transportation, urban/local agriculture and food security, urban planning, wastewater, and water. These sectors are then assessed through 104 core and supporting indicators (with between 2 and 10 indicators per sector). These indicators are all centered on development and quality of life in a sustainable way (ISO 37120:2018).

The similarities and differences between these US measurement tools will be addressed in Sect. 5, where they will be compared with the UR indicator sets of Sect. 4.

4 Urban Resilience Indicators

Urban resilience is much discussed, but only a narrow amount of indicator sets are published. A qualitative study found a dense network and limited amount of regularly cited actors, which in fact usually work together (Batra et al. 2017). The two indicators analyzed in this section were developed for global application.

4.1 City Resilience Index (CRI)

One of the main urban resilience indicator sets is the **City Resilience Index (CRI)** developed by Arup, a multinational firm providing services for all aspects of today's built environment, and with the support of The Rockefeller Foundation, which is one of the main actors in the field of urban resilience (Kirbyshire et al. 2017; Arup 2020).

It serves to measure and compare cities, but its most important aim is to provide cities with a better understanding and assessment of their own resilience. The index is designed to be comprehensive and holistic and applied to at least 100 cities around the world through the 100 Resilient Cities Challenge. In Asia, 19 cities from nine countries are taking part in the program. These are cities from South-east Asia like Bangkok (Thailand), Da Nang (Vietnam), or Singapore, cities from the northeast like Seoul (South Korea), Haiyan (China), or even Indian cities like Jaipur and Chennai (100 Resilient Cities 2017). It was developed to be comprehensive after analyzing different approaches in the literature, but also integrated a performance-based approach focused on functions illustrated in case studies. It was then tested by fieldwork on six geographically different cities, which suffered a shock or chronic stresses (Arup 2015).

The City Resilience Index (CRI) defines 4 dimensions and 12 goals (see Fig. 1).

These goals are then subdivided between 3 to 5 indicators, for a total of 52 indicators. A Measurement Guide provides 156 qualitative questions (2 to 5 per indicator) to assess the performance of the indicators. These questions are associated with proposed quantitative metrics and a best case/worst-case scenario to rate the answer on a scale from 1 to 5 against a global benchmark (Arup 2016).

4.2 International Standard for Resilient Cities (ISO 37123:2019)

The International Organization for Standardization (ISO) published in December 2019 the ISO 37123-standard, named "Sustainable cities and communities—Indicators for resilient cities" (ISO 37123:2019). The publication aims to provide standardized indicators and methodologies that enable a uniform approach to what is measured

Fig. 1 Dimensions and goals of the City Resilience Index (Arup 2016, p 3)

and how to measure it. As an international standard, it should enable a global comparison between cities of different sizes and locations. The standard defines 19 sectors: economy, education, energy, environment and climate change, finance, governance, health, housing, population and social conditions, recreation, safety, solid waste, sport and culture, telecommunication, transportation, urban/local agriculture and food security, urban planning, wastewater, and water. These sectors are the same as defined for the sustainable cities and communities ISO-norm (37120:2018). Three sectors, those of "recreation… sport and culture…[and] "waste water" do not include any new indicator and refer instead to the indicators of ISO 37120. The other sectors are then assessed through 68 newly developed indicators (between 1 and 9 per sector). These indicators are all centered on hazards, risks, shocks, stresses, vulnerability, and disruption potential (ISO 37123:2019).

5 Analysis of Common Points and Differences of Both Indicator Types

5.1 General Analysis

The previous sections showed that both UR and US are not clearly defined and extend to a multitude of fields, but those trying to design indicators do not agree on exactly which ones should be used. This multitude of domains therefore does not allow UR or US to be as easily assessed as other topics such as a country economic development, which can easily be assessed using mainly the simple indicator of GDP per capita. Therefore, multiple indicators or sets of indicators are needed as

they "simplify, quantify, analyze, and communicate the complex and complicated information" (Singh et al. 2012).

Most of the indicator sets and indexes, whether for UR or US, use the "3E1I"structure: environment, equity (social), economy, and institutional dimensions. They then adapt it to their own focus and thus assess these dimensions in their own way (Lee and Huang 2007). Indicator sets not assessing the institutional dimension justify it through the difficulty to measure it faithfully (The Urban China Initiative 2014).

The topic of natural resources and the ways different indicator sets tackle that topic is interesting. There is no real rule as to the place assigned to natural resources in US or UR indicators sets. Each index has its own ways of handling the issue. When specifically analyzed, it is sometimes granted its own domains of analysis, like in the Urban Sustainability Index (The Urban China Initiative 2014), and it is sometimes assessed through very specific domains like in the ISO sustainability standard (ISO 37120:2018) and ISO resilience standard (ISO 37123:2019). There are also some indicator sets that only consider natural resources as a small part of their environmental domain, such as the Sustainability Index for Taipei (Lee and Huang 2007), or only view it through the lens of securing the supply without necessarily working on preserving it, like the City Resilience Index (Arup 2014). It is puzzling that the City Resilience Index (CRI) assigns so little value to resources, as it stands to reason that by depleting its resources, a city is affecting their redundancy and thus becoming less resilient (Alberti 1996).

5.2 Analysis Using the Example of the Domain of Water Supply

For a practical and illustrated analysis of the different approaches used by UR and US indicator sets, it is helpful to focus on the domain of water supply. The way it is handled and the importance it is given will be analyzed based on the indicator sets presented in Sects. 3 and 4. The findings are summarized in Table 1.

5.2.1 Urban Sustainability

The Sustainability Index for Taipei examines the field of water supply through four indicators listed in two of its four main domains. These are in the economic dimension: "Average daily per capita water use (liter) (excluding industrial use)" and in the environmental dimension: "Proportion of slightly-polluted rivers", "Reservoir water quality", and "Tap-water quality" (Lee and Huang 2007). This index evaluates both the quantity and the quality of water from both the service side and the resource side.

Table 1 Comparison of selected US and UR indicator sets

	Urban sustainability indicator sets			Urban resilience indicator sets	
	Sustainability index for Taipei	USI 2016	ISO-norm 37120 for sustainable cities	City resilience index	ISO-norm 37123 for resilient cities
No. of categories	4	4	19	4	16
Total no. of indicators	51	23	111	52	68
"3E1I" Structure?	Yes	3E	No	Yes	No
Categories addressing water supply	Economic and environmental dimensions	Environmental and resources dimensions	Water	Health and Wellbeing + loosely: Infrastructure and ecosystems	Water
No. of indicators related to water supply	4	2	7	1	2
List of Indicators related to water supply	• 6: Average daily per capita water use (liter) (excl. industrial use) • 78: Proportion of slightly-polluted rivers • 38: Reservoir water quality • 39: Tap-water quality	• Public water supply • Water efficiency	• Seven indicators related to water (23.1 through 23.7), relating to percentage of city with: potable water service (23.1), sustainable access to improved water (23.2 and 23.4); statistics about: water consumption (23.3 and 23.5), water loss (23.7), as well as frequency of service interruptions (23.6)	• 1.3: Inclusive access to safe drinking water + somewhat loosely: • 8.1: Effective stewardship of ecosystems • 8.3: Retained spare capacity + once 8.4 "Balanced supply and demand of resources"*	• 23.1: Number of different sources providing at least 5% of total water supply capacity • 23.2: Percentage of city population that can be supplied with drinking water by alternative methods for 72 hours

(continued)

Table 1 (continued)

	Urban sustainability indicator sets			Urban resilience indicator sets	
	Sustainability index for Taipei	USI 2016	ISO-norm 37120 for sustainable cities	City resilience index	ISO-norm 37123 for resilient cities
Analysis	Both **quantity** and **quality** of water from both **supply** side and **resource** side	**Quantitative** water **supply**	Both **quantity** and **quality** of water **supply** service	Merely **supply** side	Securing mostly the **quantitative supply**
Relative weight of water supply indicators	4/51 = 8%	5 × 33% + 33 × 17% = 7%	7/111 = 6%	1/52 = 2%	2/68 = 3%

*The CRI once listed an indicator centered on resources, the once 8.4 indicator "Balanced supply and demand of resources" in its Measurement Guide (Arup 2016), but for unclear reasons it is not further explained how to take the measurements, and actually disappears in other reports.

The Urban Sustainability Index (USI 2013, 2016) considers water supply in two indicators among its 23: in the category "Environment", sub-category "Built environment": indicator "Public water supply", which measures the coverage as well as in the category "Resources", sub-category "Resource utilization": indicator "Water efficiency", which measures the total water consumption (liters per unit GDP) (The Urban China Initiative 2014). The water supply is only approached from a quantitative perspective, while the quality of aquifers and supplied water is not assessed. It should be noted, however, that this index consists only of 23 indicators, which do not allow for assessing a very large range of information in all its detail, but do identify trends.

The international standard ISO 37120 "Sustainable cities and communities—Indicators for city services and quality of life" has a dedicated category for water. It englobes seven indicators, the first four being core indicators: "Percentage of city population with potable water supply service", "Percentage of city population with sustainable access to an improved water source", "Total domestic water consumption per capita (liters/day)", "Compliance rate of drinking water quality", "Total water consumption per capita (liters/day)", "Average annual hours of water service interruptions per household", and "Percentage of water loss (unaccounted for water)" (ISO 37120:2018). This index evaluates both the quantity and the quality of the service "water supply" without really measuring the status of the aquifers that supply the water.

5.2.2 Urban Resilience

In the City Resilience Index (CRI), the environmental and resource aspect is only marginally evaluated. Among the 52 indicators, only one directly relates to the water sector: "Inclusive access to safe drinking water" in an adequate supply. Two other indicators are loosely associated with water supply: "Effective stewardship of ecosystems" to maintain and enhance the ecosystem services and "Retained spare capacity" through flexible resource use in order to minimize the demand on critical infrastructure. The CRI once listed an indicator centered on resources, the once 8.4 indicator "Balanced supply and demand of resources" in its Measurement Guide (Arup 2016) but for unclear reasons it is not further explained how to measure it and actually disappeared in other reports.

The international norm ISO 37123 "Sustainable cities and communities—Indicators for resilient cities" dedicates an analysis category to water and evaluates it with two indicators: "Number of different sources providing at least 5 percent of total water supply capacity" and "Percentage of city population that can be supplied with drinking water by alternative methods for 72 hours". Efforts to diminish the water footprint or assess and preserve the quality of the aquifers/drinking water are not assessed here, but they can be partially found in the ISO-norm 37120 which precedes the ISO-norm 37123 (ISO 37123:2019).

5.2.3 Comparison of the Manner and Extend the Issue of Water is Addressed

US indexes mainly assess the *quantitative* sustainability of the water *supply*. The quality of the water and the state of the aquifers and/or water bodies it originates from are sometimes taken into account, but not always. Indicators for UR primarily evaluate the security of the *quantitative* water *supply* and tend to further disregard the quality or the origin of the water.

The importance given to the topic of water is also reflected in the relative weight of the indicators. While indicators related to water supply constitute 6–8% of the analyzed indicators in the studied US indicator sets, they only represent 2–3% of the assessed values of the UR indicator sets analyzed. It seems that the resource of water is given relatively greater importance in the evaluation of city sustainability, as it is an important part of "not compromising the future" whereas the supply of water is only one element among many others that has to be secure for a city to be resilient.

6 Discussion of the Possibilities and Methodic of Combining Both Approaches

6.1 Thematic Level: Combining Both Approaches

To combine US and UR, one needs to combine more than preparation for two events, and also combine more than one long-term "normal case" with some "worst-case" scenario preparation. One actually needs to examine an "overarching ethic" (Plummer 2006) for the preparedness in order to face unplanned situations. A resilient but unsustainable city will not be able to sustain the core service that make it resilient. A sustainable city that is not resilient will struggle to overcome a shock it never prepared for, which will threaten its sustainability. A rational, sustainable, and resilient city is therefore one increasing the wellness of its population while preparing for unforeseen disasters without depleting the environment in the process.

In addition to being flexible, reflective, integrated, resourceful, inclusive, and efficient, a sustainable, resilient city should be sufficient and consistent while also planning for redundancy and robustness in case of stresses. In the domain of water, for long-term sustainable resilience, cities need on the one hand to preserve their already exploited resources, while on the over hand securing new sources of water in case of an emergency. The preservation of the actual resources is a typical case of "both a destination and a journey" (Parliamentary Commissioner for the Environment 2004). It requires abstaining from over-exploiting aquifers by constantly monitoring the quantities withdrawn as well as assessing the capacity of the aquifers and/or water bodies to replenish. Preserving the quality of the supplied water also implies the control of every substance that could be harmful to the local aquifers or water

bodies. It is therefore an everlasting task, one which can only be successful so long it is not discontinued.

6.2 Conceptual Level: Universality and Specificity

On the conceptual level, the indicator set should provide a common basis of indicators to compare different cities and their improvements with one another. An indicator set, which is specifically designed only for one city, can at the most deliver some clues to the progress of the city itself, but would only provide skewed information if applied to a city it was not designed for.

However, most studies found the need to develop a new indicator set specifically for a city or a country, because the available sets were considered not sufficiently adapted and/or relevant to the characteristics of the city/country. Therefore, the indicator set should provide a flexibility for some criteria and objectives to adapt the indicators to the geographic and socio-economic characteristic of cities.

To compare different cities, the differences in data availability should be also taken into account and some flexibility should be planned for it. However, the indicator values should be standardized to simplify the calculations and comparison.

7 Conclusion

As the issues of sustainability and resilience in the face of global climate change are gaining momentum, it is becoming more urgent to define clear goals and to be able to measure the progress made toward achieving these goals. However, since the notions of urban sustainability and urban resilience themselves are so vague and can cover many areas, it is not a simple exercise to define these above-mentioned goals. One actually needs to enhance an ethic (Plummer 2006) with the preparedness to face unplanned situations.

Furthermore, the methods to reach toward the US or UR are not always compatible with one another. Goals may not be the same depending on the context a city is faced with, whether it be its circumstances, priorities and ambitions, or socio-economic context (Lützkendorf and Balouktsi 2017). As the problems of water availability and its quality are once more becoming critical in an increasing number of cities (Hofste et al. 2019; Damania et al. 2019), the need for a unifying approach is becoming more pressing. In the domain of water, for a long-term sustainable resilience, cities need on the one hand to preserve their already exploited resources, while on the over hand they work on securing new sources of water in case of an emergency. But the quantity of water a city can afford to withdraw and the effort to secure additional water sources can vary considerably depending on the city.

Moreover, the exercise of defining relevant indicators, based on available data (if possible, long-term and widespread data), to provide clear, concise, easily understandable information is a complex task. To select variables and criteria as well as objectives to grade them requires answering complex questions and making controversial choices (Alberti 1996).

To bring all these aspects together in a single set of indicators and try to resolve all contractions may seem similar to squaring the circle. It is nevertheless possible with an integrated, holistic approach combined with an iterative method.

Limitations This study does not claim to be representative, as it uses a few indexes (2 to 3 per category) as examples to illustrate its main points. There are therefore limitations to the presented results. The analyzed indexes were designed mostly for western standards, i.e., for countries and cities that mostly already have the capacity and the means to achieve their aims, but just need some help to determine the best way to better themselves. Even though the China Initiative claims that China has problems similar to those of developing countries (The Urban China Initiative 2010), China can in fact be described nowadays as a threshold country instead of a development country. Therefore, the approach for truly emerging countries is missing, as their special social, economic, geographic, and even historical and institutional circumstances are not addressed. Furthermore, no index specially developed for tropical regions or other particular geographical circumstances was presented here. A more comprehensive study is therefore needed to validate and generalize these conclusions.

Perspective As stated above, a city designed to meet the challenges of the future must be both sustainable and resilient. It stands to reason that the systems composing the city have to be simultaneously sustainable and resilient, but their whole life cycle should also be taken into account. Furthermore, the process to build and maintain such systems should also be sustainable and resilient. It is here that one finds a research gap, which needs to be investigated in further studies and publications.

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Convivial Cities: Alternative to Cities of Consumers: An Exploratory Note

Balbir Singh Butola

Abstract Urban centers were/are happening places. They are centers of innovation, knowledge, economic wealth, and political power. Cities such as Shanghai, Mumbai, and Karachi wield more power in China, India, and Pakistan, respectively, than the national capitals in these countries. Cities such as Seoul, Shanghai, Mumbai, and Karachi, to mention only a few urban centers in Asia, don't only contribute in generating large volume of capital through national and international sources, but these centers have also emerged as drivers of information technology and real estate. They are valorized as the fulcra of development and modernization. Such constructions were based on the experiences of European countries, which were possible mainly through exploitation of natural and human resources from the colonies with the help of modern technologies. These technologies (machines) were developed to replace slaves but converted men into slaves of machines. To expect that these machine-based models of development under different nomenclature (e.g., Subaltern Urbanism) will yield favorable results in the post-colonial countries is preposterous. Convivial cities have the potential to cause a paradigm shift in alternative urbanization in post-colonial countries, mostly in Asia, South America, and Africa. The shift is in the nature of creating autonomous and creative intercourse among the stakeholders of development and modernization: market, society, culture, environment, technology, etc. The present research is based on experiences of the barefoot doctors and engineers at Tilonia, Indian Desert. It is a model of development in which skill is imparted through doing and learning: age, language, and gender differences do not put restrictions on acquiring skills, and certification of competence comes through demonstrating practical solutions to numerous day to day problems. Solutions such as provision of safe drinking water, electrification (solar lanterns), solar cookers, and bio-gas energy plants, rainwater harvesting, handicrafts, and night school for working housewives are put in place. Female entrepreneurs lead in these convivial cities. This model is so successful that it has been adopted by over 43 countries in Asia, Africa, and Latin America with the help of barefoot doctors and engineers

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trained at Tilonia, which has emerged as an alternative to cities including Mumbai and Shanghai that value modern skills highly vulnerable to obsolescence. Moreover, high consumption of diverse resources imported from other places and leaving behind large volumes of non-biodegradable toxic waste and pollutants in the environment have become synonymous with the cities of consumers. This paper attempts to start a discourse centering on the concept of convivial cities as an alternative to the cities of consumers.

Keywords Convivial cities · Barefoot doctors and engineers · Post-colonial · Modernization · Development

1 Introduction

It has been proved through archaeological evidence that there were numerous urban centers in Asia even 3000 years BC. Most of these urban centers were organically linked to their surrounding ecology and material conditions. These organic links came under severe stress and strain after the integration of Asia with the world system during colonization. Emergence of port towns with strong forward and weak backward linkages marked the typical characteristics of Asian urban centers during colonial domination. Today, most of these countries are free from colonial domination, but they are still tied to old colonial urban structures though with some modifications. Consequently, most of the urban centers in Asia exhibit hybrid characteristics, i.e., cosmopolitan urban superstructure based on predominantly pre-capitalist economic structure. These independent Asian countries have never made serious attempts to alter the process of such urbanization. In this research, an attempt has been made to critique the existing urbanization processes and document the efforts of Bunker Roy (actual name Sanjit Roy) and Aruna Roy not only to challenge the ongoing urban processes in Asia but also to create an alternative convivial city at Tilonia, Rajasthan.

Cities have many faces (Paddison 2001, 11). Ceteris paribus, cities are synonymous with socio-cultural diversity. It is largely because of this diversity, that the "cities' air makes (hu)man free" (Pirenne 1978, 52) from prejudice and empowers them to explore new forms of social contracts and social and cultural capitals. This in turn contributes to making life, economy, as well as studies on cities, dynamic and complex. Such work encompasses many aspects, including the "structure of the city, its growth and change, (expressed in physical, economic, social, and other terms), the nature of urban social processes, their interplay with class, gender, and race as cleavage-forming dimensions in the making of the different geographies of the city, social organization and disorganization, and economic and social processes linked to their structure and change" (Paddison 2001, 2).

Discourses centering around these aspects of cities have been very common across cultures, spaces, and times, but the importance cities received under late modernity is unprecedented. It brought a paradigm shift in studies on cities, encompassing

nearly everything that was even remotely related to modernity, particularly citizenship, rights, democracy, social justice, public sphere, technological innovation and diffusion, industrialization, development, vulnerability, sustainability, corporate social responsibilities and environment, and social justice. Summarizing the enormity of importance the cities received among academic disciplines during this period, Dunleavy categorized most of these studies under five broad themes: location analysis, spatial network systems of cities, socio-cultural, socio-political (institutional), and political economy of the city (Dunleavy 2001, 4–6). It is evident that although the themes listed were not exhaustive, they did highlight the importance cities acquired and consequently emerged as the core of capitalist political economy. According to Mumford (1938), "the city as one finds in history, is the point of maximum concentration of power and culture of a community. It is the place where the diffused rays of many separate beams of life come into focus, with gains in social effectiveness and significance. The city is the form and symbol of an integrated social relationship; it is the seat of the temple, the market, the hall of justice, the academy of learning. Here in the city, the goods of civilization are multiplied …; here is where human experience is transformed into viable signs, symbols of (a) conduct system of order" (Mumford, 104). Ultimately, cities are identified with centers of civilization and culture (Paddison, 12).

2 Interrogating the Cities

Such categorization of themes in urban research was criticized particularly by the Marxists and postmodern scholars. David Harvey viewed city and humans in dialectical terms. According to him, humans make cities, and cities make humans. Cities are "man's most consistent and, on the whole, his most successful attempt to remake the world he lives in more after his heart's desire. But, if the city is the world which man created, it is the world in which he is henceforth condemned to live. Thus, indirectly and without any clear sense of the nature of his task, in making the city man has remade himself" (Park 1967 as cited in Harvey, 2008). Similarly, for Lefebvre, city under modernity is "in a state of dispersed and alienated actuality" (Lefebvre 1996, 148). Moreover, as a historic and social text "city no longer has a coherent set of prescriptions…. This is a text moving away. It takes the form of a document, or an exhibition, or a museum. The city historically constructed is no longer lived and is no longer understood practically. It is only an object of cultural consumption for tourists, for aestheticism, avid for spectacles and the picturesque. Even for those who seek to understand it with warmth, it is gone." Such a metamorphosis of city from a social and historical text to an object of consumption also resulted in the fall of humans as social animal into urban animal, not the wild one in the jungle but a caged one in the zoo, a human zoo (Morris 1996). "Cities also compel humans to settle for a new normal by waging relentless war against their own offspring, fellow beings and their cultures, environment, ecology, and life itself. Under normal conditions, in the natural habitat, wild animals do not mutilate themselves, masturbate, attack

their offspring, develop stomach ulcers, become fetish, suffer from obesity, form homosexual pair bonds, or commit murders. Among city dwellers, needless to say, all these things occur. (T)he zoo animals in a cage exhibit all these abnormalities…. (C)ity is not a concrete jungle, it is a human zoo" (Morris 1996, 7).

It is evident from the above discussion that discourses on cities continue to oscillate between the abovementioned binaries, yet for all practical purposes, cities continue to occupy the center stage in global political economy, largely because the "flow of capital, communications, entertainment, goods, services, and people" (Segbers 2007, 4) continues to gravitate around the cities, particularly global cities because they offer better sites "for the over valorization of corporate capital" (Sassen 1996, 206). Moreover, it is largely by virtue of being a city that we find "every great city to be a raging inferno of novelty and inventiveness" and, once again, "only in the city does sustained innovation stand a real chance. Only a city is strong and secure enough in its amassed conformity to tolerate the disruptive forces of rebellious originality and creativity. The sharp swords of iconoclasm are mere pin-pricks in the giant's flesh, giving it a pleasant sensation, rousing it from deep sleep and urged into action" (Morris, 38) and also to launch fresh war on every new enemy. Consequently, corporate capital is able to harvest maximum benefits from these cities, largely because of the high degree of autonomy, freedom, and privilege they enjoy in order to stimulate their economic performance and the production of taxable wealth, which in turn benefits these cities in "becoming sites of self-induced and self-centered economic activities, innovations, and growth independent of the national economic environment" (Segbers 2007, 8). Thus, the city regions are increasingly turning into central units of political and economic activity (Sassen 2002a, 22).

Consequently, it was predicted that "sometime in the next year … will constitute a watershed in history. For the first time, the urban population of the Earth will outnumber the rural" (Davis 2004, 5), and the figure is expected to rise to 65 percent of the total population by 2050. The pace of urbanization has been so dramatic that in 1950 there were 86 cities in the world with a population over one million; today, there are 400. By 2015, there will be at least 550, and ultimately, cities will account for all future world population growth, which is expected to peak at about 10 billion in 2050.

The abovementioned binaries were the focus of studies on cities in the twentieth century. The turn of the century brought in a new dimension in the field of urban studies and highlighted new fault lines between Eurocentric urban studies and urbanization in the Global South, or Subaltern Urbanization. Initially, Robinson tried to overcome the limitations imposed by the existing binarism in urban studies and suggested "a more cosmopolitan approach" (Robinson 2002, 532). According to her, "restructuring the terrain on which different kinds of cities are thought within urban studies could enhance the understanding of cities everywhere," failing which she preferred introducing a new category of "cities without categories," particularly in the Third World or the Global South.

Post-colonial urban historians took strong objection to covert hijacking of historical experiences of urbanization in the Global South. It was heralded by the rise of Subaltern History, according to Guha (1998), who opined that these narratives

are overwhelmingly lopsided in favor of developmentalism and are against historical experiences of urbanization in the Global South, written with the blood and sweat of the colonized. Roy (2009) in particular opined that there is a need to intervene in the epistemology and methodology of urban studies, which is dominated by the scholars of the Global North. The imperatives of such interventions are deeply entrenched not only into the history but also the psychology of the colonized. She adopted an Orwellian approach to take on the developmentalist urban theories and proclaimed that the weak in a world governed by the strong either must break the rules or perish. She suggested that the weak has the right to make a different set of rules for themselves. As a protagonist of the narrative, she was inspired by some significant changes that took place around the turn of the last century and first decade of the present one. Some significant events include the rise of the Subaltern Historiography after the concept developed by the Italian Revolutionary Antonio Gramsci (1978) and elaborated by Guha (1983, 1998), Chakrabarty (1988), Chatterjee (2013), Spivak (1988), Rem Koolhaas and Harvard Projects of City Lagos, Nigeria, Lagos/Koolhaasby Dutch Film Director Bregtje van der Haak (2002), the success of Danny Boyle's (2008) film Slumdog Millionaire (winner of Eight Academy Awards and Seven BAFTA Awards), and journalist Simon Crerar's (2010) report on the Mumbai Slum Tour.

Roy was supported in her endeavor by many other scholars, e.g., Scott (2001), Heslop (2014), Denis et al., (2012), Davis (2004), Benjamin (2008), Crerar (2004), Godlewski (2010), Schindler (2014), Hecker (2010), etc. Once equipped with the alternative methodology, she felt disturbed by the omission of "megacity" in global and world city studies. She embarked on alternatives not only for understanding the megacity but also "their herculean problems of underdevelopment—poverty, environmental toxicity, disease … the grounds for numerous diagnostic and reformist interventions" (Roy 2011, 224). Thus, the megacity as praxis, she opines, ' = "can be understood as the constitutive outside of contemporary urban studies," which positioned her differently from Sassen's claims that "citizenship originated in cities, and cities played an important role in its evolution" (Sassen 2002b, 18). According to her, Subaltern Urbanization, Occupancy Urbanism, Urban Gentrification, or Megacity do not stand as dialectical opposites of the Global City. On the contrary, these are rather conditions for the emergence of the Global City of the North. They form an outside that by being inside creates radical undecidability. In this sense, the megacity is the "subaltern" of urban studies in place of Third World Cities (Robinson 2002, 531–554). It is a "metonym for Underdevelopment, Third Worldism, the Global South. As a metonym, the megacity conjures up an abject but uplifting human condition, one that lives in filth and sewage but is animated by the alchemic ability to survive and thrive" (Roy 2011, 224).

Thus, it is not only the ability to survive and thrive by doing business as usual at places like Lagos (Nigeria) and Dharavi (Mumbai, India), the places "of poverty and hardship," which they have transformed not only into a "place of enterprise, humor and non-stop activity…with an annual turnover of approximately US$ 665 million" (Roy 2011, 225), but also into a "terrain of habitation, livelihood, and politics, entrepreneurs of misery, spaces of difference," "reservoirs of primitivism that

provide an alternative to old cities in the North," "unplanned spectacle" (Godlewski 2010, 9), Jugaad Economy (Jeffery 2009, 182–211) and slums as spaces of adventure and sightseeing. Thus, Roy is able to elevate the local narrative articulated through Slumdog Millionaire (Dharavi) and Lagos/Koolhaas (Nigeria) as part of Harvard's Project on the City and Hernando de Soto's (2000) analysis of the "ecology of the slum, a world of dead capital waiting to be turned liquid" and generalizes the Third World Megacities as places of "self-organizing economies of entrepreneurialism" where slums emerge as the people's economy, populated by heroic entrepreneurs, a form of grassroots uprising against state bureaucracy, a revolution from below (Roy 2011, 227). These economies are living testimony to the postulations made by Leo Tolstoy in Anna Karenina: "all happy families are alike; each unhappy family is unhappy in its own way." These unhappy families are rich in experiences, creativity, skills in transforming waste, and "dead capital into liquid capital, thereby unleashing new frontiers of capital accumulation." Schindler (2014), while agreeing with Roy, who suggested widening the scope of Subaltern Urbanism to First World cities such as Flint, Michigan, by bringing in a shift from deductive to inductive methodology.

Roy, following a mix of Gramsci and subaltern historiography, theorizes "Subaltern Urbanism" against apocalyptic and dystopian narratives of slum by adopting a three-pronged strategy: epistemology, methodology, and agency. Subaltern as a concept that occupies a central position in her theorization is based on the writings of Spivak, without getting into the historicity and archaeology of the concept. In fact, Roy preferred Spivak over the Subaltern Studies Collective because "subaltern marks the silences of archives and annals," and she considers that there is a need to construct "theoretical projects that disrupt subalternism and thus break with ontological and typological understanding of subalternity" (Roy 2011, 231). But, once again, her theoretical propositions, as well as the empirical evidences she brought in to substantiate these propositions, are handicapped by missing both the text as well as the context of urbanization in post-colonial countries.

In the absence of clarity on the principal fault line(s) and lack of identification of the principal actor/architecture, Subaltern Urbanism has become immensely rich in acquiring immanent values without indicating transformation. Transformation for Gramsci was possible by spreading the reach of struggle into the field of culture, philosophy, common sense, and civil society in order to stifle the process of consent. These were over and above the work done by the communist party as vanguard of revolution through organizing the subaltern classes. Moreover, constructing a narrative on "Slumdog Cities" as a result of autonomous processes of urbanization amounts to bailing out the Lumpen Capitalist Classes, along with the hegemonic state apparatuses in the Global South from their exploitative socio-spatial pathologies, including converting these cities into "dumping grounds for surplus population working in unskilled, unprotected, and low-wage informal service industries and trade" (Davis 2004, 23), dumping sites for obsolete technologies, toxic industrial wastes, hazardous chemicals, and radio-active materials and ultimately resulting in the emergence of "informal life typified by flexibility, pragmatism, negotiation, as well as constant struggle for survival and self-development" (Roy 2011, 228). Therefore, Subaltern Urbanism, though unconsciously, absolves the exploiter elite political classes along

with the states from their acts of historic injustice and crimes that they continue to unleash on the people and ecology in the Global South. Moreover, it is not only the anti-people policies of governments but also their much-cherished constitutions that assume and justify that income through ownership—profit, interest, rent, etc., is valid, justifiable, moral, and normatively proper. It gives freedom to move, but does not ensure the right to have a source or wherewithal for securing a livelihood or adequate facilities for accommodation essential for mobile job-seeking citizens in the Global South, particularly India (Desai 1985, 29–30). These factors are equally responsible for the growth of Slumdog cities, but are conspicuous by their absence in the narratives of subaltern urbanists.

In the backdrop of the abovementioned contradictions both at the level of epistemology and praxis, an attempt has been made in this research to critically evaluate the ongoing urban research and if possible open new discourse centering around convivial cities. The need for the alternative discourse arises because of the way urban centers have been structured within the capitalist economy with the following characteristics:

1. Urban and rural are seen in terms of social, political, economic, tradition, and modernity binaries.
2. Cities are constructed as spaces of comforts, convenience, and leisure, where machines work for humans.
3. Education is essential not only for technological innovation but also control over the machines.
4. True freedom is possible by replacing slaves with machines, and full automation is the real transition from the realm of necessities to that of freedom.

3 The Convivial Cities

A convivial society and city visualize ongoing binaries between the rural and urban, centering on ever-increasing industrialization, concentration of tertiary, quaternary activities, and wealth as the prime reasons for destruction of delicate social and environmental fabrics of convivial ways of life. It visualize the ways of life and livelihood in urban centers and cities, pontificating on the generation of wastes, accumulation of obsolete and toxic products not only detrimental to development but also a threat to human freedom, quality of life, dignity, self-reliance, ecology, and ultimately convivial effectiveness. The imperatives of venturing into such activities are propelled by neglecting the needs of the immediate producers and consumers in order to take care of the distant (space and time) producers and consumers, which ultimately converts all socio-ecological milieu into unsustainable and hostile spaces, spaces of trial. They extinguish the free use of the natural abilities of society's members, along with their resilience, isolate people from each other, lock them into manmade shells and finally destroy them as social humans embedded with other members of society and the natural environment, along with their inalienable organic relations (Illich 1975, 11).

A convivial society, as well as a convivial city, aims to overcome these structural impediments by liberating human beings from the tyranny of past prejudices and discrimination in terms of gender, class, and caste hierarchies on the one hand and on the other, slavery of technologies on self-reliance, formal education, and self-learning. But, above all, these vouch for strong moral and nonviolent oppositions to the Seven Social Evils listed by Mahatma Gandhi in Young India: Politics without Principles, Wealth without Work, Pleasure without Conscience, Knowledge without Character, Commerce without Morality, Science without Humanity, Worship without Sacrifice (Gandhi 1925).

Tilonia is a city in a remote part of the Indian desert in district Ajmer Rajasthan established by a small group of social workers under the leadership of Bunker and Aruna Roy to reduce the rural–urban divide that had been the characteristic feature of development and to remove the stigma related to work in the hierarchical caste system in India. Furthermore, it was meant to provide a nonviolent solution to social and environmental injustices resulting from uncontrolled concentration of wealth, people, crimes, and toxic waste in the name of development and create a conviviality.

3.1 Tilonia: The Convivial City

The obsession of capitalist development with the ever-increasing adoption of machines in our daily life has proved that "machines neither work for humans nor can they ever replace slaves." On the contrary, it has become a common experience that "as the power of machines increases, the role of persons more and more decreases," and ultimately, machines have enslaved humans. Thus, looking at the ongoing saga of development from the convivial point of view, human freedom lies not in becoming a consumer but in having autonomy to produce things, relations, and knowledge in order to live a meaningful life, which is possible only by counter positing conviviality to industrial productivity and mass consumption, meaning, they need "autonomous and creative intercourse among persons, and the intercourse of persons with their environment; and this in contrast with the conditioned response of persons to the demand made upon them by others, and by manmade environment" (Illich, 24). Thus, the core of convivial society is self-reliance, mutual interdependence, and intrinsic ethical values.

Tilonia was built around the Social Work Research Center (SWRC) and its world-famous Barefoot College, an ideal example of a "Convivial City" with the following characteristics.

3.2 Interrogating the Rural–Urban Binaries

Urban centers in India are visualized as centers of innovation, enterprises, entrepreneurs, and creativity as opposed to the villages, which are seen as traditional,

conservative, sluggish, and unheroic. The convivial approach inverts such constructions and proposes that rural–urban binaries are artificially created to camouflage the exploitative power imbalance among different socio-spatial units. It is yet another way of viewing spatial units through the lens of social hierarchy, which refuses to acknowledge villages as text whose recognition, creativities, and redistribution have been denied, ultimately yielding to the perpetuation of inequalities and domination by outsiders (Dogra 2010). It is their interaction, position at the bottom of the spatial hierarchy, and dependence on urban centers that have always suppressed the dormant skill and creativity of village entrepreneurs. The way out of this imbroglio, according to Baba Amte, is that "the poor and illiterate people of our villages don't need charity, they need opportunity" (Dogra 2010, 4). This would be possible by transforming the present consumer cities into convivial cities. Tilonia, the center of Barefoot College, is a humble beginning to realize the much-cherished goal of Mahatma Gandhi. It lays emphasis on tapping the dormant skills present in the villages by providing suitable opening, simple training, and restoration of faith in their abilities. Village life is opaque but has greater depth as opposed to urban life, which is spectacular but shallow.

3.3 Critique of City-Centered Development

Development, which had become synonymous with socio-economic inequalities, neglect, and marginalization of rural and remote areas, except for the purpose of resource extraction, dumping site for the industrial wastes, drain on raw skill and ecological crises is interrogated. The convivial city recognizes and encourages the creativity of rural entrepreneurs particularly females. This alternative development model emphasizes production by the masses as opposed to mass production, thus paving the way for a holistic life.

3.4 Critique of Formal Education

Gandhi said education is neither the beginning nor an end of skill formation. For Gandhi, along with Tagore and in the context of present research, the founder of Barefoot College, knowledge certified through paper qualification is the end of education. It is a death knell to learning and skill formation. Learning skills on the job are the only way to upgrade knowledge through sheer practical experience. High costs of learning and long duration of schooling are counterproductive to the dignity of labor, as well as insensitive to culture, ethics, and social harmony. Schooling should be for the people and not people for the school. The concept of night schools, vocational education, environmental education, awareness about the advantages of eco-services in rural life instead of knowledge about an abstract world and distant environment should be the focus of the convivial city life. The special features of these night

schools are that they give opportunity to housewives who can find time only during the night after completing their daily work. These schools also offer bridge courses to promising students who failed to attain regular classes. The schools also offer books and other reading materials to students in order to enhance their skills and education.

3.5 Inclusive Education

Myths of linguistic diversity and physical disabilities have been often cited as reasons for low levels of literacy and education in India. The convivial society and city at Tilonia has proved that linguistic diversity and physical disabilities are not impediments in knowledge enhancement, skill development, and productive engagement. Nondo, a physically challenged woman running a photocopying business, including maintenance and minor repairs of the machines, and Giriraj, a deaf and mute individual earning his livelihood from screen printing, poster printing, and imparting training to other villages, are examples of convivial society. Similarly, the solar engineers from diverse nationalities, linguistic backgrounds, and illiterate (mostly) women from Africa, South and Southeast Asia, and Central and South America trained at Tilonia, proved that skill and knowledge are beyond the artificial barriers created by language, formal education, gender, and nationality.

3.6 Transparency and Ethics: Two Pillars of Convivial City

From its inception four decades ago, the Social Work and Research Center was affiliated with 200 villages across the state of Rajasthan. Today, it is operating in 1,300 villages in 96 countries world over, mostly developing countries, with the motto "built by the poor for the poor" within the broader ethical frame of "equality, austerity, collective decision-making, decentralization, and self-reliance" (Dogra 2010, 13). Its global reach is maintained through SWRC, Hatheli Sanstan, and Barefoot International. Some of its achievements have been that over 1,000,000 people have benefited from solar lights developed by barefoot engineers, 500 million liters of kerosene was replaced by clean energy, light, and cooking, and 1 billion liters of clean water is provided every year to remote villages. These have been possible by adhering to strict measures of transparency and ethics. SWRC workers received a highest salary of Rs. 5940 and a lowest of Rs. 3948 per month with a ratio of 1:1.4 between the highest and the lowest in 2010. In addition, all the full-time workers are given food, housing, solar electricity, and health care, as well as educational support for two children (Dogra, 11). All financial transactions are made through banks, and the salary of the workers is paid through labor cards and mate cards. The authentication of the work is done through four-stage photographs from certain angles of the work site:

a. Before the work is undertaken,

b. When voluntary work is provided,
c. When the work is in progress, and
d. When the work is completed.

All accounts as well as activities of the organization are verified through social audit.

3.7 Decentralization Through Participatory Democracy

All the organizational activities are carried out by common villagers with special emphasis on women and other marginal groups. Experts in each field are brought in on a voluntary basis, and care is taken "to avoid unequal hierarchies and unequal relationships at both levels." All members eat together and wash their dishes, a small but very significant step toward bringing big change in a caste-dominated society in India. Similarly, the main emphasis of the SWRC is on pro-poor learning and empowering people from weaker sections of society. Special care is taken to train a person from a poorer household to repair the hand-pump, for example, and priority is given to poor children in the schools.

3.8 Self-Sufficiency in Energy Production

Solar energy is developed as a renewable and clean energy. Energy development is conducted by tapping the hidden skill and creativity of less educated (or even illiterate) villagers, so that after six months of training they emerge as barefoot solar engineers and technicians, efficient in the fabrication of charge controllers and inverters, core winding, printed circuit boards, testing, wiring, installation of solar panels, and repair and maintenance, etc. These solar engineers have installed energy systems for lighting, photocopying, cooking, water heaters, communication, televisions, computers, and community radios, not only in remote areas of Ladakh and Jaisalmer, India, but in countries such as Bhutan, Afghanistan, Chad, Sierre Leone, Zambia, Namibia, Kenya, and Tanzania. The solar engineers trained at Tilonia were mostly women, some of them grandmothers who could hardly communicate with others. So, neither age nor language nor gender nor even nationality stood in the way of them acquiring a skill.

3.9 Community Health Services

Rural India is notorious for high rates of child and maternal mortality. The SWRC conducts frequent health check-up and awareness camps in the villages, and there are

awareness groups for women in every village, emphasizing the advantages of safe drinking water, water filters, smokeless hearths (Chhulhas), personal hygiene, safe delivery, a campaign against harmful superstitions, family planning, child and mother immunizations, and nutrition. These dovetail with the schemes run by the state and central governments under the supervision and auditing of the village committee. The performance of the rural health mission of the SWRC, as evaluated by the Ekatra Study,[1] revealed that "infant mortality rate (IMR), which was as high as 312.5 per 1000 live births in 1977 in villages under the Nallu Field Center of SWRC, was brought down to 62.9 in 2001–2002" (Dogra, 33). It has been possible because of convivial city-rural interaction through "extensive programs for immunization, nutrition, pre- and postnatal care, safe deliveries through Trained Birth Attendants (TBAs), health education, family planning, health care and nutrition of primary and pre-school children (through distribution of Amrit Churna at Anganwadis), hygiene, and improved environment by spraying for malaria, disinfecting wells, and better sanitation through building sanitary toilets" (Dogra, 34–35).

3.10 Local Resource Mobilization and Village Ecology Planning

"Saving Precious Drop of Rain" is the flagship program of the SWRC in arid and semi-arid regions like Rajasthan. Roof-top rainwater harvesting, recharging the ground water table, and managing surface run-off with the help of community participation in the construction of traditional water conservation techniques such as Johads, Ani-Cuts, Khadeens, Tanka, ponds, and streams have not only reversed the spread of deserts but also transformed these into shelter belts with social and farm forestry zones across Rajasthan.

3.11 Female Empowerment Through a Minimum Equal Wage Principle

Women are not only brought to participate in paid work outside their home but also paid equal wages. Similarly, special skill is imparted to them in using local resources and traditional skills in manufacturing household items such as rope, baskets, brooms, mats, pickles, sweets, bed sheets, decoration pieces, dolls, tie dye fabric, and village craft training. Women are educated through puppet shows prepared by the Social Work Research Center. Thus, a judicious combination of traditional media and modern communication techniques, mostly involving the women, has

[1] Ekatra Study was conducted by and NGO Ekatra to evaluate the functioning of the Social Work and Research Center popularly known as Barefoot College in terms of various programs it has initiated at the grassroots level in rural India particularly the center at Tilonia.

been very effective in combating traditional mindsets. The SWRC workers have also prepared 300 h of video and 400 h of audio recording of traditional fold forms for documentation and posterity (Dogra, 58–59).

The convivial society and city that have existed at Tilonia, District Ajmer, Rajasthan, for over four decades are a testimony that the division into rural and urban binaries is detrimental to development with a human face. Development for the purpose of accumulation and control over population and resources will not only lead to increasing dependence of humans on machines, therefore loss of human dignity and creativity, but it will also cause unprecedented ecological crises. It will also rupture the delicate balance between nature and culture that has been preserved over many generations and bring in the culture of obsolescence.

The experiments that have been made at Tilonia have so far succeeded in sustaining convivial society by: Need-based development against greed-based development, transparency against opaque bureaucratic hierarchy, grass-root level democracy against centralization of power, on-job practical skills against certification and paper qualification, self-reliance against dependence on machines, and finally, ethics against high and ostentatious ways of life.

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Assessing the Livelihood Capacity of Workers and Planning Orientation for Residential Areas Toward Sustainable Livelihood of Workers in Industrial Zones Around Hanoi, Vietnam

Lan-Huong Le and Anh-Vu Nguyen

Abstract The massive development of industrial zones in Vietnam in recent years has resulted in a significant wave of migrant workers from rural areas. Apart from facing a lack of adequate housing, these workers have to face social problems such as low income, precarious work, and difficulty in social integration. The number of workers over 30 years old being laid off after a period of working in industrial zones has increased dramatically in recent years, becoming an alarming phenomenon. The assessment of the livelihood capacity of workers and the corresponding orientations for the planning of residential areas aimed at sustainable livelihood is a crucial study. The study objectives are indicators that can be used to evaluate the capacity of employees to sustain a livelihood. The research methodology includes spatial research and quantitative sociological methods based on DFID's sustainable livelihood framework. The authors surveyed five industrial zones around Hanoi with 300 questionnaire forms and assessed workers' housing conditions as well as their livelihoods. The results show that the livelihood capital of workers is rather low. The authors point out that while natural capital is unlikely to be improved, human capital, social capital, and physical capital can improve significantly if there are reasonable housing policies and planning solutions for the workers. This study provides a new perspective on the development of social housing for low-income workers in Vietnam: housing development not only increases the number of housing units available, but also helps fulfill the purpose of developing resources that support human livelihood.

Keywords Sustainable livelihood · Livelihood capital · Low-income worker · Planning of the residential area

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1 Introduction

After nearly 30 years of industrial zone development, by the end of 2018, Vietnam had 326 industrial zones established, of which 250 were in operation. These industrial zones have provided jobs to about 3.85 million workers in the whole country (Ministry of Construction 2020). Among them, Hanoi has 13 approved industrial zones, of which 8 zones are in operation with a total area of 1,236 hectares. According to data collected by the research team from interviews at the Ministry of Planning and Investment, these Hanoi industrial zones have created jobs for about 150,000 people, of which 70% are migrant workers.

The young migrant workers in industrial zones (IZs), mostly manual workers, have been barely equipped with professional skills. Thus, their starting salary is rather low and can only meet their minimum demands for living (Oxfam 2015). They have to live in poor housing conditions, as well as inadequate infrastructure systems, particularly social infrastructure (JICA 2016). Overwork is quite common, as noted in over 60% of the study cases (207 factories and workshops investigated) (Better Work Vietnam 2015). As a consequence, those workers have health-related problems and almost no time to participate in activities such as cultural activities, sports, self-learning, and social interaction for personal development. A project entitled "Urban Poverty Observation" conducted a survey to measure six key indicators of living conditions among migrant workers in Hanoi within a four-year span (2008–2012). The outcomes indicated that "expensive living costs" and "insufficient social integration" are the two most serious problems to migrant workers. Other disadvantages include "inappropriate access to social welfare services," "unfavorable working conditions," "low-quality living," and "low-income jobs" (ActionAid, UKAid and Oxfam 2012). Indeed, workers in many industrial zones are coping with great difficulties in their daily lives.

These workers have good reasons to worry about their future; most of them are working in factories that require simple job skills and high school certificates (Pham 2018). It is apparent that these manual laborers are facing an unstable future as a result of having no advanced qualifications (UNDP 2015; World Bank 2018). Another investigation undertaken in 2016 by the Institute of Workers and Workers Union reveals that the average working time among workers in industrial zones is seven years only. Those who are over 35 years old can be replaced by younger workers, and this happens quite often. (Vu 2018). If migrant workers lose their jobs at this age, they would have to cope with a difficult situation. It will be very hard for them to find a new job or to attend some training courses, because of their limited awareness, knowledge, and age, as well as health. Losing jobs shall put a financial burden on their shoulders, and their children's education may also be affected. In the context of the 4.0 Industrial Revolution, which included the robotization in mass production, there was a lower demand for workforce,[1] a situation that must be taken

[1] Industrial Revolution 4.0 goes with the trend of robotization in industrial production, leading to mass joblessness among human workers. For example, Minh Long I ceramic factory in Vietnam

into account, not only in Vietnam but also in other countries (Balliester and Elsheikhi 2018; Kelly 2016).

This chapter considers how best to develop industries while still ensuring social sustainability and humanity. Further questions include: How should the change be structured so that workers will be able to acclimatize themselves to the changes in their lives and jobs after 10–15 years working in industrial zones? What can urban planners and project developers contribute to helping workers build new lives with more sustainable livelihoods? With these questions in mind, the authors hypothesize that a social housing project for workers, if implemented in reality toward sustainability, must help develop human resources apart from providing more accommodations for workers and their families. With such assistance, they will be able to ensure the capacity for sustainable livelihoods. Therefore, this research aims to assess the current indicators of sustainable livelihoods among workers in a few selected industrial zones in Hanoi and then to recommend an orientation for planning and building residential areas for workers with the goal of sustainable livelihood.

2 Research Methods

2.1 Definitions and Theories

One definition given by Chambers and Conway (1992) has been widely recognized and officially documented by the United Nations Development Programme (UNDP) and the Department for International Development (DFID): "A livelihood comprises the capabilities, assets, and activities required for a means of living. A livelihood is sustainable when it can cope with and recover from stresses and shocks and maintain or enhance its capabilities and assets both now and in the future, while not undermining the natural resource base." This study uses a theoretical framework for sustainable livelihoods developed by DFID, in which human livelihoods comprise human capital, physical capital, social capital, natural capital, and finally, financial capital.

Human capital is defined by the Penguin economics dictionary as "the skills and abilities of an individual to help that person earn his or her income." The Organization for Economic Cooperation and Development (OECD) study introduces the broader concept in which human capital is "knowledge, skills, abilities and personal attributes that can facilitate the creation of benefits belong to individuals, society, and economy." According to this definition, human capital is in a constant process of change from the moment of individual birth to death. For Vietnamese IZs' workers, if we look at "personal attributes" to generate income at the current time, the indicators to evaluate human capital include: (i) youth (with the current situation of recruiting

imported 7 robots for production in 2015. The number of workers for the same workload dropped from 400 to just 20 people (Source: Tuoitre 2020).

young workers, with the age of the employee affecting their employment opportunities); (ii) knowledge (education level of the employee); (iii) skills (skills at work, as shown through the job position); (iv) health (based on assessment of health status, number of sick leave/year, etc.).

Physical capital comprises the basic infrastructure, tools of work, or physical means held by the public, households, or individuals that help people meet basic requirements for work and increase labor productivity (DFID 2000). The physical capital of IZs' workers in residential areas, therefore, includes: (i) housing (area, ownership status, home amenities); (ii) local area infrastructure; (iii) household equipment and tools (vehicles and other work tools).

Social capital is seen as a resource arising from social connections and serving members (individuals or collectives) in social networks (DFID 2000). To evaluate the social capital status of the workers in IZs, the applicable criteria include: (i) employee's social relations (including relations with family, fellow countrymen, colleagues, urban relatives and friends, neighbors, and local government); (ii) employee's social organizations (youth associations, women's groups, religion, sports, arts, and other interest groups); and (iii) residential participation activities (community activities such as cleaning, setting up house rules, improving housing spaces).

Natural capital is described as the stocks of natural resources from which further resources and services can be developed, which may prove useful to livelihoods (DFID 2000). While natural capital plays an important role in the rural population, it has little effect on urban dwellers (Rakodi and Lloyd-Jones 2002). Natural capital is also a factor that is difficult to improve, but it can change over time. For workers in IZs, natural capital is in short supply due to the lack of land or other natural resources. However, if natural capital is considered as an objective factor affecting human livelihoods, the location and livelihood environment of the area can be considered as one of the evaluation criteria.

Financial capital refers to the financial resources that people use to achieve their livelihood objectives. Personal and household financial capital is understood as wages, bank deposits, pensions, and other factors that can be converted into money to help a livelihood (DFID 2000). The indicators to evaluate the financial capital of workers include: (i) total income (from employment in the IZs and part-time jobs if any); (ii) accumulation (the amount saved after spending); (iii) access to capital (borrowing from banks, credit institutions, relatives, friends).

2.2 Scope of Research

Among the eight industrial zones in operation in Hanoi, the research team selected five case studies including North Thang Long, Sai Dong, Quang Minh, Noi Bai, and Thach That (the position shown in Fig. 1). These industrial zones are quite large in terms of land area, noted for a high level of occupancy and also for a large number of workers.

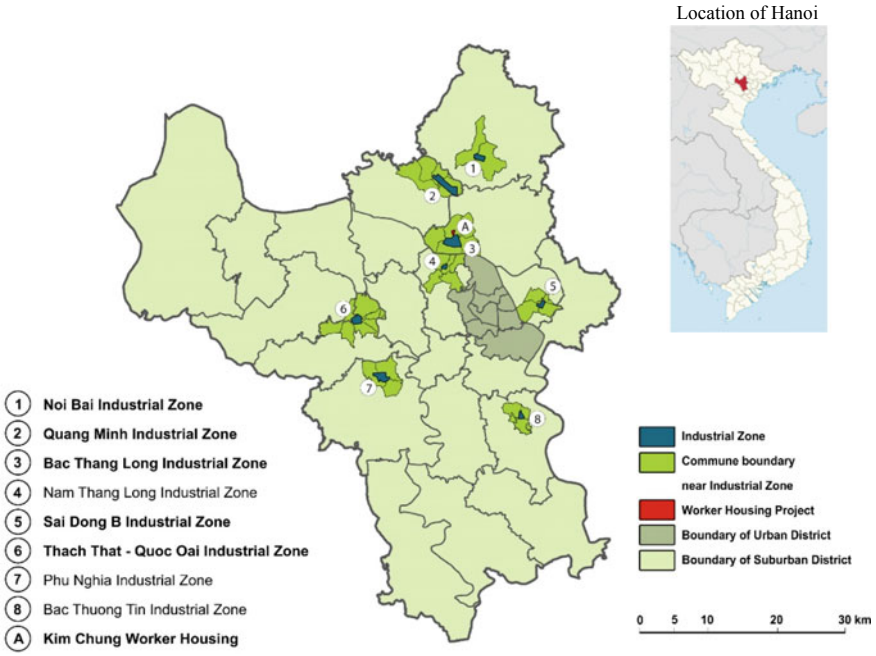

Fig. 1 Map of industrial zones in operation in Hanoi. *Source* Authors

A common living concept for workers in these industrial zones is rented housing provided in the villages adjacent to the IZs. A project-based housing area is found only in the North Thang Long industrial zone, namely Kim Chung residential area with 18 blocks from 5 to 15 stories, which offers accommodation for about 11,000 workers. Housing conditions for workers in Kim Chung are generally better than in villages, where there are mainly rows of temporary boarding rooms with no private toilet (Figs. 2 and 3). In order to compare the impact of residence models on the Sustainable Livelihood Index of workers, the team members handed out 100 questionnaires in North Thang Long industrial zone, equally divided into two categories: project-based housing (50 questionnaires) and village-based rental housing (50 questionnaires). In the other four industrial zones, there is only one housing pattern (village-based rented houses), and 50 questionnaires were sent to the workers in each case study (Table 1).

2.3 Data Collection

These workers are hard to reach because they work long hours, an average of about 10.9 h per day or almost 53 h per week, including a regular shift plus a few hours of overtime. When they come back home, they are often sleeping, resting, or eating, and many of them were not willing to be interviewed. Once the five industrial zones

Fig. 2 Some pictures of Kim Chung workers' housing projects. *Source* Authors

Fig. 3 Some pictures of village-based rental housing for workers near North Thang Long industrial zone. *Source* Authors

Table 1 Database of IZs in operation in Hanoi and number of questionnaires for each surveyed area

No.	Industrial zone	Start year	Area (ha)	Rate of occupancy (%)	Number of workers	Number of questionnaires
1	North Thang Long[a]	1994	274	100	60,990	100
2	Noi Bai[a]	1994	114	98	18,520	50
3	Sai Dong[a]	1995	47	100	8790	50
4	Quang Minh[a]	2007	407	85	36,270	50
5	Thach That[a]	2007	155	98	13,850	50
6	Phu Nghia	2007	165	71	13,840	–
7	Ha Noi–Dai Tu	1995	40	34	6670	–
8	South Thang Long	1998	30	98	1565	–
	Total					300

Note [a] Areas had been selected for the survey
Source Authors' synthesis based on data provided by the Ministry of Planning & Investment

were selected, the research team contacted the local government and the industrial zone management board in each industrial zone to seek permission to implement the survey and to receive a list of owners of rental units in nearby villages. From the list, we identified possible units to target for implementing the survey.

In each industrial zone, the target sample size was 50 workers to be surveyed at their place of residence. Workers' scheduled shifts included a morning shift, not counting overtime (6 am–2 pm), an afternoon shift (2 pm–10 pm), or a night shift (10 pm–6am). We planned our visits to each industrial zone to coincide with the time that workers were expected to return home from their shifts to increase the contact rate. The research team used a convenience sampling method (i.e., workers who were at home at the time of our visit); however, we did not interview more than two households per housing development[2] in the village in order to seek greater spatial dispersion of households. Of the individuals we asked to participate in the survey, the acceptance rate was between 50 and 60% depending on the industrial zone.

The survey was conducted using a paper questionnaire. The questionnaire was developed by the research team based on the theoretical framework of sustainable livelihoods and the characteristics of Vietnamese industrial workers. The finished surveys were double-checked for missing items, then digitalized for further analysis. A final set of 289 questionnaires were selected out of a total of 300 that were initially handed out.

[2] Village-based rental housing (often referred to as informal housing) is developed by villagers on their own land. Depending on the amount of land they have, the area for a rental housing development can range from a few dozen to several hundred square meters. This area is typically divided into rows of rooms (usually 5 to 20 rooms). Each room is around 6-10m2 (for 1–2 people).

2.4 Data Analysis

The authors used the framework for sustainable livelihood developed by DFID with five main sources, namely human capital, natural capital, physical capital, social capital, and financial capital. These capitals could be calculated on the basis of some specific criteria. As these criteria are evaluated and measured with different rating scales/systems, they need to be standardized and then calculated on the basis of average values, just as the Human Development Index (HDI) by Anand and Sen applied (Anand and Sen 1994), before dealing with sustainable livelihood indicators. Livelihood criteria can be described as follows:

$$\mathrm{LC}_i = \frac{\mathrm{In}_i - \mathrm{In}_{\min}}{\mathrm{In}_{\max} - \mathrm{In}_{\min}} \tag{1}$$

in which: LC_i: standardized value of i criterion

In_i: average value of i criterion.

$\mathrm{In}_{\max}$ and $\mathrm{In}_{\min}$: maximum and minimum values of i criterion, respectively.

After each criterion has been standardized, all the criteria for one livelihood capital shall be calculated on the basis of an average value, to estimate the value of each livelihood capital. The formula for Livelihood Capital Index (LCI) shall be given as follows:

$$\mathrm{LCI}_j = \sum_{1}^{i} \frac{\mathrm{LC_n}}{i} \tag{2}$$

in which: LC_i: standardized value of each criterion j can range from 1 to 5

i: the total number of criteria of each livelihood capital.

Once the indicator of each livelihood capital has been determined, a Sustainable Livelihood Index (SLI) can be averaged with the each component criterion weighted by importance. These weight values can be fixed based on expert interviews and evaluations from 289 households regarding the importance of each criterion to a sustainable livelihood. On a 0 to 10 scale, experts and workers evaluate human assets, social assets, financial assets, physical assets, and natural assets at 10, 10, 10, 9, and 8 points, respectively. An SLI can be calculated as follows:

$$\mathrm{SLI} = \sum_{1}^{5} \frac{W_j \times \mathrm{LCI}_j}{\sum W_j} \tag{3}$$

in which: W_j: weight of j livelihood capital

LCI_j: standardized value of j criterion.

3 Research Outcomes and Discussions

3.1 Evaluation of SLI Among Industrial Zone Workers in Hanoi

As recommended in a UNDP guideline, when 1 is the top score, SLI is rated "unsustainable" if SLI < 0.2; "limited sustainability" if 0.2 < SLI < 0.4; "sustainable" if 0.4 < SLI < 0.6; "progressively sustainable" if 0.6 < SLI < 0.8; and "abundant" if SLI > 0.8 (UNDP 2017). Compared to the survey outcomes (Table 2), it is apparent that livelihood capacity could be ranked at level "limited sustainability" since four key indicators (natural, physical, social, and financial assets) all failed to reach "sustainable" level.

Among sustainable livelihood capitals, human capital is at the top of the list (with a value of 0.47), since the majority of young workers (89% of 289 interviewees are between 18 and 30 years old) have a good health status. The financial capital index comes second (reaching 0.37) with an average salary of nearly 6 million VND, with over 70% of the worker households believing that this salary is enough to live on, if frugally. The natural capital and physical capital of the workers are low because they do not own land or houses. All workers live in rented houses with low housing quality and few comfort conditions (more than 40% of houses do not have private toilets, 92% of houses do not have air conditioners, and 26% of households do not have any basic equipment including refrigerators, televisions, or water heaters). It is noticeable that the social capital of these workers is also very low (only 0.21). The survey shows that while migrant workers have close relationships with their fellow countrymen, their contacts with local inhabitants are limited. More than 80% of workers do not participate in any social group or community activity in their living area.

In the survey sites of the North Thang Long industrial zone, workers living in the Kim Chung housing area have a slightly better livelihood than those in rented village housing in terms of three assets (human, physical, and social). Although the Kim Chung residential area is now gradually degraded and lacks some amenities, the workers here enjoy a better quality of life (in terms of floor space per capita and equipment). They also have a small community center located in the A4 building and open space (small park). Among the surveyed industrial zones, North Thang Long and Sai Dong can be found with higher human, material, and financial capitals. These industrial parks are located near highly urbanized areas with well-established services and infrastructure systems. The survey results show that there is no significant difference between the remaining zones (Quang Minh, Noi Bai, and Thach That). These three industrial zones are all located in rural areas, so the workers stay in villages with underdeveloped infrastructure. As a result, their indicators related to housing conditions and the quality of public services are all quite low.

Figure 4 illustrates the results of the indicators on assessing the sustainable livelihoods of workers in the five industrial zones surveyed and gives the average value index for Hanoi.

Table 2 Summary of SLI criteria among IZs' workers in Hanoi

Capital/asset	Criteria	Unit	Real value	Max	Min	Capacity index
Human capital	Educational background	class	12	15	9	0.50
	Work position	1 to 3	1.3	3	1	0.15
	Health status	1 to 5	3.2	5	1	0.80
	Difference between labor force and dependents	0 to 2	0.92	2	0	0.46
LCI of human capital						0.478
LCI of human capital with weight (1)						0.478
Natural capital	Land ownership	0 to 1	0	1	0	0
	Favorable location	1 to 5	2.69	5	1	0.423
	Environment	1 to 5	1.85	5	1	0.213
LCI of natural capital						0.212
LCI of natural capital with weight (0.8)						0.169
Physical capital	Housing as an asset	0 to 2	0	2	0	0
	Average floor area per capita	m^2/person	9.6	20	5	0.307
	Housing condition	1 to 5	3.1	5	1	0.525
	Comfort	0 to 7	2.8	7	0	0.257
	Infrastructure	1 to 5	1.86	5	1	0.465
LCI of physical capital						0.288
LCI of physical capital with weight (0.9)						0.272
Social capital	Social relations	1 to 5	2.49	5	1	0.373
	Participation in social groups	0 to 3	0.24	3	0	0.08
	Participation in local activities	0 to 3	0.56	3	0	0.187
LCI of social capital						0.213
LCI of social capital with weight (1)						0.213
Financial capital	Average income	million VND	5.97	10	3.1	0.416
	Family savings	million VND	2.66	10	0	0.266

(continued)

Table 2 (continued)

Capital/asset	Criteria	Unit	Real value	Max	Min	Capacity index
	Access to loans	0 to 4	1.7	4	0	0.425
LCI of financial capital						0.369
LCI of financial capital with weight (1)						0.369
Total SLI						0.310

Source Research results of the authors

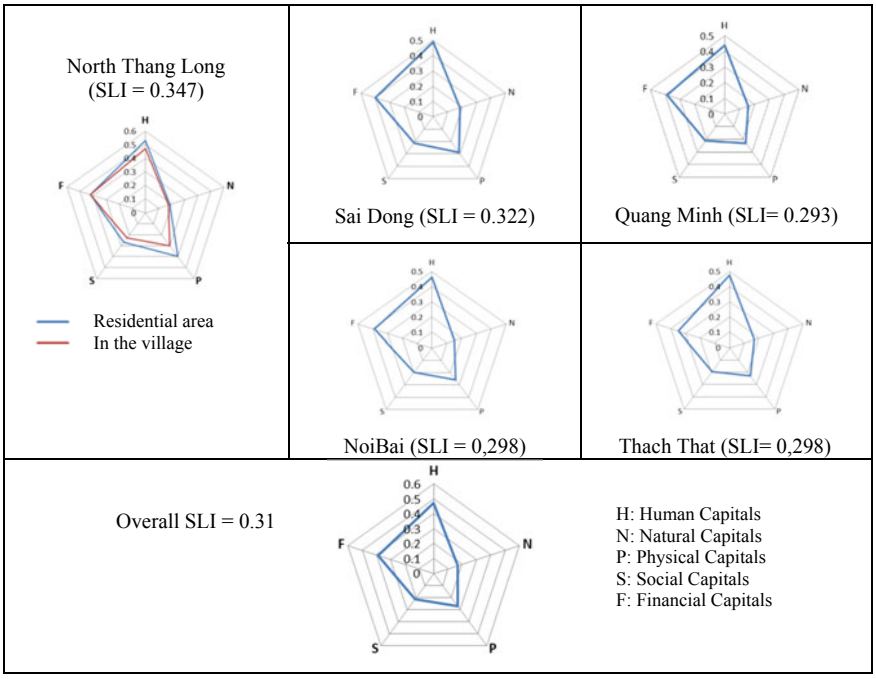

Fig. 4 SLI in each industrial zone investigated and overall SLI for IZs in Hanoi. *Source* Research results of the authors

3.2 Planning Orientation for Workers' Housing Projects Toward Sustainable Livelihoods

In order to enhance the human capital index, housing projects for workers must be systematically planned with a wide range of social services including education, health care, culture, sports, and entertainment, so that the workers can make full use of these services for their personal development: not only in terms of knowledge or skills, but also to enhance their physical activity and spiritual life (Le 2019). These

service areas should be regarded as the core of a living quarter for workers when seeking to set up sustainable livelihoods.

The way such a living quarter is planned and designed has an influence on the workers' physical assets, to a certain extent. Thus, in addition to a standard infrastructure system, it is necessary to develop a variety of housing patterns for workers focusing on affordability and supporting policies targeted at tenants. Furthermore, it is advised to offer mixed-income residential areas and encourage this concept, because it will bring great benefits to the community and help develop local human resources, for both individuals and the community (Levy et al. 2010; Joesph et al. 2007).

The study results reveal that the workers with a poor indicator for social capitals can hardly participate in social activities and local community programs, especially low-income groups (Brocklesby and Fisher 2003; Pittman et al. 2009). For this reason, communication should be facilitated, and space for communication needs to be created within all residential zones, particularly for the workers.

Improving family income with new livelihoods is also a means of ensuring sustainable livelihoods (Chambers 1995). Aided by the Plan International Project,[3] many female workers have been able to attend training courses and become employed by service providers in the surrounding areas of industrial zones in Hanoi, after they quit their jobs as low-paid workers (Pham 2018). In view of planning, a housing project for workers may include free-trade zones as mixed-use areas or shopping streets, where there are many opportunities for residents to work part time or change careers to increase household income.

Although natural assets play an important role in the countryside, they do not affect livelihoods as much in the cities (Rakodi and Lloyd-Jones 2002). But, the so-called concept of "livelihood environment" can always be considered an essential indicator for evaluating natural assets in this study, which can be partially improved by means of supporting policies for socioeconomic development as well as the establishment of an efficient information system.

In summary, planning policies and solutions (Table 3) aimed at developing housing projects for workers can have a major influence on sustainable livelihoods. This indicator can be gradually upgraded, from "in shortage" through "limited" to "satisfactory."

[3] Plan International has launched the project "Creating sustainable employment opportunities and a safe community for young female immigrants in Hanoi." The project is funded by the Australian Ministry of Foreign Affairs and Trade and is implemented in Dong Anh district, Hanoi, with the coordination of the North Thang Long Technical - Economic School, the Women's Union of Dong Anh district and Light Community Health Development Institute (LIGHT). The project was held from December 2016 to June 2019. Approximately 2,000 female migrant workers have been provided information and advice on accommodation, employment, and study opportunities; 800 people were trained to enhance professional skills, soft skills, and work ready skills; 590 people were connected with businesses for internship opportunities and stable jobs after training; and 100 women received training and self-employment support from models planned by themselves (Source: LIGHT 2020).

Table 3 Recommended solutions to enhance Sustainable Livelihood Index for workers and their families in industrial zones (Source: Research results of the authors)

		Livelihood threshold			Solutions	
		Deficient	Basic/sustainable	Developed/completed	Direct (space)	Indirect (policies)
Human capital (H)	Knowledge	• Leaving school early • Difficult to gain access to education	• Going to school (level of education based on age group)	• Going to school (level of education based on age group) • Study as needed	• Standard schools (both quantity and quality) • Online training	• Investment policies in education systems
	Skills	• No training courses available	• Training courses	• Training courses provided • Regular (and advanced) training with numerous job options • Environment to develop professional skills	• Vocational schools and counseling centers • Online training • Free-trade service areas that bring more income	• Supporting policies • Professional organizations and associations
	Health	• No medical care • No physical exercise • Substandard living condition	• Basic healthcare services • Physical exercise • Standard living condition	• Basic healthcare services • Daily physical exercise • Good living condition	• Standard healthcare services • Sports facilities • Good housing quality	• Policies to attract more investment in social infrastructure • Relevant housing policies

(continued)

Table 3 (continued)

		Livelihood threshold			Solutions	
		Deficient	Basic/sustainable	Developed/completed	Direct (space)	Indirect (policies)
Social capital (S)	Social relations	• Only within family members and relatives	• Relationships with family members and relatives • Relations with next-door neighbors	• Relationships with family members and relatives • Relations with next-door neighbors • Relations with fellow citizens	• Community centers (small-scale and large-scale subject to levels)	• Appropriate investment and management policies • Encouragement of the public participation and self-governance
	Participation in social groups	• No participation	• Participation in clubs, arts, and sports teams/groups	• Participation in clubs, arts, and sports teams/groups • Participation in activities within the neighborhood • Participation in other activities at district and city levels	• Club houses and entertainment centers • Community spaces within a neighborhood	• Development policies targeted at various groups • Efficient information systems
Physical capital (P)	Housing	• Poor housing	• Standard/decent housing for all	• Standard housing • Flexible housing • Home ownership	• Decent homes at reasonable prices, with various options for housing patterns	• Housing development policies • Housing financial support

(continued)

Table 3 (continued)

		Livelihood threshold			Solutions	
		Deficient	Basic/sustainable	Developed/completed	Direct (space)	Indirect (policies)
	Work tools	• No work tools	• Transport means and activities that help increase income levels	• Transport means and activities that help increase income levels • Facilities for production and business purposes		• Relevant financial policies
	Infrastructure	• Substandard system	• Standard level	• Standard level • Driving force for local socioeconomic development	• Enhancement of infrastructure quality for workers housing projects and surrounding areas	• Policies that attract more investment and consolidate management
Financial capital (F)	Savings	• None or little	• Savings for hard time (illness, unemployment)	• Savings for hard time (illness, unemployment) • Savings for business start-ups	• More job opportunities for higher income (job centers)	• Policies that enhance income level for workers
	Access to loans	• Difficulty	• Abilities to borrow moneys from credit organizations and banks	• Abilities to borrow moneys from credit organizations and banks		• Prioritized loan policies • Efficient information systems

(continued)

Table 3 (continued)

		Livelihood threshold			Solutions	
		Deficient	Basic/sustainable	Developed/completed	Direct (space)	Indirect (policies)
Natural capital (N)	Land	• None	• None	• None		
	Location	• Located far from urban areas • Isolated, without relations to neighboring areas	• Located within well-developed economic zones and fairly highly urbanized areas	• Located within well-developed economic zones and highly urbanized areas • Strong urban areas and EZ relations	• Development of regional infrastructure systems and connection with other regions	
	Environment	• None	• Basic services for business and production	• Favorable conditions for economic development		• Supporting policies • Database for development

4 Conclusions and Recommendations

The research results show that the SLI among workers in Hanoi is estimated at 0.31—equal to "limited sustainability." Many workers need urgent help in developing natural, social, physical, and financial capitals. It is rather difficult to create a significant impact on natural capitals, while the other capitals can be substantially improved with relevant planning and building policies as well as solutions.

In order to achieve sustainability, the following solutions should be considered: (1) developing more housing types, enhancing housing quality, and applying more financial supporting policies that encourage home ownership and mixed housing concepts; (2) systematically developing social infrastructure systems, such as education, health care, culture, and sports within living quarters built for workers; (3) shaping more spaces for commercial activities and services within such neighborhoods, giving the residents more opportunities to participate in service activities and helping them improve their income; (4) designing spaces for community communication and activities in the building, group of buildings, and the entire residential area; (5) facilitating public participation in development and management of public spaces in their living quarters; and (6) establishing an efficient information system to help workers and the parties involved search for and find information on housing, services, and job offers, as well as connect with other residents.

In summary, improving the Sustainable Livelihood Index for employees and contributing to social stability are important goals for local industrial development. To develop sustainable residential areas for workers, planning and design solutions need to take into account the strengthening of workers' livelihood capitals.

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Evolutionary Livability of New Urban Areas in Hanoi: From Plan(ning) to Market(ing)

Minh Tung Tran, Thanh Hung Nguyen, and Ngoc Huyen Chu

Abstract Livability concerns reflect a natural evolution of planning priorities to meet the needs of a relatively affluent post-industrial society. In Vietnam, after the socioeconomic reform in 1986, livability became a norm in urban development policies. As for Hanoi, this concept was first mentioned in its master plan publicized in 2011. A large number of housing projects were set up hastily and unceasingly along the peri-urban belts of the city, where the development of new urban areas (Khu Do Thi Moi—KDTM in Vietnamese) appreciably improved both the quality and quantity of urban housing. From being a social welfare good in the planned economy, housing has become a commodity traded in competitive real estate markets of the market-oriented economy. As livability of a KDTM is closely related to living conditions and effectively reflects its residents' perceptions, this paper analyzes the change of a livability-forming viewpoint in new housing projects and provides updates on Hanoi-(re)making trends since 1954. By studying two cases (Linh Dam, with the "KDTM Model" title awarded in 2009, and Ecopark, "The best KDTM" title awarded in 2018), this paper also explores the differences among methods of livability-making in KDTMs of Hanoi from plan(ing) to market(ing). Opinions of residents on the improvement of livability aspects in these two KDTMs are also quoted, and analyses were done for such feedback.

Keywords Livability · Hanoi · New Urban Area (Khu Do Thi Moi—KDTM) · Model of KDTM · Livable KDTM

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1 Introduction

1.1 Trend of Livability in Vietnam

Livability concerns reflect a natural evolution of planning priorities to meet the needs of a relatively affluent post-industrial society that emphasizes quality of life and recreational opportunities more than earlier generations did (Inglehart 1990). The quest for livability is currently a critical urban issue (Kaal 2011). Considered "a new ideology", livability became a popular topic in the 1980s as planners began studying shifts in development patterns from the decline of urban centers to rapidly growing suburban areas. Livability encompasses a wide array of issues relating to overall quality of life and well-being (BrookLyndhurst 2004) and gained popularity through the annual surveys that rank the world's most livable cities. Now, this concept is more of a qualitative construct representing a set of characteristics that relate to the attractiveness of an area as a desirable place to live, work, invest, and conduct business (Giap et al. 2014). Livability is reflected in two factors. The first is the population's characteristics, assessed through the prism of their needs and desires. The second is the urban physical and biological environment affecting the population's lives and livelihoods. The interplay of these dynamics that define livability varies across space and time (Rutha and Franklin 2014).

In 1986, after a long period of hardship due to the state-planned and subsidized economy, Vietnam started its change to a market-oriented economy. This renovation (or Doi Moi in Vietnamese) policy reformed land, liberalized prices, boosted the private sector, expanded trade and investment (World Bank 1996), and dramatically changed the cities' appearance. The concept of livability (livable city) was first mentioned after the impressive changes in Da Nang city from a provincially run city to a centrally run one in 1996 with a series of renovations toward a "Green and Livable City" (World Bank, 2017). The city-(re)making model of Da Nang has raised a movement to (re)create attractive and livable cities in Vietnam. With the concept of a livable in mind, developers began to translate it into smaller scales: livable housing projects, a means to attract customers and create a reputation and brand name in a fiercely competitive and fledgling real estate market.

Now, livability is becoming a norm in urban development policies, especially for leading cities like Da Nang (Party Central Committee 2019) and Hanoi (Government Office of Vietnam 2017). From the standpoint of policies, programs, political manifestos, and business philosophies, maintaining or improving a city's degree of livability appears to be one of the main concerns of various entities, ranging from local and central authorities to civil society and business (Kaal 2011). Livability was mentioned in Hanoi's master plan in 2011 after its boundary expansion in 2008 and adopted in a much narrower and more operational sense: the "green(er), clean(er), beautiful(er)" agenda. Although located in the lower half of international rankings (Mercer 2019), the progress in annual position (EIU 2018) reflects Hanoi's efforts to improve the appearance of a livable city. Paradoxically, although the city has always been a target of complaints in regard to environmental pollution, traffic jams, and

overloaded infrastructure, among others, it has the second-highest migration rate (General Statistics Office of Vietnam 2015). That has brought a large number of rapidly developed and largely contiguous housing projects on the peri-urban belts, in which KDTM (Khu Do Thi Moi—new urban areas) account for a high share in land area and number of houses.

1.2 Hanoi's Making Space: From Functional City and Planned Neighborhoods to Open City and New Housing Projects

Since 1954, Hanoi planning, which was always influenced by the Soviets, wherein city-making was a high manifestation of the state's power and behavior in order to implement five-year plans, to a certain extent was a strengthened method left by the French [2]: emphasizing orthodoxy and earnest designs and determining the form and appearance of a long term and stable city. This method can be easily implemented in a centralized economy where the state plays an exclusive role, as an investor, a developer, and also a housing supplier. The spatial development plan must strictly obey predetermined programs and is reflected in provision of subcenters with urban functions, which are coded in different color blocks on the map. Furthermore, containment and somewhat effective migration barriers helped Hanoi develop these ideas about the future of the socialist city (Geertman 2007).

As a result of the adoption of the "mikroraion" model of the Soviet Union in Vietnam (Geertman 2007; Logan 2000), "Khu Tap The" (KTT—collective housing blocks) were designed with a living standard expressed in per capita floor area, mainly 4–6 m^2/person (Ngo 1998). Such a modern residential block was characterized by uniform housing units and by standardized, modularized, and industrialized construction methods. However, the livability of these neighborhoods was not earned from apartment units but from state-provided amenity services outside the buildings (Ngo 1998), including education (kindergartens, primary schools), livelihood (collective restaurants, state-owned shops), and culture-sports (cultural houses, sports centers). This created a new living standard: housing with public services made residential blocks self-sufficient. These KTTs often received financial or technical support from socialist countries. Due to the foreign style architecture, they became desirable in the eyes of residents.

Together, globalization and competition among world cities triggered a remarkable transformation in Hanoi. All activity sectors, population groups, and newly developed areas of Hanoi were robustly reshaped by these metropolitan trends and by planning processes, funding, and management decisions (Leducq and Scarwell 2018). However, changes to the housing sector took place at a much slower pace. Until 1995, the level of housing sector privatization was "little or none" (World Bank 1996), and governments struggled to find a new model of housing development in the form of projects involving economic enterprises after the end of housing subsidies.

Conceived in 1993–1994, the seven pilot KDTMs charged by state-owned enterprises were developed after many negotiations on policy adjustments to ensure the harmonization of interests and obligations among actors (Pandolfi 2001). After that, this model was replicated with the participation of the private sector.

According to a 2015 World Bank report, housing production in Vietnam can be segmented into several sub-markets: state-driven, commercially produced, and self-built housing development (Samad et al. 2015). The state has gradually withdrawn from housing provision and re-allocated the real estate market to the private sector under a free market mechanism. Even former state-owned enterprises in the housing sector have been equitized. As a result of liberalization, private-sector housing production has flourished. City authorities were obsessed with achieving the goal of a vibrant private-sector housing market. The state, instead of holding a monopoly role, now simply formulates policies to promote and control housing production in the desired orbit. Even urban planning, a "sensitive" field, is shared with the private sector. In some KDTMs, private enterprises are allowed to help the government with urban planning when the project area has no "state's plans". This is a revolution in city (re)making to take advantage of social resources and to create legal conditions to pave the way for the projects.

The period 1986–1997, with a series of changes in policies, is considered a transitional movement between the two housing production mechanisms: "according to (program) plan" before 1986 and "responding to market (demand)" after 1997 (Fig. 1). The year 1998 was when private developers took over and, since then, have taken the lead in the total volume of new housing produced (Samad et al. 2015). Also, because of the launch of the KDTM model in 1998, Hanoi issued a new master plan (replacing the one just announced in 1992), considered to be relatively successful, with the orientation to expand the city with housing projects, of which KDTMs occupy a large proportion, opening a new era for Hanoi spatial development.

2 KDTMs Assessed Through the Lens of Livability

2.1 Era of KDTMs

After Doi Moi, Vietnam introduced a new strategy: project-based housing development, wherein the state's perspectives on the economic value of land and the sharing of housing stock differs from that of the private sector (World Bank 2011). After the first seven pilot KDTMs in 1997–1998 (Pandolfi 2001; Tran 2018), this model spread widely in Hanoi: Agricultural areas were filled quickly by residential lands (Tran 2016, 2018). In recent decades, hundreds of master-planned KDTMs were developed on the urban fringes of the city and garnered a great deal of attention lately to the post-Doi Moi era (Labbé and Boudreau 2011), promoted as a new city-(re)making concept with post-reform policies (Tran 2015). KDTMs are a hybrid product of government-led policies, entrepreneur-driven planning, and resident-organized space

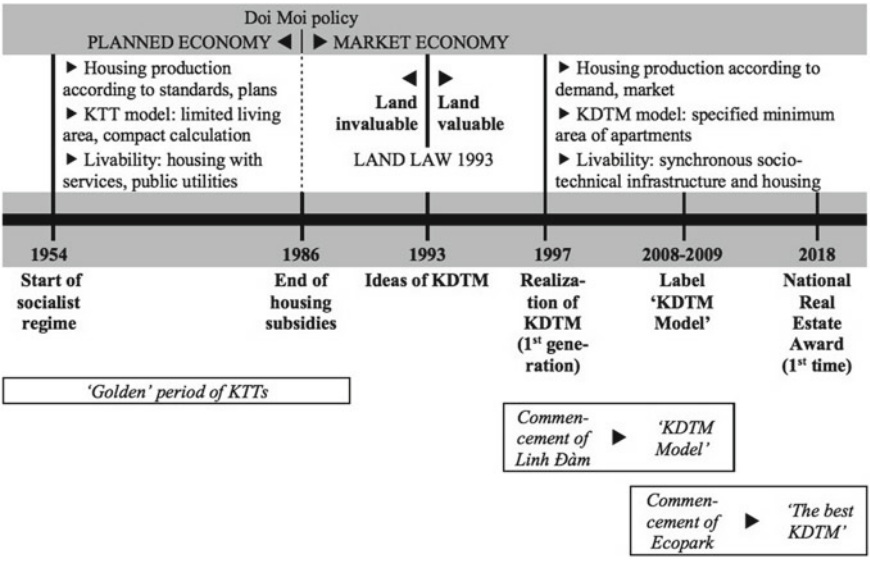

Fig. 1 Evolution of new housing projects in Hanoi since 1954. *Source* Authors

(Trinh 2014). However, due to market imperfections and management shortcomings or manipulation, the investors merely focus on building units for sale, while public service facilities are often ignored with uncertain promises to provide it later, regardless of the approved plans (Trinh 2014). From the planned economy's social welfare, housing becomes a commodity traded on the competing real estate market (Pandolfi 2001). There are several variants of KDTMs, including eco-KDTM, gated-KDTM, and smart-KDTM (Tran 2018) that provide superior real estate products, emphasize livability, and create competitive images: an approach to best satisfy the needs of customers by creating adequate residential environments in which livability is considered the trump card.

Achieving the vision of lively-safe-sustainable-healthy cities has become a general and urgent desire, particularly with social and cultural opportunities, as well as attractions associated with a lively city (Gehl 2010). Seeing the livability of a KDTM related to living conditions and reflecting residents' perceptions, we conducted a premise survey in 2018 on attractiveness and livability of four representative KDTMs in Hanoi, in which residents were randomly selected for interview by surveyors (Table 1). On the other hand, two more important KDTMs have received national titles:

(1) Linh Dam, one of the seven pilot KDTMs, was awarded the "KDTM Model" title by the Ministry of Construction in 2009. Even though it was evaluated by its owner as "having awakened the whole southern gateway area of Hanoi, where ponds, lakes, and low-lying fields once dominated, and being a potential model for cities across the country" (Figs. 2 and 3), Linh Dam, from another perspective, may no longer have the opportunity to integrate a service center as

Table 1 Brief information on the surveyed KDTMs

KĐTM	Linh Dam	*Viet Hung*	*Van Quan*	Ecopark
Panorama				
Year of commencement	1997	*2003*	*2004*	2009
Distance to the city center	10 km	*10 km*	*11 km*	17 km
Area size	200 ha	*210 ha*	*61 ha*	500 ha
Population scale (ppl)	25,000	*26,000*	*14,000*	40,000
Number of surveyors (ppl)	47	*46*	*56*	64

Note In this paper, we analyze only the data of Linh Dam and Ecopark. The data of Viet Hung and Van Quan are used solely for comparative purposes

Fig. 2 Linh Dam awarded with "KDTM Model" title in 2009. *Source* Authors, in 2011

originally expected (Fig. 4). It has been transformed into a commuter town and also become a subordinate settlement model, due to its increasing dependence on external resources. This was caused by the lack of internal resources because the opportunities to provide common space, services, and on-site jobs are gone (Khuat 2016).

(2) Ecopark is one of the six KDTMs awarded "The best KDTM" title by the Vietnam National Real Estate Association in 2018. Established 12 years after Linh Dam, it was described by its owner as "a standard model of a green KDTM in Vietnam, the beginning of a great journey that the residents can experience a new way of living with the values of community, culture, and people"[1]

[1] http://www.ecopark.com.vn/gioi-thieu/tong-quan-du-an, last accessed 2019/08/30.

Fig. 3 Master plan (modified after labeling in 2009) of Linh Dam: Many public buildings were replaced by high-rise apartment buildings *Source* Authors, in 2011

Fig. 4 Comparing two photos taken in 2011 and 2020: the unplanned implantation of HH complex (12 40-story buildings built in 2014–2016, providing about 9000 apartments) and the disappearance of the words "model new urban area" on the nameplate of Linh Dam *Source* Authors

(Fig. 5). With a distance of 17 km from the city center, Ecopark wanted to become a crowded residential community, with daily and long-term use instead of weekend residence. This KDTM is also considered one of the representatives that "mainly aimed at the wealthiest segment of the region's urban population" (Labbé and Boudreau 2011), creating a new trend of life enjoyment, upper strata, or high-class living (Fig. 6). However, behind the luxurious spotlights of Ecopark are the plights of farmers who are struggling after losing cultivation land.[2]

Research questions were formed from preliminary findings on livability in KDTMs, via case studies of Linh Dam and Ecopark. First, how does the change in the viewpoint of creating livability in KDTMs take place, along with an update of Hanoi's city-(re)making trends? Second, through the two typical examples, Linh Dam and Ecopark, what is the difference between the two ways of livability-making

[2] https://vov.vn/kinh-te/dia-oc/bat-cap-thu-hoi-dat-nong-dan-thanh-thay-kien-804898.vov, last accessed 2019/08/30.

Fig. 5 Place-making of Ecopark by green living environment: green tree and water surface (artificial) are trump cards. *Source* Authors, in 2020

Fig. 6 Advertisement of new properties at Ecopark: 'Resort masterpiece in the heart of Ecopark'. *Source* Authors, in 2020

after ten years of socioeconomic transformation? To answer these questions, we have conducted: (1) a literature review establishing a time context, based on desk study, for livability in KDTMs in the evolutionary progress of Hanoi, identifying practical examples and forming key issues; (2) a premise survey, using questionnaires in KDTMs to assess residents' satisfaction based on the 21 indicators above; (3) on-site interviews asking residents for their opinions on attractiveness and livability of their KDTMs; and (4) comparing and summarizing: examining the survey results to answer the research questions by comparing them with our hypotheses. Through field observations or observational research, the active observations enabled us to describe the two studied KDTMs, their attractiveness, and livability in relation to time and space.

2.2 *Preliminary Findings on the Livability in KDTMs via Case Studies of Linh Dam and Ecopark*

Based on fieldwork and neighborhood-making aspects, we evaluated the satisfaction of the residents in the KDTM they were living in, according to the five-level Likert scale (very unsatisfied, unsatisfied, quite satisfied, satisfied, very satisfied), over 21 indicators in six groups (Table 2).

Residents in Linh Dam are most satisfied with (5.3) Power supply, (1.1) Location and natural conditions and (1.2) Natural environment, and most unsatisfied with (4.4) Facilities around the houses, (6.1) Pollution, (2.1) Open space, and (3.1) Internal traffic. Nearly 30% of the residents are "very satisfied" with the (1.2) Natural environment thanks to the availability of the 74 haLinh Dam lake, while nearly 20% ranked (3.1) Internal traffic "very unsatisfied" because of traffic jams, accidents, and lack of car parks. In Linh Dam, just six of the 21 indicators received more than 50% very satisfied or satisfied ratings, while in Ecopark, only one indicator received

Table 2 Indicators for evaluating the satisfaction of residents of the KDTMs

Groups of indicators	Indicators
(1) Location and natural conditions	(1.1) Location in the city
	(1.2) Natural environment
(2) Public spaces	(2.1) Open space
	(2.2) Service and utility space
(3) Transportation	(3.1) Internal traffic
	(3.2) External connection
(4) Dwelling	(4.1) Housing design
	(4.2) Housing space
	(4.3) Housing facilities
	(4.4) Facilities around the housing
	(4.5) Initial cost of housing
	(4.6) Monthly cost for housing
(5) Technical infrastructures	(5.1) Provide clean water
	(5.2) Drainage
	(5.3) Power supply
	(5.4) Garbage collection
	(5.5) Information and communication
(6) Living environment	(6.1) Pollution
	(6.2) Security and safety
	(6.3) Easy to live
	(6.4) Improving income inside the KDTM

less than 50% the rest over 70%, including 100% (5.3) for Power supply. The two indicators that Ecopark residents are least satisfied with are (6.4) Improving income inside the KDTM and (1.1) Location and natural conditions (Fig. 7).

For quantitative comparisons, we converted the five-level ratings into scores: "unsatisfied" to 0, "very unsatisfied" to -1, and the positive attitudes to 1, 2, and 3. Most of the ratings received in Linh Dam are lower than in Ecopark (Figs. 8 and 9). The most significant differences between the two KDTMs are (4.4) Facilities around the houses, (2.1) Open space, and (6.2) Security and safety, which are the key factors that Ecopark always emphasizes in order to establish trademark, superiority, and appeal to customers because of its locational disadvantage. Ecopark has been very

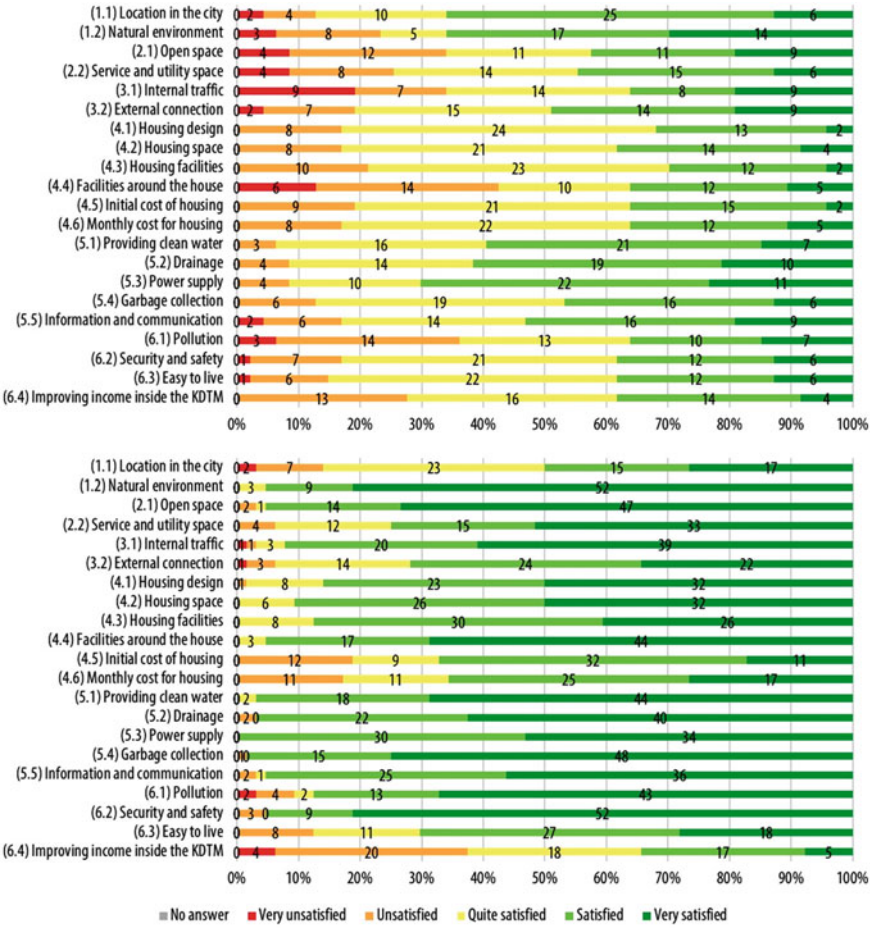

Fig. 7 Satisfaction of residents in Linh Dam (upper) and Ecopark (lower)

methodical in creating an image of a positive living environment—exactly what the market is seeking while housing supply is increasing. Meanwhile, in the opposite direction, Linh Dam received lower ratings for (4.4) Facilities around the houses, (3.1) Internal traffic, and (6.1) Pollution: Its residents started feeling insecure about the natural and social environment where they live.

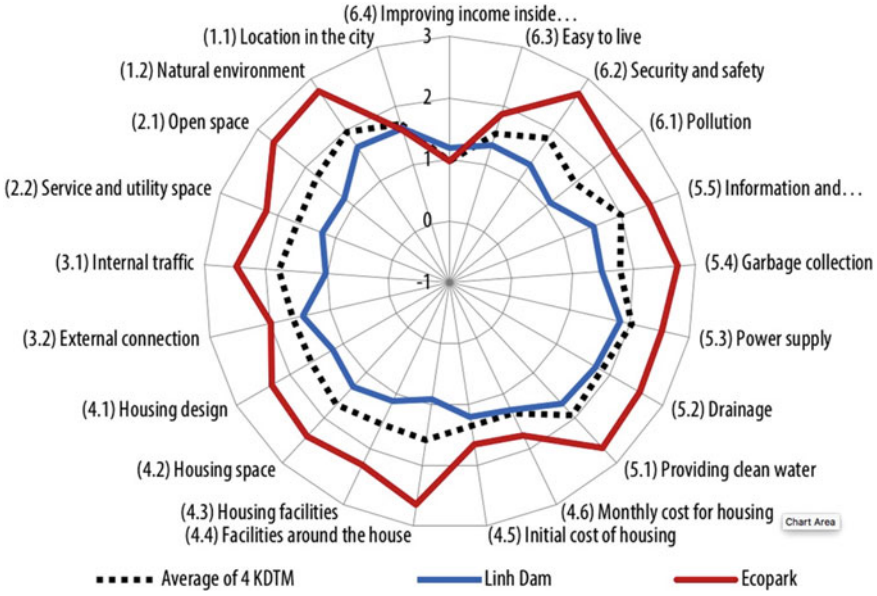

Fig. 8 Satisfaction in Linh Dam, Ecopark, and the average of 4 other KDTMs

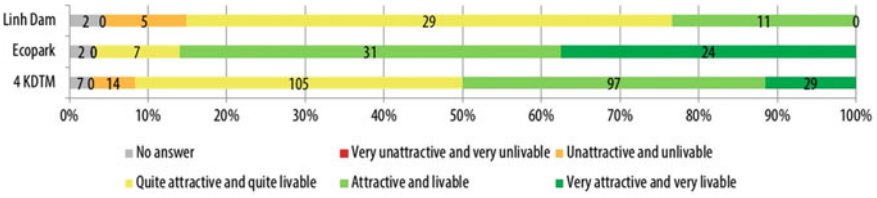

Fig. 9 Attractiveness and livability ratings in Linh Dam, Ecopark, and the average of 4 other KDTMs

3 New Urban Areas, New Thinking on City (Re)making

3.1 Model (of) KDTM Toward the Planned Success of a New Housing Policy

There are two main sources of housing need: the quantitative deficit due to new urban household formation and an additional need of improvement or replacement due to the qualitative deficit largely attributed to non-permanent houses and houses that lack basic services (Samad, et al. 2015). KDTMs are developed in the form of investment packages that cover three important factors technical infrastructure + social facilities + housing (Government of Vietnam 2006; National Assembly of Vietnam 2009). KDTMs have simultaneously solved both quantity and quality issues regarding housing, helping the government better manage city-making through large project packages instead of countless individual construction activities that led to a loss of control in the early 1990s. The governments created favorable conditions both in policy and financing, so that the pilot KDTMs could be successful as planned.

Therefore, Linh Dam was selected as a model for a new housing era because of its ideal factors: a neighborhood greened by a large lake and apartment buildings with fewer than 20 floors, alternating with gardens, lawns, shade, and internal roads, thus creating a new living environment. It was recognized as a KDTM Model (Nguyen 2009) thanks to: (1) investment preparation being carried out correctly according to current regulations; (2) construction conducted in accordance with approved plans, creating a harmonious architectural space; (3) concerted investment in socio-technical infrastructure, meeting the requirements of people during the project process; (4) construction project management ensuring quality and complying with building codes and standards; (5) quality of life and ecological environment; and (6) managing and developing services for community benefit. This title of Model KDTM is valid for only five years (Ministry of Construction 2017). However, though the title has not been renewed, Linh Dam is still thought of as an aspirational model. No new models have supplanted Linh Dam as a Model KDTM.

3.2 Anarchical Competition Among Livable KDTMs

Thus, the "state-owned" title is not advocated by investors. However, to facilitate advertising and sales, they sought and appointed title for their projects. For example, "high-class KDTM" became a trend that meets the people's desire to enjoy nice homes after a long period of poor housing standards. It also satisfies the needs of new rich groups in the society. Consequently, the slogan for Ecopark, "the green city, live life to the fullest", appeared more and more in the media and created a new perspective of residential zones, aiming mostly at high-class customers willing to spend in exchange for a higher living environment and to stay away partly from the natural and social pollution outside the KDTM's boundaries. Several websites

Table 3 Specific criteria for "The best KDTM" and "The most livable residential" in the NREA 2018

The best KDTM	The most livable residential
(1) Comply with approved detailed planning targets and land use (2) With an area of 5 ha or more and put into use in the past ten years (3) Have a synchronous infrastructure system (4) Have trees and environmental protection above the planning targets	
(5) Ensure the criteria for fire protection and parking above the planning targets *(6) Apply green and smart solutions in the project*	*(5) Have outstanding static traffic as specified in the planning* *(6) Apply smart solutions in the project (using technology in operating systems of security, fire protection, and machines in the building and each apartment…)*
(7) Min. occupancy rate of 70% or more (8) Appreciated by the majority of customers and residents	

Source Charter of the NREA 2018

have ranked livable KDTMs, but only a few offer selection criteria, and most of the qualitative assessments or quantitative results are relatively general and impulsive, leading to confusion about the definition of livability.

In that ambiguous context, the NREA was proposed in 2018. There were two livability categories, "The best KDTM" and "The most livable residential complex", selected by using relatively similar criteria, mainly covering the physical facilities, except criterion no. 8, which was based on the residents' evaluation (Table 3). In a sense, the quality of life factor did not appear. After the award, there were some arguments about the accuracy and rationale of these categories.

4 Do the Labels of KDTMs Satisfy Their Residents?

The similarity in KDTM Model and the best KDTM criteria complies with the law and planning for concerted infrastructure development. However, the former reflects the approach from the urban governance standpoint, focusing on construction standards, while the latter aims to highlight specific (physical) needs of residents. We have received relatively unexpected responses from residents about how each of these KDTMs can become more attractive and livable (Table 4).

In Linh Dam, residents are dissatisfied by the density. Linh Dam's plan(ning) was not respected: Some public facility lands were converted into housing, and some housing projects were adjusted to increase the number of floors, floor area, etc. This resulted in the population being inflated from a relatively romantic and planned figure of 25,000 people (125 people/ha) to a very realistic figure of nearly 70,000 people (350 people/ha) (Khuat 2016). The unrestricted density has led to overload and loss of control on safety, security, sanitation, quality and quantity of public facilities, etc. The rigid targets of service capacity since the 1990s with impractical predictions

Table 4 Residents' thinking about the way their KDTM could become more attractive and livable

	Linh Dam	Ecopark
Reducing	Population and construction density	Housing costs and monthly expenses
Enhancing	Security	Lighting, security, limit "outsiders"
Improving	– Environmental sanitation – Fire protection – Quality and quantity of public spaces – Apartment design – Safety and preventing traffic congestion (limiting means of transport in some areas)	– Spaces for the elderly (one of the specific characteristics of this KDTM) – Community activities (strengthening meetings and exchanges among residents), associations/unions of the residents – Popular activities to make the KDTM more bustling
Adding	– Playground safe for children and the elderly – Schools – Parking lots	– Medical services (hospital) – Market – Solutions to improve the connection with the city center

(a legacy of influence from the planned economy era) have led Linh Dam to lose flexibility before the social changes (typically, the lack of underground parking or public car parks) or increase in daily demand (massive conversions of housing into service space, of non-building into building spaces to maximize the business area). Linh Dam has become a bustling, diverse area but without the initially expected tranquility; it is no longer ideal, even if more popular. Thus, this KDTM is attractive in terms of the diversity of living activities and interaction with people from surrounding villages and neighborhoods who use services here, but this has made it even more chaotic (Fig. 10).

In contrast, Ecopark represents a reasonable control of the population, quantitatively and qualitatively, by choosing upmarket housing and service prices, forming a civilized and well-behaved community regarding usage and maintenance of their KDTM, which makes Ecopark too quiet, boring, and lacking popular activities,

Fig. 10 Linh Dam is now like a big village market with many activities for its residents. *Source* Authors, in 2020

Fig. 11 Carefully guarded areas and tranquil green streets, due to limited traffic, are typical images in Ecopark. *Source* Photo by Minh Tung Tran, 2020

hence, more suitable for pensioners and the elderly. Besides, residents in the upper segment have loosened community bonding due to their closed lifestyle in their fully furnished houses. The traditional outdoor market is replaced by modern indoor supermarkets and shops, which fail to ensure negotiation between buyers and sellers and create extended community relationships. Ecopark's location far from the city center seems to be the reason Hanoians are hesitating to choose it as a place to live when their workplace, preferred schools, relatives and friends, especially almost of the municipal hospitals, are still located in the city, and KDTM bus service is far from convenient. The strategy to attract customers using events and mass media, along with awards and titles, has appealed to "outsiders with an inquisitive eye" and that partly affects local social life, security, and safety of the residents (Fig. 11).

Though both Linh Dam and Ecopark are attractive, by asking the last question "livable or not?", we found a clear difference in our survey: If Linh Dam's residents still hesitate between staying in this KDTM or moving out (with the ratio of 20/27), the ratio is even more evident in Ecopark (53/5) (Fig. 12).

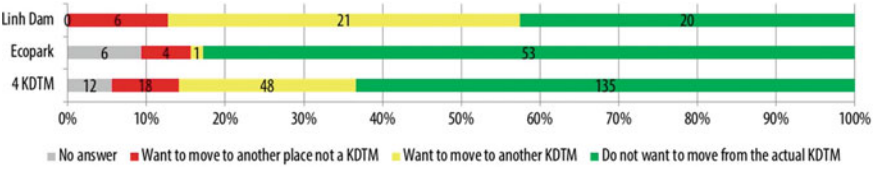

Fig. 12 The percentage of residents (of Linh Dam, Ecopark and 4 other KDTMs) who want to stay long term in their KDTM

5 Conclusion

Thus, Linh Dam and Ecopark, built ten years apart, have shown different, even seemingly contradictory, ways of creating livability. While Linh Dam promotes residents' livelihoods based on fully exploiting the physical environment, Ecopark enhances the lifetime value to residents associated with the biological environment. Therefore, each KDTM aims to attract a different customer. Linh Dam residents are the standard urban population who make use of their residence as a place of livelihood. Therefore, the actual population density of Linh Dam KDTM has been pushed up much higher than the original design to ensure a crowded, vibrant atmosphere and a balanced market between supply and consumption. Meanwhile, Ecopark residents separate where they work, live, enjoy life, and spend money. Ecopark KDTM is aimed at the wealthier, higher social status, and older residents who want to enjoy life through quality accommodation characterized by quiet, ecology, and controlled population density. The image of a desirable life has made Ecopark's livability assessments more positive than Linh Dam's, except for its ability to improve local income.

The two KDTMs, although built ten years apart, represent two different periods of residential area making. Linh Dam is the first product of the post-planned economy toward a market economy. Somehow, the way of KDTM-making is still attached to the technocracy through planned indicators, partly repeating the problems faced by KTTs of the housing-subsidy period: The planned targets quickly overloaded the collective housing and made them obsolete after only 20–30 years of operation, although initially planned for 50–70 years. These KTTs, if physical degradation is ignored, are attractive and livable places, where the community is promoted by sharing, supporting, and relying on each other. Can we keep the hope that although Linh Dam no longer retains its original physical appearance it will still be attractive because of social bonding? The current real estate market in KDTMs, through a typical example Ecopark, reflects the guidance in housing production and supply to fill people's needs, and marketing tools are more effective than in the state's (technical) standards. While 20 years ago, KDTMs were more attractive with higher class facilities than average, in the last 10 years, buyers have come to enjoy the difference in their residence environment compared to the rest of the city. When people's living conditions have been improved, customer satisfaction has always been the central concern, so marketing always emphasizes the contrast between positive elements inside and negative issues outside the boundaries of KDTM, to show livability.

The Hanoi-(re)making has transformed from socialist modernism, powered by arguments of "form follows function" or "the house is a machine for living", to a new urbanism—a planning and development approach based on the principle of satisfying needs of and improving accommodation facilities for the people, illustrated with the motto "customers are god". This tendency shows that Hanoi is becoming more and more market-oriented and more humane, an essential foundation for a livable city in the future.

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Is Linh Dam Still a Livable New Town? How to Make It Work Well Again?

Nguyen Quang Minh, Ngo Thi Ha Thanh, and Ly Quoc Son

Abstract In 1999, Linh Dam was officially inaugurated as the first complete urban housing and service complex in Hanoi and welcomed its first residents. This 184-hectare new town was a pioneering housing project constructed by Housing and Urban Development Corporation (HUD) with a brand-new concept imported from several countries in Southeast Asia. Systematically planned and properly designed, as well as having the many advantages of a well-chosen site, Linh Dam became a prototype of a "livable living quarter" in Hanoi and a "dream to strive for" among millions of city inhabitants. This coveted status remained unsurpassed for the first ten years (1999–2009). Recently, however, this residential area has changed considerably (and negatively) in many aspects, including increased traffic, land use, building density, population size, cityscape, and poor environmental quality, among other criteria. After 20 years, Linh Dam should be re-evaluated to see how "livable" it really is. Based on on-site observations, expert and public opinion surveys, and, particularly, a rating system encompassing seven key criteria (environment, landscape, public space, technical infrastructure, housing quality, social services, and communal activities), a re-development scenario has been proposed to restore some of the so-called lost values of livability without upending residents' everyday activities, before putting another (and much better) plan into action for a long-term pathway toward a truly livable living quarter and a more sustainable future.

Keywords Livable city · New town · Sustainable urban development

The original version of this chapter has been revised. Incorrect statement was included in the chapter title and that has been corrected. The correction to this chapter is available at https://doi.org/10.1007/978-981-19-8726-7_36.

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1 Introduction

1.1 Urbanization in Vietnam

In 2018, the urbanization level in Vietnam reached 38% (Ministry of Construction 2019). Compared to 29.6% in 2009 (World Bank 2011), Vietnam's urbanization rate increased 1% per year, and over 3% in Hanoi and Ho Chi Minh City (Vietnam Plus 2019). As of May 2019, there were 828 cities and towns in Vietnam, including two special cities (Hanoi in the North and Ho Chi Minh City in the South), 20 cities of Grade I, 29 cities of Grade II, 45 cities of Grade III, 85 cities of Grade IV, and 647 towns of Grade V (Vietnam Plus 2019). The cities and towns are graded on four key indicators: population size, population density, percentage of laborers in non-agricultural sectors, and level of socio-economic infrastructure. The urbanization rate in Vietnam is projected to exceed 50% in 2035 (World Bank 2016), in accordance with the trends for Asia and for the world generally. However, in Vietnam, urban development brings more than a simple improvement of living quality for the majority of residents. In fact, urban dwellers have to face numerous problems, such as traffic congestion, air and water pollution, food safety, flooding, and more. As time goes by and the city grows, new challenges arise while old problems remain unsolved.

1.2 Livability Worldwide

Livability is most often used to describe the diverse aspects of society, surroundings, and shared experiences that shape a community. Livability is focused on the human experience of a place and is specific to the place and time in question. It includes an interrelated set of economic, spatial, and social components that together are challenging to understand and measure in the defined world of planning and development. As such, livability is best defined by the state, region, association, or community in question and is best measured at a geographic scale where definitional consensus about livability can be found (Cambridge Systematic 2010). As a major research organization, Partners for Livable Community believe that livability is the sum of the factors that add up to a community's quality of life, including the built and natural environment, economic prosperity, social stability and equity, educational opportunities and cultural possibilities, and entertainment and recreation (Partners for Livable Community 2017).

A livable place is a place suitable for and worthy of human living. As such, a livable city or community is commonly recognized as a place with qualities that are good for human life. Although urban livability concerns issues such as overcrowding, housing quality, air quality, green space, and safe and adequate supplies of water and sanitation which have been at the core of urban planning, public health, and other urban professions that emerged in the twentieth century, the concern with community

or urban livability as a distinct concept is more recent (National Research Council 2002).

In the 1980s, livability was interpreted as vitality reflected in the dimensions, requirements, and capabilities of human beings in view of biology, with an emphasis on three factors, namely sustenance, safety, and consonance. Access for goods and people as well as "fit" was essential for a livable community (Lynch 1981). Some professional organizations developed their own concepts of livable cities from certain or specific perspectives. The World Health Organization (WHO), for example, regarded a livable city as a healthy city in the 1970s, using considerations of both the social and physical environments. The quality of life could be partially established on the basis of health care and environmental protection (Duhl and Sanchez 1999).

Danish architect Jan Gehl, whose projects are well known for putting people first, emphasized the importance of livability, noting that a good city should offer its residents and tourists the following crucial factors: 1. Liveliness, 2. Safety, 3. Sustainability, and 4. Healthiness. In terms of liveliness, the city should be full of activities, from the simplest to the most complex: sitting, staying, walking, meeting, cycling, eye contact, playing, self-expression, playing, training, and experiencing (Gehl 2010).

Livability or the livable city is becoming a hot topic across the globe thanks to the attention given to the annual ranking of the World's Top/Most Livable Cities—a true competition among many cities in North America, Western and Northern Europe, Japan, Australia, and New Zealand that have well-earned reputations for livability (Table 1). Cities from developing countries still have a long way to go, but for those striving for livability, just like sustainability, is never too late.

The Economist Intelligence Unit, which conducts this ranking annually, has used six key criteria consistently for the evaluation of quality and livability: (1) Social stability (25%); (2) Health care (20%); (3) Culture (10%); (4) Environment (15%); (5) Education (10%); and (6) Infrastructure (20%) (CNN 2019).

Table 1 World's Top 10 livable cities in 2017, 2018, and 2019 (CNN 2019)

	2017		2018		2019	
No	City	Country	City	Country	City	Country
1	Melbourne	Australia	Vienna	Austria	Vienna	Austria
2	Vienna	Austria	Melbourne	Australia	Melbourne	Australia
3	Vancouver	Canada	Osaka	Japan	Sydney	Australia
4	Toronto	Canada	Calgary	Canada	Osaka	Japan
5	Calgary	Canada	Sydney	Australia	Calgary	Canada
6	Adelaide	Australia	Vancouver	Canada	Vancouver	Canada
7	Perth	Australia	Toronto	Canada	Toronto	Canada
8	Auckland	New Zealand	Tokyo	Japan	Tokyo	Japan
9	Helsinki	Finland	Copenhagen	Denmark	Copenhagen	Denmark
10	Hamburg	Germany	Adelaide	Australia	Adelaide	Australia

1.3 Livability in Vietnam

In Vietnam, livability is mostly referred to in tourist guides (to attract more visitors) and in real estate business campaigns (to sell more apartments and villas targeted at middle-class and high-end users). In academia, however, livability has not yet been comprehensively investigated.

On many websites and in various guidebooks on tourism, the five cities (Hoi An, Da Nang, Nha Trang, Da Lat, and Vung Tau) often top the list of favorite destinations in the country and are named "most livable cities in Vietnam" by foreigners, largely thanks to the local infrastructure and services for tourism, as well as the beautiful landscapes. Da Nang is well known for its successful application of urban design solutions to public spaces including bridges, streets, waterfronts, roundabouts, city parks, and city gates.

The real estate website Ecoland (which is among the largest and most prestigious of such marketplaces) published a list of the Top 15 Livable New Urban Areas in Vietnam (Table 2) based on five criteria: (1) Infrastructure with many public spaces; (2) Good services and facilities/amenities; (3) Low level of conflict between residents and project developers; (4) Projects that go without big problems in management; and (5) Having a well-established plan to build community culture (Ecoland 2018).

It seems the case that criteria 3 and 4 exist primarily for investors and managers, rather than local residents. An intensive study of a project, however, has not yet been undertaken. If systematically conducted, such studies will provide both a panorama

Table 2 Top 15 livable new urban areas in Vietnam-2017 ranking (Ecoland 2018)

No	Name of new urban area	City/province	Project developer	Size (ha)
1	Eco-park	Hung Yen Province	Vihajico Corporation	500.0
2	Vinhomes Times City	Hanoi City	Vingroup	364.5
3	Park Hill Premium	Hanoi City		
4	Royal City	Hanoi City	Vingroup	120.9
5	Ecolife Capitol	Hanoi City	CCC Corporation	40.6
6	Park City	Hanoi City	VIDC Corporation	77.0
7	Dang Xa	Hanoi City	Viglacera Corporation	69.6
8	Ciputra	Hanoi City	Ciputra Indonesia	305.0
9	Sunrise City	Ho Chi Minh City	Novaland Corporation	5.1
10	Phu My Hung	Ho Chi Minh City	Phu My Hung Co. Ltd.	750.0
11	Vinhomes Central Park	Ho Chi Minh City	Vingroup	43.9
12	Dragon Hill Residence	Ho Chi Minh City	Phu Long Corporation	58.6
13	Vinhome Riverside	Hanoi City	Vingroup	279.0
14	Gamuda Gardens	Hanoi City	Gamuda Land Group	73.0
15	The Manor Central Park	Hanoi City	Bitexco Corporation	89.7

and an in-depth view of housing development policies and programs of a city toward livability.

1.4 Objectives of Research

This chapter conducts a case study of Linh Dam New Town in Hanoi in order to:

- Assess the quality of life in the sector and explore how it changed over the years, based on the scoring of numerical variables.
- Provide a factual basis upon which livability for residents can be improved.

1.5 Methods of Research

In order to achieve the objectives, the authors used the following methods:

- Site survey and data collection undertaken in September and October 2019.
- Analysis.
- Consultation of public opinions via questionnaires sent to 750 households (with 688 replies responses) and two detailed interviews—one with a group of residents who felt unsatisfied with the current living conditions, and the other with groups of newcomers to Linh Dam—to understand their reasons for choosing to live in Linh Dam.
- Comparison of expert opinions with those expressed by the public as verification and confirmation of the accuracy of local residents' assessments.

2 Quality of Life in Linh Dam—Re-assessment

2.1 Introduction of Linh Dam New Town

Located in Hoang Mai district, approximately 8 km from the city center in the southwest, Linh Dam is a sector that has been selected as a case study in this research, because it is a pioneering urban housing project in Hanoi implemented for the first time by the Housing Urban Development Corporation of Hanoi (HUD), paving the way for many other project-based housing development plans to follow in subsequent years. Covering 184 ha with a 74 ha central lake and 51.3 ha of parks and gardens, Linh Dam was immediately named a "dream living quarters", a "model project", and a "pioneering planning concept" when it opened. It was also advertised as "the most livable new urban area" in Hanoi and even in Vietnam (HUD 2000). At 22.3 m^2 *per capita*, the average green area in Linh Dam was one of the highest in the whole country (Fig. 1).

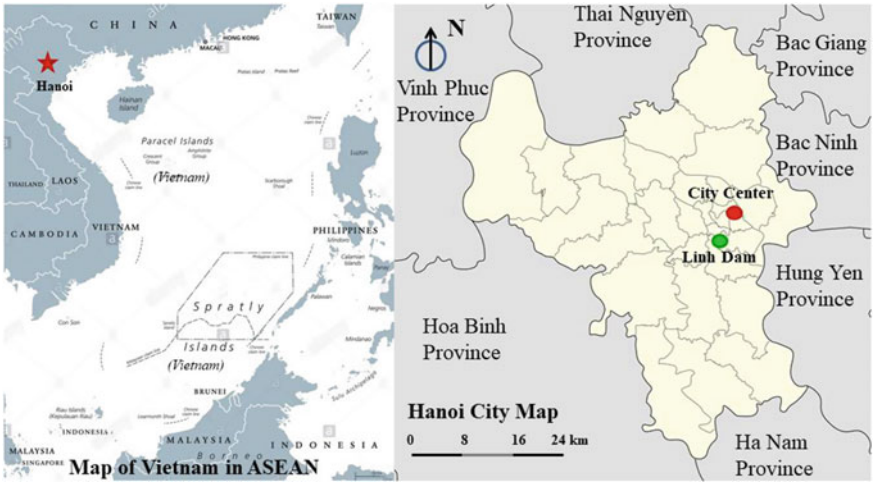

Fig. 1 Map of Vietnam with Hanoi and Map of Hanoi with Linh Dam (Background maps: www.nationonline.org and www.vi.wikipedia.org)

Linh Dam was initially planned for 23,000 residents with an appropriate building density. Nearly 20 years later, subsequent to additional on-site construction, Linh Dam is home to some 70,000 residents—a threefold increase within a few years. Consequently, the green area per capita indicator has abruptly fallen, from 22.3 m^2 to 5.2 m^2 (Bao Moi 2017). The planning concept developed in 1997 to intensify large-scale housing development was complete within 12 years. With the additional construction of two public buildings and several multi-story apartment blocks, including 12 super high-rise and compact towers, some green area (about 14.8 ha) has been lost. The 12 super high-rise and compact towers are marked with HH complex designated on the map (See Figs. 2, 3, and 4).

2.2 Number One Reason for Choosing Linh Dam as Permanent Residence

For the first ten years (1999–2009), Linh Dam was considered a "great success" in terms of planning and landscape design, yet today it is regarded by both specialists and local people as a "failure" or a "regret" in view of planning and construction management (Nguyen et al. 2019). 688 residents were asked for their opinions and assessments regarding living quality in their settlement and in addition, three academic staff at the Faculty of Architecture and Planning of the National University of Civil Engineering in Hanoi were consulted for the study, giving their expert evaluations and opinions regarding the livability of Linh Dam. 363 of the 688 residents (52.8%) have been living there for at least five years and the remaining 325

Fig. 2 Land-use planning for Linh Dam New Town as of 2009 (above) according to the 1997 development concept proposed by the HUD and the adjusted development concept for Linh Dam as of 2019. *Source* Authors. Background maps: Google Earth, 2009 and 2019

Fig. 3 Linh Dam new urban area in 2020 with the recent construction of HH complex. *Source* Authors

Fig. 4 Green areas and activities of the local community in Linh Dam New Town as two key indicators that have contributed to a livable living quarter over the years. *Source* Authors

Table 3 Leading reason for choosing Linh Dam New Town as permanent residence

No	Reason	Number of respondents	Percentage (%)
1	Easy access and convenient to use everyday life services	244	35.46
2	For work and study of one's own	150	21.80
3	For schooling of children	115	16.71
4	Easy to visit grandparents and relatives	78	11.34
5	Not given (no specific reason)	46	6.69
6	Quality of space, landscape, environment	28	4.07
7	Getting married	10	1.46
8	Born and living continuously as a local resident here	08	1.16
9	Endowed property	05	0.73
10	Reasonable price for purchase	04	0.58
	Total	688	100

Source Nguyen et al. (2019)

respondents (47.2%) can be regarded as "newcomers". The main reasons for choosing to live in Linh Dam are given in descending frequency in Table 3.

As the statistics have already shown, the top four reasons for choosing Linh Dam New Town as permanent residence are all somewhat related to distance: between homes and daily life services (within 400 m), between homes and workplaces (mostly within 4 km), between homes and accredited schools (within 2 km, if not using pick-up and drop-off school bus services), and between homes and parents' domiciles (for a weekly visit on the weekend).

2.3 Assessment of Livability in View of Technical Infrastructure

Technically, livability is assessed based on seven key criteria: (1) Road and access; (2) Parking; (3) Power supply; (4) Water supply; (5) Drainage of rainwater and wastewater; (6) Communication, television, and Internet; and (7) Waste collection and environmental sanitation. The results are summarized in Table 4.

The most notable downward trend was found in roads and access. This is because road construction did not keep up with the rapid increase in population (almost threefold within ten years, from 2009 to 2019). As a consequence, traffic jams occur more frequently, almost on a daily basis, and many residents have already complained about this situation. Similarly, parking is a huge concern to a large number of local people, especially those living in HH complex, which consists of 12 super high-rise

Table 4 Survey Outcomes-Part 1: technical Infrastructure (Nguyen et al. 2019)

No	Criterion	Assessment of the past situation			Assessment of the current situation			Note of change[a]
		Quantity	%	Score	Quantity	%	Score	↓ ↑ →
1	Technical Infrastructure			**3.36**			**3.22**	↓ **(−4.17%)**
1.1	Road and access	**688**	**100**	**3.39**	**688**	**100**	**3.09**	↓ **(−8.85%)**
	Positive (score 4–5)	353	51.3		255	37.1		
	Neutral (score 2–3)	291	42.3		372	54.1		
	Negative (score 0–1)	44	6.4		61	8.8		
1.2	Parking	**688**	**100**	**3.32**	**688**	**100**	**3.08**	↓ **(−7.22%)**
	Positive (score 4–5)	330	48.0		257	37.3		
	Neutral (score 2–3)	308	44.8		368	53.5		
	Negative (score 0–1)	50	7.2		63	9.2		
1.3	Power supply	**688**	**100**	**3.64**	**688**	**100**	**3.65**	→ **(+0.27%)**
	Positive (score 4–5)	419	60.9		405	58.9		
	Neutral (score 2–3)	234	34.0		268	39.0		
	Negative (score 0–1)	35	5.1		15	2.1		
1.4	Water supply	**688**	**100**	**3.59**	**688**	**100**	**3.60**	→ **(+0.28%)**
	Positive (score 4–5)	402	58.4		393	57.1		
	Neutral (score 2–3)	264	38.4		279	40.6		
	Negative (score 0–1)	22	3.2		16	2.3		
1.5	Water drainage	**688**	**100**	**3.43**	**688**	**100**	**3.41**	→ **(−0.58%)**
	Positive (score 4–5)	366	53.2		329	47.8		
	Neutral (score 2–3)	285	41.4		333	48.4		
	Negative (score 0–1)	37	5.4		26	3.8		
1.6	Internet and telecommunication	**688**	**100**	**3.70**	**688**	**100**	**3.71**	→ **(+0.27%)**

(continued)

Table 4 (continued)

No	Criterion	Assessment of the past situation			Assessment of the current situation			Note of change[a]
		Quantity	%	Score	Quantity	%	Score	↓ ↑ →
	Positive (score 4–5)	427	62.1		433	62.9		
	Neutral (score 2–3)	245	35.6		236	34.3		
	Negative (score 0–1)	16	2.3		19	2.8		
1.7	Waste collection	**688**	**100**	**3.45**	**688**	**100**	**3.34**	↓ **(−3.19%)**
	Positive (score 4–5)	345	50.1		299	43.5		
	Neutral (score 2–3)	322	46.8		367	53.3		
	Negative (score 0–1)	21	3.1		22	3.2		

Note [a] The difference of less than 1% of the overall score (±0.035 with the average value of 3.5—between Grade 3 and Grade 4 in most cases) can be considered "unchanged"

apartment towers recently built to provide accommodations for about 40,000 new residents in a so-called "re-adjustment plan" (see Fig. 3). The respondents say that car and motorbike parking area does not only fail to meet their demand, but it also takes them a much longer time to drive into and out of, and the parking service is not convenient either, in their opinions. Waste is collected more professionally today, but sanitation remains as a problem, as the amount of waste increases considerably in tandem with the population. In case of flooding caused by heavy rain (a 70 mm or higher rainfall within one hour), waste falling out from full containers at some waste collection points is carried everywhere by rainwater. The overall score has therefore decreased by 4.17%, from 3.36 to 3.22 (Nguyen et al. 2019).

It is necessary and also interesting to compare the livability assessment in technical infrastructure made by the residents with the experts' evaluation. For experts, a 0.5 grading is used for a more accurate assessment. The results are given in Table 5.

2.4 Assessment of Livability in View of Social Infrastructure

Socially, livability is assessed based on eight crucial criteria: (1) Education; (2) Health care; (3) Shopping; (4) Other daily life services; (5) Sports activities; (6) Cultural activities; (7) Common actions for the environment and charity; and (8) Social contact and exchange. The results are summarized in Table 6.

Education and health care saw some backward steps, primarily because of an overcrowded settlement and an overloaded school system and clinic network. Meanwhile, improvements were made in shopping facilities, with the emergence of Vin-marts

Table 5 Experts' evaluation of livability in comparison with residents' assessment—Technical infrastructure (Nguyen et al. 2019)

No	Category of livability in technical infrastructure	Experts' evaluation				Residents' assessment (B)	Difference: (A) compared to (B)
		Expert 1	Expert 2	Expert 3	Average (A)		
1.1	Road and access	3.0	3.0	3.0	3.0	3.09	−0.09
1.2	Parking	3.0	3.0	3.0	3.0	3.08	−0.08
1.3	Power supply	3.5	3.0	3.5	3.33	3.65	−0.32
1.4	Water supply	3.0	3.5	3.5	3.33	3.60	−0.27
1.5	Water drainage	3.0	3.0	3.5	3.17	3.41	−0.24
1.6	Internet and telecommunication	3.5	3.5	3.5	3.5	3.71	−0.21
1.7	Waste collection	3.0	3.0	3.0	3.0	3.34	−0.34
	Total				3.19	3.22	−0.03

and other convenience shops such as a Circle K, Coop Food, and Green Store in the area, along with a large number of options for daily life goods and services available within a short walk distance from homes (normally 400 m). Open areas have been partially occupied. Nevertheless, more sports and cultural activities are organized for smaller groups of residents in the semi-public square or yard in each housing cluster instead of for large communities, as they were a few years ago, especially in the HH complex. As a result, both categories (sports and culture) remain unchanged. There are, however, less common actions taken for the environment and charity. At the same time, social contact and exchange tend to happen on a smaller scale and not so often as before. That is why the overall score in social infrastructure also decreased by 2.35%, from 3.40 to 3.32 (Nguyen et al. 2019).

Similarly, in social infrastructure, the livability assessment made by the residents should be compared with the experts' evaluation. The results are given in Table 7.

It goes without saying—as demonstrated in Tables 5 and 7—that livability indicators are more strictly rated in each category by experts than by residents. In most cases (13 out of 15 indicators), the difference is minor (less than 10% of the lower grade 3—equal to 0.3). Most of the respondents who voted "worse quality" are those who have been living there for over 10 years (Group 1), while newcomers (Groups 3) tend to rate "better quality." The residents thinking that the quality would be the same have been living there for four to seven years (Group 2), and they found a balance between the gains and the losses of urban ecology/environment in the current urban development (Table 8).

Table 6 Summary of survey outcomes-Part 2: Social infrastructure (Nguyen et al. 2019)

No	Criterion	Assessment of the past situation			Assessment of the current situation			Note of change[a]
		Quantity	%	Score	Quantity	%	Score	↓ ↑ →
2	Social infrastructure			**3.40**			**3.32**	↓ **(−2.35%)**
2.1	Education	**688**	**100**	**3.62**	**688**	**100**	**3.43**	↓ **(−5.25%)**
	Positive (score 4–5)	353	51.3		327	47.5		
	Neutral (score 2–3)	314	45.6		335	48.7		
	Negative (score 0–1)	21	3.1		26	3.8		
2.2	Healthcare	**688**	**100**	**3.55**	**688**	**100**	**3.38**	↓ **(−4.79%)**
	Positive (score 4–5)	299	43.5		251	36.5		
	Neutral (score 2–3)	357	51.9		398	57.8		
	Negative (score 0–1)	32	4.6		39	5.7		
2.3	Shopping	**688**	**100**	**3.48**	**688**	**100**	**3.71**	↑ **(+6.61%)**
	Positive (score 4–5)	377	54.8		431	62.6		
	Neutral (score 2–3)	290	42.1		248	36.1		
	Negative (score 0–1)	21	3.1		9	1.3		
2.4	Other daily life services	**688**	**100**	**3.40**	**688**	**100**	**3.51**	↑ **(+3.24%)**
	Positive (score 4–5)	349	50.7		354	51.5		
	Neutral (score 2–3)	310	45.1		326	47.4		
	Negative (score 0–1)	29	4.2		8	1.1		
2.5	Sports activities	**688**	**100**	**3.46**	**688**	**100**	**3.45**	→ **(−0.29%)**
	Positive (score 4–5)	342	49.7		342	49.7		
	Neutral (score 2–3)	328	47.7		333	48.4		
	Negative (score 0–1)	18	2.6		13	1.9		
2.6	Cultural activities	**688**	**100**	**3.26**	**688**	**100**	**3.28**	→ **(+0.61%)**
	Positive (score 4–5)	260	37.8		259	37.6		
	Neutral (score 2–3)	413	60.0		410	59.6		
	Negative (score 0–1)	15	2.2		19	2.8		
2.7	Common action for environment, charity	**688**	**100**	**3.10**	**688**	**100**	**3.03**	↓ **(−2.26%)**
	Positive (score 4–5)	209	30.4		186	27.0		
	Neutral (score 2–3)	450	65.4		472	68.6		

(continued)

Table 6 (continued)

No	Criterion	Assessment of the past situation			Assessment of the current situation			Note of change[a]
		Quantity	%	Score	Quantity	%	Score	↓ ↑ →
	Negative (score 0–1)	29	4.2		30	4.4		
2.8	Social contact and exchange	**688**	**100**	**3.25**	**688**	**100**	**3.22**	→ **(−0.92%)**
	Positive (score 4–5)	273	39.7		248	36.0		
	Neutral (score 2–3)	389	56.5		412	59.9		
	Negative (score 0–1)	26	3.8		28	4.1		

Note [a] the difference of less than 1% of the overall score (±0.035 with the average value of 3.5—between Grade 3 and Grade 4 in most cases) can be considered "unchanged"

Table 7 Experts' evaluation of livability in comparison with residents' assessment—Social infrastructure (Nguyen et al. 2019)

No	Category of livability in social infrastructure	Experts' evaluation				Residents' assessment (B)	Difference: (A) compared to (B)
		Expert 1	Expert 2	Expert 3	Average (A)		
2.1	Education	3.0	3.5	3.5	3.33	3.43	−0.10
2.2	Health care	3.5	3.0	3.5	3.33	3.38	−0.05
2.3	Shopping	3.5	3.5	3.5	3.5	3.71	−0.21
2.4	Other services	3.5	3.5	3.0	3.33	3.51	−0.18
2.5	Sports activities	3.5	3.5	3.0	3.33	3.45	−0.12
2.6	Cultural activities	3.0	3.0	3.5	3.17	3.28	−0.11
2.7	Other campaigns	3.0	3.0	3.0	3.0	3.03	−0.03
2.8	Social contact	3.5	3.0	3.0	3.17	3.22	−0.05
	Total				3.27	3.32	−0.05

Table 8 Public comments on environmental and ecological quality of Linh Dam New Town

Environment/ecology	Improved quality	The same quality	Worse quality	Total
Quantity	148	360	180	688
Percentage (%)	21.5	52.3	26.2	100

Source Authors

3 The Story of Quality and Livability in Linh Dam New Town

As highlighted above, the problems that the community is facing today in Linh Dam New Town, after two decades of urban development, are: (1) Road circulation and access; (2) Parking; (3) Environmental sanitation; (4) Urban ecology and landscape; (5) Schooling for children; (6) Health care for the community; (7) Action programs with common goals; and 8. Social contact and exchange. These are also eight aspects which have lost points in the general assessment of livability and serve as fodder for complaint for local residents, especially those who have lived there for more than ten years. Many long-time residents cannot help comparing the current context with the past situation.

The root of all the aforementioned problems is a very high population and construction density that has put huge pressure on the existing technical and social infrastructure systems: nearly 70,000 residents are now sharing the infrastructure systems and space initially planned for 23,000 town dwellers only. No matter how the services can be improved with new facilities, more locations and additional or special offers, etc., the quality index per capita fails to meet the standard requirements, and the quality of life becomes lower than expected.

Therefore, in order to enhance the quality of life or the level of livability for Linh Dam New Town, it must first develop a depopulation plan, as a pre-requisite condition for livability to take root once again. That means that the planning approved in 1997 needs to be implemented in reality. The HH complex has to be dismantled, as it is proving to be a serious violation of planning and building regulations, but somehow it was administratively enabled to take place. Over 45,000 new residents, who moved in from 2015 to 2018, will be relocated somewhere else in the city. The green areas, when restored, will be approximately 30 ha for 23,000 residents (or 13 m^2 per capita—almost meeting the standard of 15 m^2 per capita required by the Prime Minister in Decision No. 1659/2012/QD-TTg regarding the National Urban Development Program toward 2020) (Government of Vietnam 2012).

Before striving for livability, it is vital to develop a variety of criteria applicable to Linh Dam New Town and many other similar settlements in Hanoi planned and built in the 2000s and 2010s. There are seven criteria for building a more livable urban area:

- **Criterion 1**: Environment, including all the basic indicators, such as air quality, water quality, land and soil quality, indoor and outdoor comfort with regard to temperature, humidity, solar radiation, wind direction, and velocity;
- **Criterion 2**: Landscape, including all the elements of the local eco-system, with natural landscape and artificial landscape;
- **Criterion 3**: Public spaces, including all the elements of urban design, such as squares, streets and pavements, crossroads, parks and gardens, and yards;
- **Criterion 4**: Technical infrastructure, including car and motorbike parking, power and water supply, water drainage, waste collection, household waste sorting, and environmental sanitation;

- **Criterion 5**: Housing quality, mainly in terms of construction, purposes of use and equipment. Environment has been mentioned earlier in Criterion 1;
- **Criterion 6**: Social services, including all the services needed for daily life and used by the residents themselves;
- **Criterion 7**: Communal activities, including all kinds of social communication, contact, exchange and cooperation, until this depopulation plan can be realized, it is possible to take small steps to improve the livability of Linh Dam New Town as follows:

  - **Step 1**: Developing underground parking areas (underneath the parks/gardens) and smart parking concepts. Creating better and safer access to buildings is also essential. These are among the most urgent demands, and must therefore be prioritized.
  - **Step 2**: Re-acquisitioning all the illegally occupied public spaces and restoring these places to the local network of green areas and public spaces which would be previously quite well planned.
  - **Step 3**: Renovating all public parks in the region, particularly the central park around the 74-ha lake and semi-public mini-gardens within the groups of residential buildings with more species of both vernacular plants (such as michelia trees, golden bell trees, and camphor trees) and some well-selected exotic plants (for example, cherry trees imported from Japan, almond trees imported from Taiwan, and blue jacaranda trees imported from South America);
  - **Step 4**: Implementing city farming wherever the concept of public parks or semi-public gardens is not so appropriate: for instance, green spaces on terraces, balconies, loggias, etc. Similarly, all the vacant land plots can be reserved for greening to maximize the self-regulatory mechanism of micro-climate.
  - **Step 5**: Using urban design as an efficient tool to raise the attractiveness of streetscape, public, and semi-public spaces within the living quarter.
  - **Step 6**: Re-structuring the local service systems, including the most frequently used or essential ones, in consideration of the local people's needs.
  - **Step 7**: Incorporating communal events into the daily, weekly, and monthly activity programs. As a result, people will feel like meeting one another more often in the open air and staying outdoors longer.
  - **Step 8**: Launching and maintaining action programs with priority given to sustainability, in addition to regular sports and cultural activities. This is a kind of cement that will strengthen social cohesion and an eye toward creating and achieving common goals.

Among these, Step 1 and Step 5 fall within the scope of action No. 6 (Infrastructure), Step 2, Step 3, and Step 4 focus on Criterion No. 4 (Environment), while Step 6, Step 7, and Step 8 help ensure the achievement of Objective No. 1 (Social Stability) as proposed by the Economist Intelligence Unit and listed in Subsection 1.2.

In all these steps, public participation should be encouraged, because it is one of the key factors in ensuring the success of all urban re-development projects, as already

demonstrated worldwide: for example, the attempt to revitalize the Cheonggyecheon river in downtown Seoul (South Korea) or the scheme to convert a brownfield near Hammarby Sjöstad in Stockholm (Sweden) into a vivid living quarter.

4 Conclusions

Livability is a complex issue and requires a multi-dimensional approach. The overall assessment at a city level ought to be based on consideration of all the living quarters. In the case of Linh Dam New Town, despite the perception of some negative changes in the recent years, it is still a livable residential area, as reflected in the overall scores of 3.19 (expert opinions) and 3.22 (in the residents' view) for technical infrastructure and, likewise, scores of 3.27 and 3.32, respectively, for social infrastructure as two pillars of the livability concept. They all range between Grade 3 (Acceptable) and Grade 4 (Good).

Correcting errors in the subsequent planning and management of Linh Dam New Town may take time, yet the values lost to growth and densification can be restored. The local authority and community have agreed that they should cooperate with each other by identifying a common goal and setting up a concrete working agenda and action program.

Linh Dam is an interesting example of the investigation into how to regain livability in an urban setting. There is certainly no one-size-fits-all development scenario. In reality, some variations may be considered and a case-by-case study will always be necessary, giving good instructions to other projects that will be carried out in the future.

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Future of Prospective Smart Cities Outside Metro Manila

Christine Joyce B. Mendoza and Christirose Jireh R. Betia

Abstract The smart-city concept is a multi-pronged strategy in addressing the challenges of future urban settlements. This study aimed to identify cities and municipalities beyond Metro Manila, the Philippines' main seat of political and economic power, that have potential to transform into smart cities over the next two decades. It characterizes the urban settlements of three Luzon regions that serve as spillover for Manila's economic activities and are home to about third of the national population. Factors that enable or impede development of smart cities, as well as national and local development and urban policies, were gathered and analyzed. Survey and secondary data supported the analysis. In the survey, leadership and governance, vision and goals, and collaboration between private and public agencies emerged as the top three sets of factors "extremely likely" to facilitate smart-city development. Guided by the Philippines' long-term vision for 2040 and sustainable development pillars, recommended directions include strengthening leadership capacity and championing leaders while ensuring a clear role for the people, private and academic sectors, and proper technology that would enable and sustain smart-city development.

Keywords Smart cities · Sustainable urban development · Urban policies

1 Introduction

Metro Manila, a conurbation of 16 cities and a municipality that is known as the National Capital Region (NCR), is the seat of the Philippine government, economy, culture, and education. As the center of development, its cities are in the forefront of urban challenges and opportunities. However, Philippines' urban settlements, with

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about 75% of the urban population living outside the main metropolitan area, are not confined within the NCR. Focusing on the three most urban populous regions, this paper aims to identify those cities and municipalities outside Metro Manila that have the greatest potential to transform into smart cities by 2040.

Smart city is a multi-faceted strategy for addressing the challenges of future human settlements toward safe, resilient, inclusive, and sustainable communities (Sustainable Development Goals No 11). The study covers three regions in mainland Luzon, namely the Central Luzon, Calabarzon, and Bicol regions. The proximity of these regions to greater Manila is close enough to allow spillover effects of economies, residential areas, and development.

The study particularly analyzes the three regions' urban settlement characteristics, identifies the enabling and hindering factors to development of smart cities, and assesses national and sub-national urban policy frameworks. At the end, ten cities are presented, along with the merits they offer as potential smart cities. The research provides documentation, often inadequate or unavailable in developing countries, of how cities and municipalities will be able to make use of "recent knowledge and technical tools" to improve the social, economic, and environmental conditions of the locality (Zarrabi 2019). It was carried out through an analysis of relevant urban local and national policies, supplemented by a survey of selected participants, secondary data, and regional and city profiles.

Various studies on smart cities such as Nam and Pardo (2011), Dameri (2013), and Jayasena et al. (2019) identify technology, infrastructure, and human capital as among the dimensions of smart-city strategy. Moreover, governance and policy were also important components of the strategy (Nam and Pardo 2011; Chourabi et al. 2012; Van Winden and Van Den Buuse 2017) while Ruhlandt (2018) included entrepreneurial capital. Of the vast literature, the end goal of this multidisciplinary concept is toward better quality of life and sustainable urban development.

Smart use of information and communications technology (ICT) is considered the prime driver of establishment and development of smart cities (Dameri 2013) and a visible proof of the ideal city strategy. However, other global studies on smart cities have revealed that this concept is also based on leadership, good governance, and urban priorities. Thus, strategies of today's cities and municipalities are geared toward developing more sustainable and smart cities to attract greater economic opportunities, investments, and skilled people, among others.

2 Methodology

The study employed analysis of relevant urban local and national policies supplemented by a survey of selected participants. Three regions outside NCR are covered in the study—Central Luzon, Calabarzon, and Bicol regions—which receive the spillover effects of Manila's economic activities.

2.1 Study Area

Focusing on urban settlements outside the NCR, the Central Luzon and Calabarzon regions served as alternative locations for industries after the 1970s decentralization policy, which prohibits establishment of new industries within the 50-km radius of the Philippine capital, based on the National Economic and Development Authority (NEDA) 2011 Regional Development Plan. These two regions are strategic in terms of spatial location and development, as well as their economic and social indicators characterized by industrial enclaves and developed and emerging industries. On the other hand, the Bicol region is the southeastern region of Luzon and serves as a geothermal energy supplier, agricultural commodities producer, and an eco-tourism destination. It is characterized as a gateway of Luzon to the Visayas and Mindanao with its local and international sea- and airports (NEDA 2017). Figure 1 shows the location of the three regions covered in the study.

2.2 Instruments and Analysis

A self-administered survey instrument was devised, composed of three main parts (1) factors facilitating and hindering establishment and sustenance of smart cities; (2) identification of top cities/municipalities that can potentially become smart cities by 2040; and (3) national and sub-national policies and programs that directly influence urban settlements becoming smart cities. The questionnaire employed five-step Likert Scale (extremely unlikely, unlikely, undecided, likely, extremely likely) questions and open-ended questions. It was administered to members of the Regional Land Use Committees (RLUC) in each region.

The RLUC is a regional body that formulates and periodically updates the long-term regional physical framework plan. Promoting the integration of land use and physical planning policies, plans, and programs into the regional socio-economic plans and programs (Office of the Philippine President 2008) is among its main functions. The committee comprised regional government agency heads, provincial planning and development coordinators, heads of leagues of local planners, academic institutions, and private sector representatives with expertise necessary to the committee's function. Respondents were chosen from this body because of the wide array of its composition. Fifteen respondents (67%) were in key planning positions in the regional/provincial/city offices; the rest were drawn from a wide variety of positions, including computer programmer, technical support staff, senior scientist, and chief geologist.

Results of the survey were analyzed and substantiated with relevant information from selected local government units (LGUs), Regional Development Council and RLUC reports, and national government agencies, such as the National Economic and Development Authority, Housing and Land Use Regulatory Board, Department

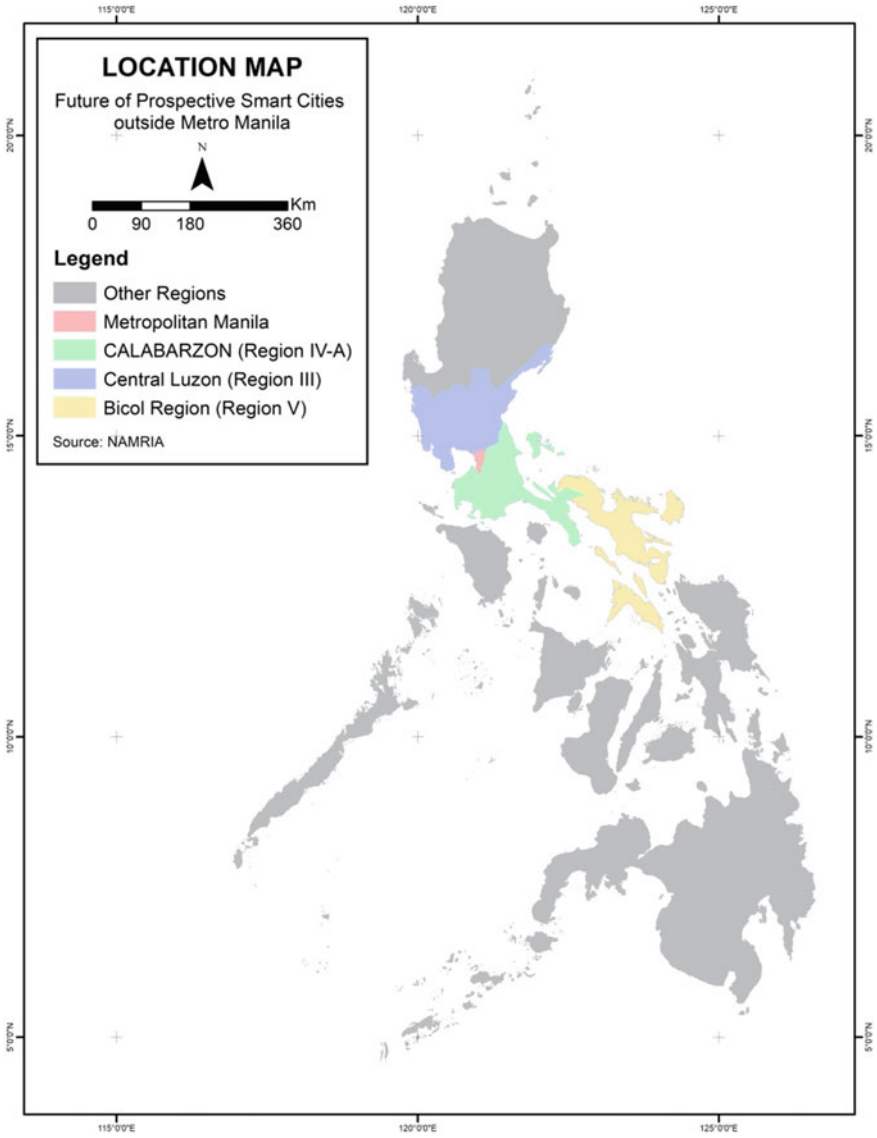

Fig. 1 Location map of Central Luzon, Calabarzon, and Bicol Regions

of Information and Communications Technology, and the Department of Trade and Industry, among others.

The results of the survey revealed cities and municipalities that the respondents deemed likely to be transformed into smart cities by 2040. These were grouped between *developing* smart cities and *potential* smart cities, based on their respective stages of development in terms of the extent or depth of vision, achievement, and

recognition as smart cities. "Developing smart cities" have clearly stated visions and goal statements that pursue a smart-city strategy or have a vision that alludes to the dimensions of smart cities; they have garnered international and national recognition for smart city-friendly policies and have concrete programs and projects in place to realize their visions. Meanwhile, "potential smart cities" have started to indicate dimensions of smart cities in their vision, have received recent recognition as smart cities, and have initiated interventions that are smart city-enabling. The study used public documents and plans; private sector-led interventions that were not mentioned in the government plans and policies were not included.

3 Results and Discussion

This section details the regional profile and urban settlements of the three regions outside Metro Manila, identifies factors affecting smart-city development, and assesses the local and national urban policies that promote smart cities in the Philippine context. At the end, ten cities are characterized in terms of their smart-city potential based on their vision and goal statements, and awards and recognition for smart city-enabling initiatives and achievements.

3.1 Regional Profile and Urban Settlements Characteristics

The archipelagic country of the Philippines is composed of three major island groups: Luzon, Visayas, and Mindanao. The islands are divided into 17 administrative regions, including those under study (Central Luzon, Calabarzon, and Bicol) and the NCR noted earlier. The regions are composed of several provinces with elected government officials.

The National Spatial Strategy (NSS) by Corpuz (2012) identified the network of settlements in the Philippines, which is the basis of the urban characterization in this section. The NSS proposed a five-tier network of settlements that includes metropolitan centers, regional centers, sub-regional centers, provincial centers, and local centers (see Fig. 2).

Settlements with larger population and more diversified services are those in the higher tiers, while settlements with smaller population are in the lower tiers. Metro Manila served as the primary metropolitan center of Luzon and the country, along with Davao City in Mindanao and Cebu City in the Visayas. In terms of population, metro regional centers have 1.2 million and larger populations; regional centers have populations 120,000–1.2 million; sub-regional centers are those with at least 120,000–700,000 residents; provincial centers have 50,000–120,000 residents, while those with less than 50,000 residents are considered local centers (Corpuz 2012).

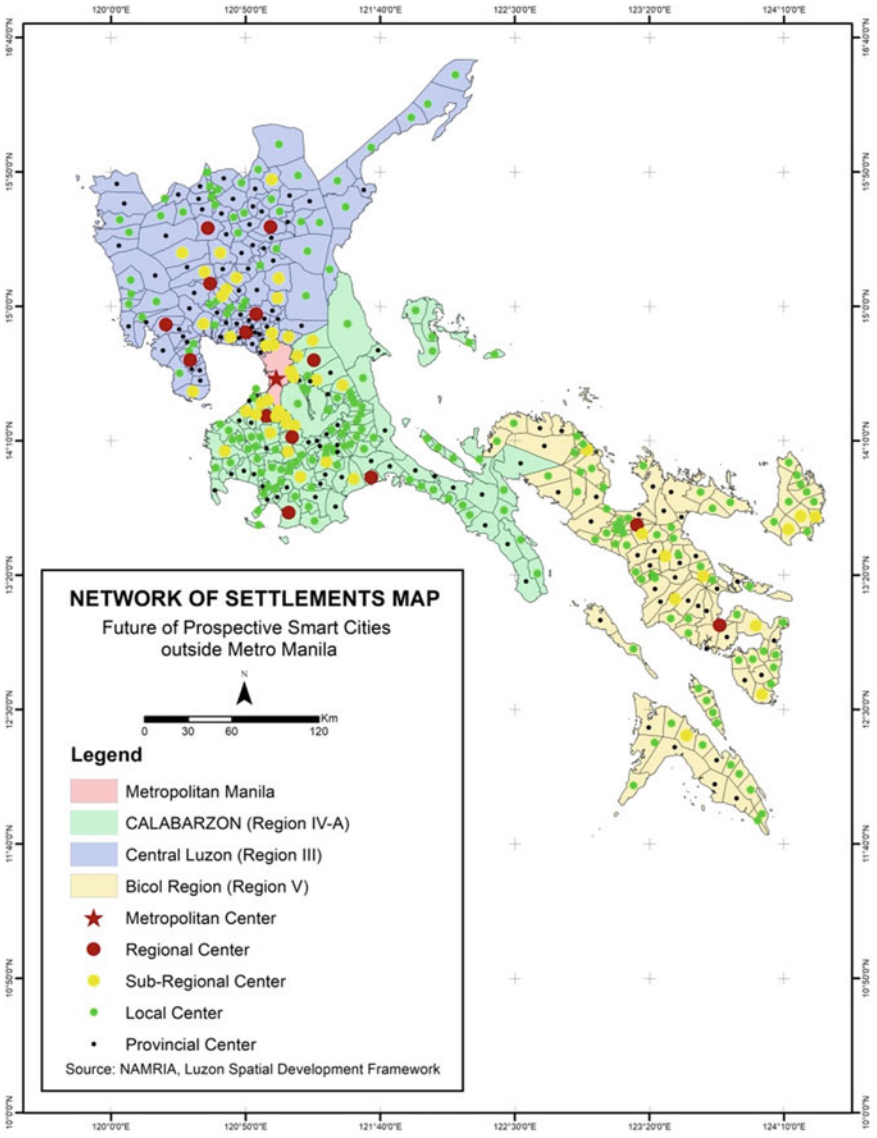

Fig. 2 Five-tier network of settlements of Central Luzon, Calabarzon, and Bicol Regions

Central Luzon Region. This region, located immediately north of Metro Manila, is composed of over 11.2 million people with seven provinces, 13 cities, and 117 municipalities. Its regional activities are centered in the City of San Fernando. About 6 out of 10 individuals in this region reside in urban areas. With an urban population of 6.9 million, Central Luzon is the fourth most urbanized region in the Philippines.

The region's contributions to the national economy are focused on the manufacturing, construction, transport, storage, and communication services sectors, as well as agriculture.

Metro San Fernando serves as a vital link to the northern regions of Luzon Island. The Metro Clark Area, including three cities (Angeles, Mabalacat, and San Fernando, part of the Mega Manila regional corridor) and its adjacent urban municipalities, serves as the center of industrial and residential activities in Central Luzon. The other five regional centers include Metro Subic, Balanga, Baliuag, Cabanatuan, Subic, and Tarlac. There are about 16 sub-regional centers in Central Luzon, which supplement the roles of the regional centers. From the inner cities to extended urban areas, these urban agglomeration areas support their neighboring provincial and local centers.

Calabarzon Region. The most populous of the three study regions, with a total population of 14.4 million (Philippine Statistics Authority 2015), this region is composed of five provinces Cavite, Laguna, Batangas, Rizal, and Quezon. Located in the south of Metro Manila, Calabarzon is home to 19 cities and second to the NCR in terms of urban population. About 66 out of 100 individuals are considered urban dwellers, with a total urban population of 9.6 million. It contributes largely to the manufacturing sector and is home to over 30 economic zones and industrial enclaves and agro-industrial industries. Calamba City is its regional government center.

The extended Mega Manila region or the Greater Capital Region (GCR) includes four cities in the Calabarzon region, Metro Dasmariñas, Antipolo, Calamba, and Batangas. The GCR contributes about half of the Philippine economic output and plays a special role in job generation, competitiveness, and poverty reduction (LRDC and NEDA 2015). Metro Batangas, gateway to other island regions and municipalities in southern Luzon, links Metro Manila to the western nautical highway. Metro Lucena, on the other hand, is an urban area that serves smaller municipalities in southern Luzon, leading to the Bicol and Mimaropa regions.

Calabarzon's sub-regional centers include Lipa City, Tanauan City, Sta. Rosa City, San Pablo City, Biñan City, San Pedro City, Cabuyao City, and 13 adjacent municipalities. These cities and municipalities are characterized by agricultural and peri-urban areas, eco-tourism and coastal development, and expansion areas of the NCR.

Bicol Region. Largely agriculture-based, Bicol region is an exporter of agricultural and marine products and has a competitive advantage in mining and quarrying. It has a total population of 5.8 million, of which 1.3 million reside in urban areas. Bicol is composed of six provinces, seven cities, and 107 municipalities. It serves as the eastern gateway to the Visayas and Mindanao regions. Legazpi City serves as the regional government center.

Bicol's regional centers are Metro Naga and Metro Legazpi growth areas, characterized by "higher urban services, employment opportunities, and linkages to major tourist destinations" (LRDC and NEDA 2015). These two metropolitan centers serve as a transportation corridor with freeways, railroads, and two main airports. In terms of sub-regional centers, it has nine cities and municipalities (Daet, Iriga City, Ligao, Masbate City, Matnog, Pili, Sorsogon City, Tabaco, and Virac), which support the

services in Metro Naga, characterized by eco-tourism and agri-economic activities, as well as academic institutions and transportation connectivity to Visayas and Mindanao.

3.2 Facilitating and Hindering Factors of Smart Cities

Smart cities literature (Jayasena et al. 2019; Melchor 2013, Philips Lighting 2017) that describes the factors likely to enable or hinder establishment and sustenance of smart cities found results similar to those of the study and verified in the survey (Table 1).

Enabling Factors. According to the survey results, intangible factors such as leadership and governance, a locality's vision and goals, and public–private collaboration are "extremely likely" to play a vital role in the creation and sustenance of smart cities. Urban settlement policies and directives usually emanate from local/national officials and are then translated to the locality's statement of desired future and condition or its vision and goals. The urban settlement policies and the vision of the localities are two factors that tend to drive cities and municipalities in the direction of a more sustainable and stable future.

More specifically, leadership is considered the most important factor in implementing a smart-city program (Philips Lighting 2017). In the context of a developing nation, a "champion" of smart cities who can serve as a prime mover of such strategy is an added success factor. Following that, an articulated vision and goals, and

Table 1 Factors likely to facilitate and hinder smart city development

Facilitating factors	Extremely likely (%)	Hindering factors	Likely (%)
Leadership and governance	73.3	Low level of citizenry education and engagement level	80.0
Vision and goals of the locality	66.7	Inadequate information and communications technology facilities	73.3
Collaboration between private and public agencies	66.7	Environmental risks and threats	66.7
Citizen engagement	53.3	Lack of knowledge and capacity for technological advancement	53.3
Local government unit planning and capacity	53.3	Short-term mindset and limited technical competence	53.3
Physical infrastructure and technology	53.3	Political uncertainties	46.6
Capital investments	53.3	Limited available capital for smart-city investments	33.3

increased collaboration with private industries will most likely enable development of smart cities.

Four items were tied in third position with 53.3% of respondents: (a) citizen engagement; (b) local government unit (LGU) planning and capacity; (c) physical infrastructure and technology; and (d) capital investments.

The capacity of the LGU to implement a smart-city development program is deemed important by more than half of the respondents. This factor may include planning and management capability as well as governance frameworks in place, not to mention a well-equipped smart-city task force that can provide technical input on strategy. With a strategy that is government-based, citizen engagement is another facilitating factor. Moreover, one of the respondents mentioned that an information campaign drive on smart-city intervention was also key to empowering and strengthening public engagement.

With the notion that smart cities are driven by ICT (information and communications technology) (Dameri 2013) or physical infrastructure, these built structures are reflections of a defined vision and goal to establish a smart city. Capital investments naturally can be sourced outside the financial capacity of cities and municipalities if a clear strategy and private–public sector collaboration are present.

Hindering factors. A less educated and less engaged citizenry topped the list of "likely" hindrances to smart-city initiatives, per 80% of respondents. Inadequate ICT facilities were seen as the second most likely impeding factor by over 70% of respondents.

Environmental risks and threats were considered the third-most likely set of hindering factors, especially in urban areas that are vulnerable to typhoons and floods and susceptible to other hazards. Over 50% of the respondents considered inadequate technological knowledge, limited technical competence, and short-term mindset likely to hamper smart-city strategy, followed by political uncertainties at 46.6%. Since local chief executives in the Philippines serve a minimum of three years, implementing a smart-city strategy might be beyond an elected official's service. Limited capital was considered last among the likely hindering factors.

3.3 National and Local Urban Policy Frameworks

Respondents identified the following national and local policies as instrumental in development of smart cities (Table 2). This section briefly discusses the national and local plans, policies, and interventions that can directly affect development and sustenance of smart cities.

National Plans and Policies. In the Philippine setting, major development directions emanate from national plans, which are then translated to regional, provincial, and local plans. Illustrative national plans include the National Physical Framework Plan (NPFP) 2000–2030, the Medium-Term Philippine Development Plan (PDP) 2017–2022, and the National Urban Development and Housing Framework (NUDHF)

Table 2 National and local policies influencing smart cities development

Level	Policies, plans, programs, projects
National	National Physical Framework Plan 2001–2030
	Medium-Term Philippine Development Plan 2017–2022
	National Urban Development and Housing Framework 2017–2022
	Ease of Doing Business Act, Philippine Competitiveness Program
	Department of ICT (DICT) Programs: Integrated Government Philippines (iGovPhil), Philippine Community eCenter, Electronic Governance in Local Government Unit (eLGU), National Grid Framework Program, Free Wi-FI Internet Access in Public Places Project, Pipol Konek
	Smarter Philippines Program (Department of Science and Technology, DICT)
	Next Wave Cities Program
Regional	Regional Physical Framework Plans Regional Development Plans
Provincial	Provincial Development and Physical Framework Plan Provincial Development Investment Plan
	Cavite's Wireless Access Program LINKod Kabitenyo website and mobile application
Local	Comprehensive Land Use Plans, Comprehensive Development Plans

2017–2022. Banner programs and projects on Smarter Philippines (Melchor 2013) and various electronic governance tools were also prominently identified by the respondents.

The NPFP 2001–2030 is based on the pillars of sustainable development and growth, balanced with social equity. Among the principles that the NPFP espouses directly affecting urban settlements are sustainable growth of cities and large towns, which ensures environmental stability and ecological integrity, and integration of consumption and production areas through appropriate facilities (NEDA 1997). Human and institutional factors such as the principles of empowerment of people and encouraging development through private and public sector partnerships were also identified. However, smart use of ICT was not yet identified in the late 1990s when the plan was formulated.

The PDP spells out the current president's development plan, which is anchored to AmBisyon Natin 2040: A Long-term Vision for the Philippines, stating that "By 2040, the Philippines is a prosperous middleclass society where no one is poor. People live long and healthy lives and are smart and innovative. The country is a high-trust society where families thrive in vibrant, culturally diverse, and resilient communities" (NEDA 2015). The smart and innovative skill sets mentioned in the vision include functional literacies, ICT literacy, and competencies in creativity, communication, and collaboration. Moreover, high-trust society identifies "clean, fair, and citizen-centered" governance as the foundation of communities of the future (NEDA 2015). Thus, the importance of human, technology, and governance dimensions of smart

cities can be tied to this long-term vision, which was detailed in the 20 chapters of the PDP and localized in the Regional Development Plans.

The NUDHF 2017–2022 is based on the Philippine New Urban Agenda's direction of having "Better, greener, smarter urban systems in a more inclusive Philippines" (HLURB 2017). This agenda is aligned with the United Nations' Sustainable Development Goal 11: making cities safe, inclusive, resilient, and sustainable, and with the stated vision of AmBisyon Natin 2040. The NUDHF identified specific strategies that address the issues faced by urban settlements and are essential in developing smart cities, such as (1) land allocation for critical infrastructures/ utilities, and infrastructure planning toward connectivity and sustainable urban development of the archipelagic country; (2) management of databases for urban development, including policies, maps, and spatial information; and (3) utilization of technology for knowledge management as an enabler of communities, infrastructures, energy and water systems, economic activities, and multi-sectoral partnerships.

As a framework more specific to urban development, the development of smart cities is more clearly encouraged in the strategies and principles of NUDHF, which promotes better quality of life for all. Use of technology to empower various urban activities was identified as important in the framework; however, implementation depends on local government units. The urban knowledge management and use of data in making decisions are deemed important; however, the use of big data is not clearly specified or defined.

Agency-specific programs that are localized include Integrated Government Philippines (iGovPhil), Philippine Community eCenter, Electronic Governance in Local Government Unit (eLGU), the National Grid Framework Program, and Pipol Konek (Free Wi-FI Internet Access in Public Places Project), among others. Moreover, laws and programs that enhance competitiveness, investment management, and business transactions were mentioned. It was observed that most of the interventions that lead to the development of smart cities are focused on improving government procedures and connectivity. The role and contribution of the private sector were not clearly factored in this set of national policies and programs.

Regional Plans and Policies. As more contextualized plans and frameworks, regional plans indicate policies and strategies such as the Regional Physical Framework 2001–2030 and the Medium-Term Regional Development Plans (RDP) 2017–2022.

The three regional RDPs include similar policies related to urban centers and smart cities: (1) concentration strategy detailing the development of dense, compact, and smart growth areas and connectivity strategy through building infrastructure, including efficient communication systems; (2) establishment of ICT infrastructure that supports businesses, transportation, and logistics functions; (3) providing an enabling environment for efficient governance through various e-governance facilities; (4) strategies for clean and renewable energy and water sources; and (5) citizen empowerment and engagement through free Wi-Fi access in all public spaces. Specific smart city-enabling policies and programs in the three regions were identified.

The Central Luzon RDP (NEDA III 2017) clearly specified policy, programs, and research undertakings such as strengthening collaboration through science, technology, and innovation among various sectors and stakeholders. It also proposed study of future competitiveness scenarios of the region's city and municipalities, on renewable energy; assessment of e-governance initiatives as well as increasing the supply of clean and renewable energy, and establishment of sewage systems in highly populated areas, among others.

The RDP of Calabarzon mentioned various e-governance initiatives and how they utilize the regional ICT strategic plan. The strategic plan serves as a basis for the development of ICT in the region, which includes the use of ICT and its supporting infrastructure to enable development and enhance connectivity of cities and growth centers, to prevent and mitigate disaster, and to improve urban governance through more intensive participation and the support of Calabarzon leadership (NEDA IV-A 2017).

Bicol region's RDP (NEDA V 2017) identified the use of ICT to harness the region's potential in improving connectivity and linking the local and international markets, as well as encouraging clean and renewable power sources (e.g., geothermal, waste-to-energy) and eco-efficient water infrastructure designs, particularly in upland and water-critical communities.

The backbone of a smart city is enhanced and technology-enabled governance, which was clearly identified in the national and regional plans. The major programs and interventions of the national offices seemed to successfully devolve to the local governments the use of technology in their transactions with people and business through iGovPhil, the Philippine Community eCenter, electronic governance in local government units, and business processing and licensing procedures.

Provision of infrastructure to support vital activities in growth centers and urban areas was mentioned in many ways and focused on road, expressway, and railway projects. However, investment to contribute directly to smart-city developments was limited. ICT development was mentioned in various parts of the RDPs, but the accompanying investment plans were not clear about funding sources and city-enabling directions. Some interventions such as clean and renewable energy and disaster prevention and mitigation were not location-specific and too broad. As regional plans, it seemed to be expected that provinces, municipalities, and cities identify more specific, geographically based, and contextualized policies, programs, and projects for their constituents.

Provincial and Local Plans/Policies. The provincial counterpart of the national and regional plans and policies specifies how cities and municipalities should best use their resources and land to direct development efforts through the Provincial Development and Physical Framework Plans and the Provincial Development Investment Plan. A more specific program in the province of Cavite in the Calabarzon region includes a Wireless Access Program and the LINKod Kabitenyo.

The Wireless Access Program, implemented in 2017, aimed to promote accessibility to provincial government information and to increase access to broadband

Internet connectivity, aligned to the province's mission to be a first-class, world-class, and smart province. Similarly, LINKod Kabitenyo, translated as Link Service for the people of Cavite, is a website and mobile application that promotes and enhances the development of ICT in Cavite. As an information gateway, citizens, students, investors, tourists, and visitors have access to e-services such as provincial announcements, traffic updates, emergency hotlines, local price watch (market and gas prices), and a list of job vacancies, among others.

The comprehensive land use plans (CLUP) and comprehensive development plans (CDP) are prepared by cities and municipalities. The CLUP provides the blueprint for putting in place the best use of the land from a selection of various potential uses, while the CDP defines the sectoral development goals, objectives, programs and projects, investment programs, and institutional framework for plan implementation. Such plans are indicative of investment priorities for local developments. Aside from these plans, as based on the survey results, the following are considered by the respondents as smart city-enabling interventions: localized e-governance platforms and programs initiated at the national levels, and specific policies, programs, and projects that enhance the delivery of services. Infrastructure and ICT-related programs, competitiveness and ease of doing business, and local transport planning, as well as water and waste plans, were also identified.

3.4 Ten Developing and Potential Smart Cities in 2040

The survey respondents identified 45 cities and municipalities as potential smart cities. Cities with the most mentions were then assessed in terms of their respective vision statements, international and national significance through awards received, and their smart city-enabling initiatives. The cities were grouped between *developing* smart cities and *potential* smart cities and arranged in terms of their urban population, based on the 2015 census (Philippine Statistics Authority 2015) (Table 3).

Among the *developing* smart cities are San Fernando City, Balanga City (Central Luzon region), Santa Rosa City, Batangas City (Calabarzon region), and Naga City (Bicol region). *Potential* smart cities are Bacoor City, Calamba City (Calabarzon region), Angeles City and San Jose del Monte City (Central Luzon), and Legazpi City (Bicol region).

4 Conclusion

Urban settlement features of the three regions were characterized using the NSS five-tier network of settlements. These three regions are home to 14 regional centers and 45 sub-regional centers with populations of 120,000 to over 1.2 million. Located in the south of Metro Manila, Calabarzon region is the most populous region in the Philippines and host to the second largest urban population, next to the NCR.

Calabarzon includes 19 cities, some of which are located in the extended region of Mega Manila, the industrial powerhouse of the Philippines and gateway to the western nautical highway and other island regions and municipalities in southern Luzon Island.

With over 11.2 million people, Central Luzon is the fourth most urbanized region in the Philippines, located in the north of Metro Manila. It has 13 cities that serve as vital links to northern regions of Luzon Island. Bicol region, with 5.8 million

Table 3 Developing and potential smart cities in central Luzon, Calabarzon, and Bicol Regions, Philippines, by 2040

City	Smart city-enabling features
Developing smart city	
Sta. Rosa City Urban Population: 353,767	Aims to be a "world class, smart and green city" supported by sustained and inclusive economic growth, transparent and accountable local governance, effective civil servants, and empowered citizenry. The vision is supported by four pillars of development with specified projects and programs to implement them: (1) knowledge and skills development, (2) clean environment and healthy lifestyle, (3) livelihood and job generation, and (4) peaceful and orderly communities. These pillars also rest on the people's participation in the shaping and development of the city (Santa Rosa City Homepage) Known as the Investment Capital of South Luzon, next ICT Hub in the Country, 10th most competitive component city; Top 100 Destinations for Information Technology and Business Process Outsourcing; and Top Ten Next Wave City in the Philippines. Its female local chief executive is the recipient of a number of individual awards of excellence as a public servant
San Fernando City Urban Population: 291,688	Its city vision includes becoming a champion of good urban governance by 2015, a global gateway by 2020, and a habitat of human excellence by 2030 (City of San Fernando Website). Has a clear roadmap with smart city components embedded (effective government, dynamic and competitive local economy, quality infrastructure, clean and green environment, without losing its cultural identity and heritage). Received an award as the 5th Most Competitive Component City 2018
Batangas City Urban Population: 222,385	Vision statement is focused on developing its agro-industrial center and serving as an international gateway with quality infrastructure, globally competitive citizenry and inspired by transparent firm and fair leadership. Has been awarded as the most honest and transparent city and most supportive to micro, small and medium enterprises, part of the Cities Development Initiatives, 2017 Best Public-Partnership implementation of its Transport Terminal and Commercial Complex, Environment-Friendly awardee among top 10 model cities of the Philippines, UNEP Livable City International Competition gold and silver awardee (Batangas City Official Website)

(continued)

Table 3 (continued)

City	Smart city-enabling features
Naga City Urban Population: 184,534	City's governance has embedded the components of a smart city in its public services as detailed in its SMILES (see, meet, invest, live, experience, study) goals of how it desires to be a "fast-growing progressive city in Bicol and southern Luzon" (LRDC 2015). Moreover, it has a city-wide program *H2ELP your CiTy*, which "calls for stronger citizen participation in governance and development." It has received long decades of international recognition in the fields of housing, ICT, and good governance, which are championed by transparent and good leadership. Among its international recognitions are Most Inspiring Innovation in E-government and Participatory Innovations (National University of Singapore), Cost Effective City (Asian Cities and Regions of the Future); CyberCity Award for Asia–Pacific (2003), Most Cost-Effective City in Asia, and Most Business Friendly City Hall of Famer
Balanga City Urban Population: 61,596	Envisions to be Smart University Town 2030: Established Center for Global Tech Businesses, guided by measurable smart town targets such as (1) smart mobility: reduction in travel time and cost by half, (2) smart economy: generation of PhP 20.0 billion and 10,000 tech jobs, (3) smart environment: ensure 15% of city area is green open spaces, (4) smart people: produce 10,000 tech savvy college graduates annually, and (4) smart government: online transaction of all possible frontline city government processes
Potential smart city	
Angeles City Urban Population: 601,447	Awarded with numerous titles for being competitive, efficient, and as the top- performing local government unit for the past 5 years. Among the ten cities awarded for E-Readiness Leadership Awards recognizing the "government efforts in adopting and strategic use of ICT" in public service delivery, tax collection, and transparency promotion, in 2014
Bacoor City Urban Population: 542,877	Its mission is to provide a more concrete direction for a smart-city initiative "to institute good governance, promote culture, trade and investment in the city through modern technology towards a safe and sound environment" (Bacoor City CLUP 2015). Awarded as a finalist on the most business-friendly local government and years of Seal of Good Local Governance Award
San Jose del Monte City Urban Population: 501,741	City Mayor advocates for "efficient urban mobility towards a walkable green city" along with local economic and infrastructure development, specifically providing a business one-stop shop service facility (City of San Jose Del Monte, Bulacan Website) and is among the finalists for the most business-friendly LGU award in 2017
Calamba City Urban Population: 416,628	Aims to be a globally competitive green city and boasts of its ISO 9001: 2015 certification for its Quality Management System. Its policy is directed to promoting and uplifting the quality of life of its residents through effective and efficient services and leadership, while ensuring "personnel proficiency and sustainability of good working and service environment" (Calamba City Official Website)

(continued)

Table 3 (continued)

City	Smart city-enabling features
Legazpi City Urban Population: 112,389	Positioned as a City of Fun and Adventure, has an interactive map, tourism, and disaster information applications. Its Balangay Legazpi provides disaster information connecting vulnerable sectors and providing before and after disaster information, which won the best Climate Practice 2017 award from the International Center for Climate Governance (Legazpi City Website). Won the 2018 Most Competitive Component City, 1st place

people, has seven cities characterized by multi-modal transportation connectivity, agricultural production, geothermal energy, and tourism.

Urban settlement policies and directives emanate from national/local chief executive officials and are then translated to the local vision statement. This is the main driver of smart cities, along with the need for greater collaboration with private industries. Conversely, low levels of citizen awareness and engagement top the list of factors that are likely to hinder smart-city initiatives, as noted by 80.0 percent of survey respondents. Inadequate ICT, hindering the creation and development of smart cities, is seen as the second of the top two impeding factors.

The national plans, policies, and interventions have shown the importance of human, technological, and governance dimensions of smart cities. Smart use of ICT was not yet identified in the late 1990s when the NPFP plan was formulated. After two decades, smart-city dimensions became apparent in the PDP and localized in the regional, provincial, and local plans and initiatives. The NUDHF serves as a vital framework for urban development, wherein development of smart cities is more clearly encouraged in the strategies and principles it purports. It was observed that most of the interventions that lead to smart-city development are focused on improving government procedures and improving connectivity. However, the role and contribution of the private sector were not clearly factored in these national policies and programs.

The RDPs have mentioned similar policies related to urban centers and smart cities such as (1) concentration and connectivity strategies through compact and smart growth, an efficient infrastructure, and communication systems, (2) establishment of ICT infrastructures that would support businesses and transportation and logistical functions, and (3) an enabling environment for efficient governance through various e-governance facilities. Recognizing the role of ICT in regional development was evident in the plan; however, investments that contribute directly to smart-city development are limited. Some interventions, such as clean and renewable energy and disaster prevention and mitigations, were not location-specific and too broad. Location-specific and contextualized smart city-enabling policies and interventions were mentioned in the city and municipal plans as a result of localized e-governance platforms and programs initiated at the national level.

Based on the survey result, ten cities were identified along with their merits to become developing or potential smart cities by 2040. Among the developing smart

cities are Angeles City, San Fernando City, Balanga City, Santa Rosa City, Batangas City, and Naga City. Potential smart cities are Bacoor City, Calamba City, San Jose del Monte City, and Legazpi City. These cities demonstrate smart city-enabling features in their local vision and goals and had received recognition for various initiatives to promote sustainable development and for the use of ICT in improving the lives of their constituents. However, their paths to becoming smart cities lie through building on their initiatives and strengthening them while integrating a more holistic strategy incorporating smart use of ICT, analyzing and managing big data, and ensuring scaled-up interventions in innovative economies, efficient energy, and water systems.

Smart-city development outside Metro Manila needs to focus on strengthening leadership capacity toward sustainable and integrated urban development strategies, building-up of non-fragmented city development programs, and championing leaders who will steer smart-city development. These initiatives should be sustained with intensified and clear roles of the private and academic sectors, by means of proper allocation of investments in technology and big data analytics, scaled-up interventions in innovative economies, efficient energy and water systems, and finally, by ensuring that well-informed and engaged citizens are at the center of these strategies.

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Review of a Green Infrastructure Approach in Urban Flood Management and Its Possible Application in Binh Duong Province

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Abstract Green Infrastructure (GI) is a concept that incorporates vegetation, natural processes, and land use into the built environment. This concept is considered an effective intervention for stormwater runoff minimization in urban flood management. In the context of increased flooding in many Vietnamese cities, the paper has carried out an overall review on GI, its advantages and constraints in urban flood management. Then, it tried to identify possible applications in the urban areas of Binh Duong province. The literature review shows that GI can bring many positive effects, such as reducing stormwater runoff, improving water quality, mitigating the impacts of climate change, and maintaining healthy and sustainable communities. However, the practical utilization of GI in urban flood management is still overwhelmed by traditional gray infrastructure such as roads, drainage pipe networks, and sewage treatment or water treatment systems, etc., which generally offer low sustainability, as shown in the literature. The main reasons are the uncertainties of GI hydrological performance, service delivery, and lack of appropriate decision-making supports for its multiple-benefit assessment. A review of the current situation on policy, authorities, and community awareness, along with the natural conditions of Binh Duong, was proposed to define the possibilities for applying GI in the province. There is a need for further studies on the technical deployment of GI solutions through experiments, methods, and tools for their performance assessment compared to the traditional gray solutions.

Keywords Green infrastructure · Urban flood management · Runoff water · Sustainable development · Binh Duong

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1 Introduction

Urban flooding occurs when drainage systems become overwhelmed because the system's capacity is much lower than the peak discharge of surface flow, especially during heavy rain. Therefore, it causes a severe challenge to cities' development and the lives of urban inhabitants, particularly residents of rapidly expanding towns and cities in developing countries (Eldho et al. 2018; Jha et al. 2012). Although this type of flood happens more frequently and has become more localized, understanding of its characteristics is lacking. Moreover, flood flows in the urban environment have just recently received attention despite many centuries of flood events (Crowe and Rotherham 2019; Luu et al. 2019).

Located in the southeast, Binh Duong province is the third-fastest urbanizing province of Vietnam. As a result, urban flooding has increased significantly, especially in the lower elevation areas and adjacent zones with a larger population, such as Thu Dau Mot city, Thuan An, and Di An town. The frequency and consequence of urban floods have not slowed in recent years, despite installation of some new drainage systems and renovations of existing ones.

The green infrastructure concept views natural areas as another form of infrastructure needed for both ecological health and quality of life that people have come to expect. Numerous publications report the benefits of green infrastructure, including delivering a wide range of ecosystem services and protecting biodiversity (Commission 2013), improving water quality, and managing water quantity by restoring the hydrologic function of the urban landscape (Lovell and Taylor 2013; Brears 2018). Therefore, this paper aims to review and systemize the properties of green infrastructure that could be utilized for urban flooding management, and then to propose possible applications in Binh Duong province as a sustainable solution.

The paper mainly uses a secondary documentary research method in which different planning and technical documents are reviewed, summarized, and synthesized based on the authors' knowledge. In addition, on-site observation and phototaking are also employed to understand the context of Binh Duong province and its towns, especially their urban flooding problem. Within the scope of this paper, the outputs shall be proposals for green infrastructure development at a provincial level, flooding areas at the city level, and project scale possibilities for application in Binh Duong.

2 Green Infrastructure in Urban Flooding Management

The traditional drainage systems (called "gray infrastructure") recently proved to exacerbate pollutant inputs and hydrologic disturbance, resulting in localized floods and degradation of ecosystem structure and function because they route the runoff directly to streams and rivers (Vojinovic et al. 2015). Therefore, the requirement that post-development stormwater discharge peaks do not exceed predevelopment

level is highly urgent (Gupta 2016). Recently, the sustainable stormwater management system that utilized the green infrastructure concept has been formulated for the characteristics of predevelopment flow regimes and reducing pollutants, and their loadings have been widely studied (Hamel et al. 2013). Some sustainable concepts are found in many different countries, such as water-sensitive urban design (WSUD) in Australia, the "Sponge City" initiative in China, sustainable urban drainage systems (SuDS) in the UK, and low impact development (LID) in the USA. Such approaches are called green infrastructure (GI) (Dhakal and Chevalier 2017). These green approaches can offer more sustainable management solutions for the cities' runoff (Alves et al. 2018).

Green stormwater management projects can have multiple uses. Not only do they act as stormwater storage areas, water conveyance areas, and runoff filters, but they also provide several co-benefits. These co-benefits include environmental and socio-economic aspects such as reducing energy and water consumption, biodiversity enhancement, and health benefits, among many others (Roy et al. 2008; Vojinovic 2015; Feng et al. 2016; Jegatheesan et al. 2019). In addition, there is growing evidence in financial and ecosystem valuation studies that investments in green infrastructure provide a good return and multiple, far-reaching positive effects on health and climate change (Winz et al. 2013; O'Donnell et al. 2017; Brears 2018; Johns 2019). The following Table 1 gives a summary of the co-benefits of green infrastructure.

Sustainable and green flexible drainage techniques alter the focus of drainage design, practice, construction, and maintenance to facilitate a higher consideration for society in general and the receiving environment. The applications of these concepts include a pond, infiltration, and harvest water at the source, encouraging evaporation, evapotranspiration, groundwater recharge, and re-use of stormwater. Table 2

Table 1 The co-benefits of green infrastructure

Environmental benefits	Economic benefits	Social benefits
Improved visual amenity	Increased property prices	Encouraging physical activity
Enhanced urban microclimate	Increased land values	Better childhood development
Improved air quality	Faster property sales	Improved mental health
Reduced flood risk	Encouraging inward investment	Faster hospital recovery rates
Better water quality	Reduced energy costs via microclimate regulation	Improved workplace productivity
Improved biodiversity	Improved chances of gaining planning permission	Increased social cohesion
Reduced ambient noise	Improved tourism and recreation facilities	Reduction in crime
Reduced atmospheric CO_2	Lower healthcare costs	

Crowe and Rotherham (2019)

Table 2 Typical green infrastructure types for urban flooding mitigation purposes

Green infrastructure type	Description	Flood risk reduction (*)
Pervious surfaces	Surfaces that allow inflow of rainwater into the underlying construction or soil	M
Green roofs	Vegetated roofs that reduce the volume and rate of runoff and remove pollution	M
Filter drains	Linear drains consisting of trenches filled with permeable material	H
Filter strips	Vegetated areas of sloping ground designed to drain water	H
Swales	Shallow vegetated channels that conduct and retain water	M
Basins, pond, and wetland	Areas that store surface runoff	H
Infiltration devices	Application of sub-surface structures for enhancing infiltration of surface water to the ground. They can be trenches, basins, or soakaways	H
Bio-retention	Vegetated areas to collect and treat water before discharge via a piped system or infiltration to the ground	H

Note (*) H—High; M—Medium (scores toward contributing to ecosystem service function reducing flood risk according to the NWRM benefit tables, available at nwrm.eu/catalogue-nwrm/benefit-tables). Woods Ballard et al. (2015); Dige et al. (2017)

provides an overview of the most popular green infrastructure components applied in sustainable drainage systems.

3 Green Infrastructure in Practice

3.1 Successful Green Infrastructure Projects

There is a trend in many cities worldwide in which green infrastructure has developed alongside measures to improve flooding management and climate resilience (Armour et al. 2014). For example, the Spangen district at Rotterdam, Netherlands, has almost no open water and a high proportion of paved surfaces within a dense urban environment. Therefore, a series of attractive, well-vegetated water squares has been proposed in the district to build resilience to climate change. The central area of each square has been lowered and paved to act as a buffer for rainwater, allowing runoff to occasionally fill the leading site to reduce the impact of rainfall and storm events on city infrastructure. In addition, a parking garage was built beneath Museumplein Square with 10,000 cubic meters of underground storage. This

initiative alone provides 12% of the water storage capacity required for the city center (Jegatheesan et al. 2019).

Another example of successful green infrastructure application in urban flooding management is Chulalongkorn University Centenary Park in Thailand, which covers 44,415 m^2 of city land; the land was worth an estimated US$700 million in 2017. In addition to reducing the urban heat island for such a crowded Bangkok area, this park plays an essential function for the flood-prone area as it collects and cleans water. Essentially, this flood-proof park can hold nearly one million gallons of water during severe floods (Holmes 2019). According to Le et al. (2019), "flood-resilient urban parks" are projects that could provide environmental, social, cultural, education, and economic functions while integrating flood adaptation infrastructure strategies. The researchers mentioned the 16 successful projects in coastal cities and urban areas that regularly experience flash floods, heavy rain, tidal floods, storm surges, and rich flood control experiences in Asian, European, and North American countries.

The World Bank Group intends to finance the assignment to provide capacity-building support and technical assistance to seven participating cities in the Mekong Delta in Vietnam. This project shall be under the World Bank Scaling Up Urban Upgrading Project, which aims to incorporate green infrastructure principles into urban planning and infrastructure design (Group 2019). In addition, Can Tho province plans to build its first green infrastructure park, covering over 0.5 hectares of land in An Khanh ward of Ninh Kieu district (VNA 2019).

3.2 Factors that Influence Green Infrastructure Project Implementation

Although the science and engineering related to green infrastructure have evolved significantly in recent years, green infrastructure still faces many challenges. Practically, the common factors that influence implementation of green infrastructure include education, provision of ecosystem services, financial incentives, and coordination among actors, laws, policies, and planning recommendations. Meanwhile, cities utilizing green infrastructure have identified challenges during implementation, such as uncertainties in performance and cost (Roy et al. 2008), lacking institutional capacity, legislative mandates, and funding (Roy et al. 2008; Johns 2019). Others include the dominance of technical engineering knowledge (Johns 2019); lacking cross-collaborative authority agreements (Armour et al. 2014); resistance to change in the public, private, and community sectors (Roy et al. 2008; Winz et al. 2013); absence of the effective conceptual models to guide implementation (Le et al. 2019). In addition, Winz et al. (2013) have also highlighted the significant overall effect of interaction between these barriers.

In summary, the critical factors that influence the adoption of green infrastructure for flooding management could be divided into the following four majors groups: (1) economic and financial factors; (2) regulation, policies, and institutional factors;

(3) technological and physical factors; and (4) awareness and education. Table 3 illustrates these common groups.

Table 3 Barriers to implementing green infrastructure (GI) in urban flooding management

Group(s)	Type
(1) Economic and financial factors	High land values and high transaction cost
	Difficulty in quantifying the co-benefits that GI brings
	Long time horizons, perceived higher risk
	Initial high costs, undefined financial responsibilities
	Low priority for GI projects compared to other infrastructure projects
	Lack of financial resources
(2) Regulation, policies, and institutional factors	Insufficient policy coherence
	Complications associated with property rights
	Lack of a clear regulatory framework
	Lock-in of traditional practices and lack of resources
	Lack of integration of green infrastructure in local rules and regulations
	Lack of long-term planning
(3) Technological and physical factors	Unfamiliarity with GI, little trust in the science and technology behind it
	Limited or no maintenance experience of GI
	Lack of understanding of how GI is relevant to local stormwater issues
	Lack of physical space for GI projects
(4) Awareness and education	Insufficient or inaccessible information on green infrastructure and its benefits for decision-makers, management level leaders, city planners, and other relevant stakeholders, such as agency staff, developers, builders, landscapers, and others, including the public
	The unwillingness or resistance by developers to integrate and use green infrastructure
	Shortage of trained professionals

EPA (2016b); Brears (2018)

4 Flooding in Binh Duong Province and Green Infrastructure

4.1 Rapid Urbanization and Flooding in Binh Duong

Binh Duong province is in the southeast region of Vietnam, south of Ho Chi Minh City. It includes the Saigon, Dong Nai, and Be rivers. Across the province, there are different topographic regions, including low mountainous terrain with slight undulation, flat plains, and alluvial valleys. The location map of Binh Duong province is illustrated in Fig. 1.

According to Binh Duong's Department of Construction, rapid urban development has reduced permeability areas, making both the quantity and velocity of surface flows significantly higher than before during heavy rainfall and has led to overload of the existing drainage systems. Failure of the drainage systems, leading to local inundation of low-lying areas during heavy rain or high tide, is the leading cause of urban flooding in the province. Besides, poor maintenance of drainage systems and low awareness about environmental protection also cause blocked pipelines and reduce the system's capacity, especially in crowded areas such as Thu Dau Mot City, Thuan An town and Di An town. Furthermore, appropriate funds for drainage system investment lag behind urbanization rates; and funding resources are unstable and usually much lower than when setting up new urban areas and development projects.

Fig. 1 Location of Binh Duong province (*Source* https://en.wikipedia.org)

(a) The runoff overwhelmed a drainage canal, causing a flood in Thu Dau Mot City central

(b) The fulldrainage canal at central Thu Dau Mot City 8 hours after heavy rain

Fig. 2 Flooding situation in Binh Duong urban areas

In addition, while the drainage systems in most new roads or traffic built-up only drain water from the road surface; surface water from the surrounding areas is ignored. Therefore, during heavy rainfall, these drainage systems have been overwhelmed by runoff from surrounding areas that cannot be drained in time, leading to floods (Phuong Le, 2016). Figure 2 below shows the flood situation in Thu Dau Mot City, Binh Duong province.

4.2 Opportunities for Green Infrastructure Solutions in Urban Flooding Mitigation in Binh Duong Province

As determined by Binh Duong province in its development mission, the party, government, and people in the area are on the way to making Binh Duong a green, clean, beautiful city worth living in. Most of the factories located in residential areas are required to move to industrial zones. According to Binh Duong's Department of Construction, 30 parks and flower gardens covering a total area of 18,000 square meters were built in Thu Dau Mot City in 2015–2017 after the decision by local authorities to utilize more sites for new parks and public gardens to improve the quality of life.

Over the past five years, provincial management deployed many projects to improve drainage systems' capacity. For example, the Chom Sao—Suoi Don new drainage system in Thuan An town, Bung Bip—Suoi Cat new drainage system for Thu Dau Mot City and Thuan An town catchment (Fig. 3), KT3 drainage channel project, and others for dredging and clearing flows of canals. These are the positive changes in awareness, responsibility, and actions on environmental protection of the political system, the business community, and the residents.

Therefore, green infrastructure should be one of the best alternatives for Binh Duong province in future urban flooding management. Along with the province's development mission, green solutions will be strongly supported by authorities and

Fig. 3 New projects for urban flooding management in Binh Duong Province. (*Source* https://www.google.com/maps and modified by Authors, 2019)

decision-makers of Binh Duong province if the costs and benefits of the projects are clearly defined.

4.3 Solutions for Binh Duong

It is clear that green solutions for urban flooding management are one of the best alternatives, and the province has many advantages in utilizing this approach. However, practical implementation in other cities has shown that the slow uptake of green infrastructure solutions into urban flooding control is due to some constraints and barriers, compared with other technical solutions. (Schanze 2017; Water 2018). Therefore, Binh Duong authorities must pay an appropriate consideration and provide research funding for green infrastructure application. This section will introduce first steps for green infrastructure deployment in Binh Duong regarding urban flooding management.

Urban Green Infrastructure Plan at the Provincial Level

An Urban Green Infrastructure Plan at the regional scale should be the first step in implementing green infrastructure for urban flooding management. This plan will act as a strategic approach for addressing the broad range of challenges in Binh Duong urban areas in addition to the flooding problem, such as conserving biodiversity, adapting to climate change, supporting the green economy, and improving social cohesion (Hansen et al. 2017). An effective plan should be the basis for dealing with

factors and barriers that influence the adoption of green infrastructure for flooding management, as summarized in Table 3 above.

Regarding flooding management, the plan should clearly define current problems related to the existing stormwater systems that are risks to the health of province residents and to socio-economic activities. The Urban Green Infrastructure Plan of Binh Duong Province, therefore, should be based on four principles as follows:

- Green and gray integration: combining elements of both green and gray infrastructure;
- Connectivity: creating green space networks;
- Multifunctionality: delivering and enhancing multiple functions and services;
- Social inclusion: collaborative and participatory planning.

Sustainable Urban Stormwater Management Plan for sensitive areas

In Binh Duong city, the high-density population areas such as Thu Dau Mot city, and Thuan An, Di An, and Ben Cat towns are strongly affected by the urban flooding problem. Therefore, these towns should develop their own Sustainable Urban Stormwater Management Plan to incorporate existing community objectives such as runoff volume reduction, increased infiltration and rainwater harvesting, flooding reduction, and social amenities for the health and well-being of the community (EPA 2016a). This plan should be an essential component of the provincial Urban Green Infrastructure Plan. Effective local planning should assess following their current status, including:

- Evaluate existing stormwater systems and consider how changes in the local climate might impact the current system's performance;
- Propose sensitive areas and environmental justice concerns;
- Evaluate implementation of projects for communities with green infrastructure requirements in their permits.

Opportunities for green and gray integrating at project scale

By 2017, 30 new green parks and flower gardens with an area of 100–300 m^2 each had been renovated or newly built in Thu Dau Mot City. By the end of 2019, that number was 66, increasing the city's total green area up to more than 50,000 m^2. This success results from Thu Dau Mot city's green space enhancement project (Dung 2018). In addition, there is a newly developed green park with a total area of 75 hectares located in Binh Duong New City, about ten kilometers from the central area of Thu Dau Mot City.

In theory, these parks function only as public and green space for recreation. But in practice, by conducting green and gray infrastructure integration, the flood-resilient urban parks function both as water infrastructure and as public space (Le et al. 2019). A thriving green and gray integration can make the parks more functional, such as catching and collecting water and storing it before it flows to stormwater runoff. In addition, the stored water from gardens can be filtered and purified by native

vegetation, then used for irrigation and other purposes. As a result, the quality of discharged water could also improve.

In addition, there are many residential or industrial investment projects located in the city where available land is minimal. Thus, the land used for green space at each project site is deficient, especially at projects in the central areas where the land value is extremely high. These include Thu Dau Mot City, Di An town, and Thuan An town, where the use and design of land for only green space is essentially ineffective in terms of land-use. This situation makes integrating green and gray infrastructure concepts the optimal solution. Integration at small-scale projects, such as renovating a concreted surface with permeable materials; installing stormwater planters along the road to absorb stormwater and prevent sewer backups; renovating the grassland around public buildings into bio-swale or rain gardens; renovating parking lots with permeable concrete floors and bio-swale for stormwater collection; etc. (Lukes and Kloss 2008; EPA 2016a).

An effective integration could help increase the benefits of green space and permeable areas and improve the design's infiltration capacity or water retention. A project's green and gray integrating plan could also be a valid quantitative document to illustrate the actual co-benefits of the project design as an advantage for decision-makers to consider in the project appraisal process.

5 Conclusions

This paper has summarized four groups of factors or barriers to implementing green infrastructure in urban flooding management by reviewing the previous research and studies. These should apply to the green infrastructure concept in urban flooding mitigation in Binh Duong province. Based on advantages Binh Duong could expect to see after the application of green infrastructure, the proposed solutions for the area are selected and summarized from the guidelines of the European Union (EU) project entitled "GREEN SURGE" and the publication of the United States' Environmental Protection Agency (US EPA) on green infrastructure application and implementation. Specifically, an Urban Green Infrastructure Plan for the province and a Sustainable Urban Stormwater Management Plan for the sensitive areas should be a robust base green infrastructure application in Binh Duong regarding urban flooding risk mitigation and climate change adaptation. In addition, developing a guideline on planning and implementing green and gray infrastructure at the project scale would be optimal and urgent for Thu Dau Mot City and other cities. The pilot-scale studies should be a lesson learned for the guideline application.

The proposed solutions in this study are a very first step for green infrastructure application in Binh Duong by raising awareness of local authorities about the approach. However, it is necessary to have further detailed research on other aspects of the green infrastructure application, such as an up-to-date risk assessment on urban flooding in Binh Duong's flooding hot-spots, research on most appropriate green infrastructure types for each metropolitan area of the province based on hydrological

characteristics, a study to define the suitable locations for green infrastructure, and the priorities of each site across Binh Duong province, and so on. The knowledge and perception of the authorities and local communities on green infrastructure for stormwater management also must be studied. More specific green infrastructure projects then may be proposed for actual implementation.

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Stakeholder Analysis Framework and Ongoing System Review for the Possibility of Green Infrastructure Application to Hanoi Urban Stormwater Management

Doan Thi Thao Linh and Nguyen Thanh Tu

Abstract Green infrastructure (GI), while long recognized around the world as a useful alternative to conventional engineering solutions, remains a relatively novel concept and a rarely employed solution for water infrastructure development in Vietnam. This chapter focuses on exploring possibilities of GI application into urban stormwater management in Hanoi, the capital of Vietnam. A key objective of the study was to shed light on stakeholders' perceptions of Hanoi urban stormwater management, particularly in terms of GI application. A stakeholder analysis was performed using a three-stage process of (1) identifying key stakeholders and their stake(s), (2) differentiating and categorizing the stakeholders, and (3) investigating stakeholder relationships. Preliminary results demonstrate that much of the stormwater management efforts in Hanoi fall into traditional engineering solutions, while not enough concern is expressed for the adoption of GI. The key stakeholders have been identified, classified, and analyzed in the proposed systematic stakeholder framework, among which municipal departments can be recognized as the most important. In addition, the study also found that the feasibility of GI application requires adequate education and consultation with other beneficiary groups. Last but not least, the success of the GI project likely depends on active civil society engagement and proper cooperation with the Hanoi government.

Keywords Green infrastructure · Stormwater management · Stakeholder analysis · Hanoi

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1 Introduction

1.1 Current Urban Flooding Situation in Hanoi

Vietnam is among the top countries of the Southeast Asian region that have witnessed rapid urbanization during recent decades. By 2018, the urbanization rate of this country had risen to 38%, and it is projected to reach 50% by 2030. Due to the concentration of population, socio-economic values and assets and environmental degradation, big cities in Vietnam, particularly Hanoi and Ho Chi Minh City (HCMC), face significant loss due to hazards and disasters (Anh et al. 2004).

Hanoi, the capital city with a profound role in political, economic, and social development, is one of the two largest and fast-growing metropolitan areas in Vietnam. High population densities, a dense network of rivers and lakes, and low-lying topography in Hanoi make the city uniquely vulnerable to extreme rainfall and consequent floods.[1] Climate change has only exacerbated urban flooding and magnifies the impacts of poor land-use and natural resource planning, such as the lack of stormwater storage areas and an increase in impervious surfaces. As a result of the rapid demographic growth and urbanization trends, associated land cover change in Hanoi has significantly disrupted the local hydrological cycle. Climate change has had an accelerating effect on flooding intensity and damage.

Urban flooding causes infrastructural, community, and environmental damages as it contributes to flash flooding, pollution of nearby surface water, and other water-related problems (Czemiel Berndtsson 2010; Vijayaraghavan 2016; EPA 2003). A notable example is the flood event triggered by torrential rains in 2008, which led to significant human casualties and economic loss (Chen et al. 2012).

1.2 Key Concepts

1.2.1 Gray and Green Infrastructure

The conventional solutions for stormwater management (SWM) apply engineering solutions to facilitate quick drainage of stormwater away from urban areas to avoid the economic damages of flooding. Stormwater infrastructure, including drainage and water treatment systems such as pipes, tanks, or underground storage facilities, in most developed areas, is primarily concrete (e.g., pipes and culverts), also known

[1] According to the Hanoi Department of Construction, under the current drainage system condition, if it rains for the duration of two hours with a rainfall intensity of 50–100 mm, 18 streets and 170 locations would be inundated. According to the inundation map developed by the Hanoi Sewerage and Drainage Company (HSDC), there are 36 locations, which are identified as having a high risk of inundation due to heavy rain events. The inundation level ranges from 0.1 to 0.3 m; at some locations, it can reach to 0.5 m and even higher. The inundation areas are located in the central (the old quarter), the south, west, and southwest parts of the city (HSDC 2019).

as 'gray' infrastructure, for this reason. However, SWM has a dual challenge: not only should it prevent or minimize surface water flow into the sewers, but it should also remediate overflows (Vijayaraghavan 2016).

'Green infrastructure' (GI) concepts (and measures) are not new to many countries around the world (Schuch et al., 2017); together, they refer to the network of natural and semi-natural areas and/or the engineered-as-natural system that utilize and/or mimick the natural process (EPA 2003). The concept has been widely applied to sustainable stormwater management and often used in conjunction with Low Impact Development, or Sustainable Urban Drainage System approaches (University of Maryland 2017). At the local scale, the most commonly implemented GIs for stormwater management includes but is not limited to, passive landscape irrigation, stormwater harvesting, biofiltration systems, green roofs, green walls, and permeable surfaces.

Many argued that Green Infrastructure is not a new and/or advanced model, but rather is rooted in other concepts and principles currently employed in geography, ecology, and planning disciplines (Mell 2015). It does not aim to replace gray infrastructure, but rather to complement or supplement the conventional engineering network. Consequently, cities can downsize their gray infrastructure, extend their lifetime, save money, create green jobs, and enhance livability (Ely and Pitman 2012). In fact, benefits of GI are beyond sustainable water management; they include (but are not limited to) temperature moderation, biodiversity enhancement, social sustainability, and financial effectiveness (Mell 2015).

1.2.2 Stakeholders

In terms of natural resource management, stakeholders are commonly defined as 'persons, organizations or groups with an interest in the way particular ecosystem services are used, enjoyed, or managed' (Gill et al. 2007).

In the context of this study, stakeholders are any organizations, groups, or individuals with a legitimate and rightful stake, involvement, and interest in the SWM system of the city (Hanoi) as well as in the application of GI practices.

1.3 Problem Statement and Study Objective

Because of its multifunctional characteristics and diverse benefits pertaining to a broad range of stakeholders, GI practices are often based on a participatory processes (Bissonnette et al. 2018). Therefore, to address the range of potentials of GI implementation, further understanding of the stakeholders' perception of GI would be necessary and incredibly useful.

In Vietnam, there has been a growing body of literature discussing the potential of GI for issues related to urban stormwater runoff (Hieu 2018, Nguyễn 2014; Cư ơng and Chung 2014; Cowles 2015; Quintero et al. 2010) in recent years. There are a

number of studies on institutional and technological aspects of GI application. On the other hand, there is insufficient information/research on its perceptual characteristics, particularly on stakeholders' perception of the GI concept. For that reason, a key objective of the study is to shed light on stakeholders' perceptions of Hanoi urban stormwater management, particularly in terms of GI application.

2 Methodology

This study uses a Stakeholder Analysis Framework that '(i) defines aspects of a social and natural phenomenon affected by a decision or action; (ii) identifies individuals, groups, and organizations who are affected by or can affect those parts of the phenomenon (including non-human and non-living entities and future generations); and (iii) prioritizes these individuals and groups for involvement in the decision-making process.' (Reed et al. 2009). It is a refinement of the methodology that emerged from a review and synthesis done by Reed et al. (2009).

2.1 Stakeholder Analysis Framework: Stages

The stakeholder analysis framework unfolds as a three-stage process of (1) identifying key stakeholders and their interests(s), (2) differentiating and categorizing the stakeholders, and (3) investigating stakeholder relationships.

Stage 1: Identifying key stakeholders and their interests: An exploratory, qualitative approach was adopted to uncover key stakeholders with an interest in GI and Stormwater Management (SWM), following which a number of methods were used to analyze their particular interests on different levels. Based on information collected from the first step, defining the context, and through a brainstorming workshop (focus group), all stakeholders and their functions were listed. The list of key stakeholders was subsequently narrowed down based on document review and expert consultation. In addition to the key stakeholders, the snowball sampling method, which had been applied during the semi-structured interview in the third phase of the study, was expected to add more new stakeholders to the list as well as assist in defining key stakeholders.

Stage 2: Differentiating and categorizing stakeholders: Based on similarities in professional characteristics (roles, power, and objectives), the stakeholders' cluster was categorized into function groups. To further enrich the categorization, a top-down 'analytical categorization,' the interest-power matrix approach, a popular tool using interest and power to classify stakeholders into groups (Eden and Ackermann 1998; De Lopez 2001), was adapted for classifying the stakeholders into 'Key players,' 'Context setters,' 'Subjects,' and 'Crowd' based on their level of interest and power/influence (Fig. 1). The level of interest and power typically change over time; for instance, stakeholders may develop alliances to either support or defeat a

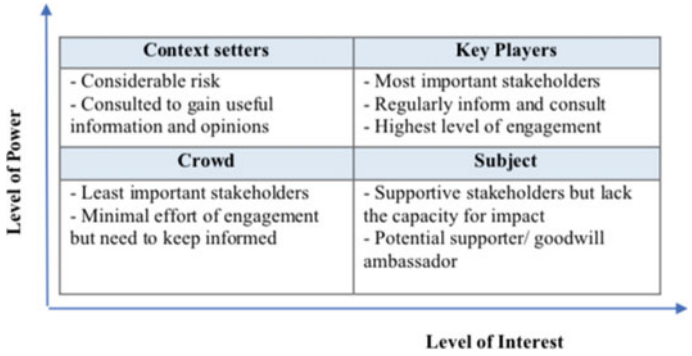

Fig. 1 The interest-power matrix approach. 'Context setters' are stakeholders who are profoundly influential but have little inter-est. If alienated, they may pose a considerable risk to the entire consultation process. They should be consulted to gain useful information and opinions. 'Subjects' are stakeholders who have high interest but insignificant influence. By definition, they are supportive but lack the capacity for impact. However, they may become influential by forming alliances with other stakeholders, especially the key players. These are often the marginal stakeholders that development projects must seek to empower. 'Crowd' is the group of stakeholders who both have little interest in and little power/ influence over the issue. This group often shows the minimal effort of engagement and needs to be kept informed (Adapted from Eden and Ackermann 1998; De Lopez 2001)

particular issue. A stakeholder analysis illustrates the current situation, but also can be used to identify where partnerships are likely to occur.

Stage 3: Investigating stakeholder relationships: As will be discussed later in the chapter, an 'actor linkage map' was used to visualize and describe the dynamic interactions and connections between the stakeholders. This map works as a starting point in discussing relationships and flow of information in the system, giving rise to a discussion of desirable mechanisms that can be used to transmit information. The map also highlights a lack of linkages between certain actors. The direction of the arrows signifies the flow of information, while the width of the flows indicates their relative intensity. It should be emphasized that the map represents the actual situation of stormwater management in Hanoi, rather than the official organizational chart or ideal procedure. 'Key players' are stakeholders who have a high interest in and power/influence over SWM and the potential for application of GI in Hanoi; for that reason, they should be actively groomed. They are the most important stakeholders, and they should be involved at the highest level.

2.2 Stakeholder Analysis Framework: Phases of Application

To avoid unnecessary prejudices and a top-down approach by the research team, which might not accurately reflect the interests of stakeholders, the research team implemented the SA in an iterative three-phase process (Fig. 2).

Fig. 2 Three phases of stakeholder analysis process. • *Phase 1*—SA by focus group: a group of experts, including two researchers and one representative of the urban management sectors (details in Table 2) worked together to build the initial list of stakeholders. • *Phase 2*—SA review and revision: The draft SA was reviewed and revised by representatives of the key stakeholders. • *Phase 3*—SA comparison: after all data were collected, the result of SA performed by the expert's groups were compared with those performed by the stakeholders, in order to work out the final result (*Source* Authors)

3 Additional Background: A Closer Look into the Hanoi Stormwater Network and Management

3.1 Hanoi Stormwater Network

With the exception of some newly developed urban areas, which have introduced separate sewer and drainage systems, most of the urban areas in Hanoi have combined sewerage and drainage systems, which collect both rainwater and wastewater via pipeline collection networks or drainage canals. Most of the municipal sewage is untreated. Thus, both stormwater and domestic wastewater are discharged together into nearby water environments such as rivers, lakes, and canals (World Bank 2013). Combined sewer overflows events release pollutants, sediments, pathogens, and diseases, as well as create adverse impacts on transportation and commercial activities. Moreover, much of stormwater management efforts in Hanoi fall into traditional engineering solutions, which are designed to facilitate quick drainage of stormwater away from urban areas.

3.2 Hanoi Stormwater Management

In Vietnam, responsibility for both urban stormwater and wastewater management is delegated to a number of ministries and agencies. The overall responsibility falls under the Ministry of Construction (MOC), though over the past decade, work is being gradually decentralized to the provincial public service providers at the municipal level. For Hanoi, the Department of Construction (DOC) at the municipal level serves as both advisor and inspector to the Municipal People's Committee in regulating planning, management, operation, investment and development, and exploitation and use of the city water drainage system. Hanoi DOC is also in charge of managing water drainage and flood prevention planning in the city, cooperating with relevant agencies to provide development strategies, and making economic and technical cost norms to manage urban drainage system. An overview of the management responsibilities of ministries, departments, and agencies involved in the city (Hanoi) drainage and sewerage management is presented in Fig. 3 below.

In Hanoi, city drainage systems are public-owned properties (51% of the shares are owned by the Hanoi/City People Committees) and are managed by a public-owned enterprise (Hanoi Sewerage and Drainage Limited Company). At the district level, the drainage systems are managed by drainage enterprises (drainage enterprises numbers 1–8; service enterprise; Yen So pumping station enterprise; and the lakes management & operation board) and work under the direction of District People Committees (World Bank 2013) (HSDC 2015). The HSDC is operated based on an asset management mechanism and an annual work order from the central government, which are paid directly from the city's fixed budget. Normally, the budget is planned and allocated for investment in upgrading and optimizing the operation of the

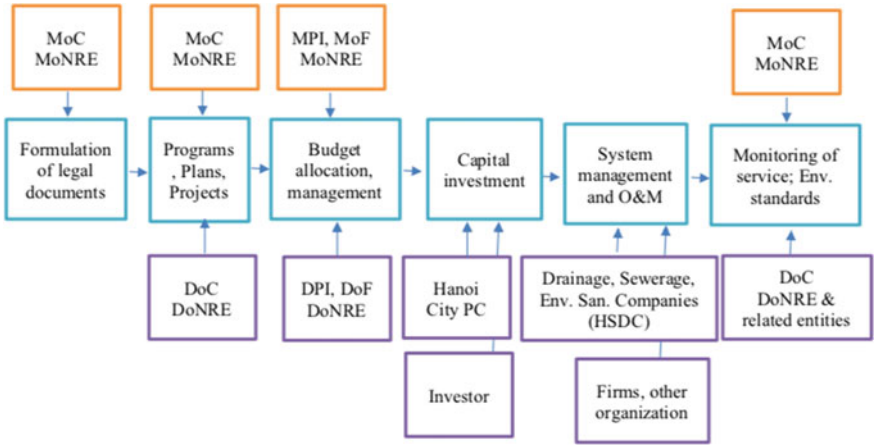

Fig. 3 Matrix of state management of urban drainage in urban areas in Vietnam. Adapted by authors. Based on World Bank (2013)

systems, but it is insufficient for innovation research and new technology application (HSDC 2015).

4 Results

4.1 Identification and Grouping of Stakeholders

At the first phase of SA, following a wide range of legislative documents, literature, and reports review, 52 stakeholders of Hanoi urban stormwater management were identified and divided into 6 main groups, which were further classified into 16 sub-groups (Table 3). In the second phase, stakeholders in each of the sub-groups were identified in order to finalize 33 of the original 52 as the key stakeholders (Table 1).

4.2 Categorization of Stakeholders

It seems logical that group A, 'regulators/governors,' was dominant in the 'key players' group. The main reason was that the Ministry of Construction (MOC), Department of Construction (DOC), Hanoi People's Committee (HPC), and Department of Architecture Planning (DAP) represent a focal point to direct urban water drainage, as well as being in charge of flood prevention planning in Hanoi. The Department of Construction serves as both advisor and inspector to the Hanoi People's Committee in regulating planning, management, operation, investment and development, exploitation, and use of the city water drainage system. On the other hand, the Japan International Cooperation Agency (JICA)[2] was the only stakeholder from group B categorized as a key player; however, in a future project, it may change.

All of the categorized stakeholders in the 'Context Setters' group belong to group A, 'regulators/governors' (Fig. 4), which are the Ministry of Natural Resources and Environment (MONRE); Department of Natural Resource and Environment (DONRE); Department of Water Resources Management; Department of Planning and Investment; Department of Finance; and District/Commune People's Committees (Table 1). As are being discussed in the current situation of the SWM, the drainage of water in Hanoi involves several sectors; however, opportunities for cooperation between the parties is relatively inadequate. For example, the natural resources and environment ministry only considers the quality of the discharged

[2] Japan International Cooperation Agency (JICA) is the world's largest bilateral aid agency. They are in charge of managing all ODA loans and grant aid. JICA has actively worked to reform policies and mechanisms through technical and financial cooperation in Vietnam since 1992 (JICA 2019). Besides, JICA had shown a great interest in urban water-related issues in Hanoi. In 1995, JICA started to conduct several studies on developing drainage systems for Hanoi City. Then, in 1998 and 2008, JICA was the investor for both phases of the Drainage Project in Hanoi.

Table 1 List of key stakeholders

Stakeholder groups		Stakeholder Sub-groups	No	Name of stakeholders
	A. Regulators/governors	1. National government	1	Ministry of construction (MOC)
			2	Ministry of natural resources and environment (MONRE)
		2. Municipal government	3	Hanoi people's committee (HPC)
			4	Department of construction (DOC)
			5	Department of natural resource and environment (DONRE)
			6	Department of water resources management
			7	Department of planning and investment
			8	Department of finance
			9	Department of architecture planning
		3. District/commune government	10	District/commune people's committee
	B. Research institutes/professional organization/association	4. Water resource institutes	11	Vietnam water supply and drainage association
			12	Vietnam academy for water resources
		5. Urban development & planning institutes	13	Vietnam institute for urban and rural planning (VIUP)
			14	Urban planning institute
			15	Hanoi institute for construction planning
			16	National institute of architecture
		6. DRR/DRM, climate change & environmental research institutes	17	Research institute for social environment transformation (ISET)
		7. Development institutes	18	IFC–world bank

(continued)

Table 1 (continued)

Stakeholder groups		Stakeholder Sub-groups	No	Name of stakeholders
			19	Japan International Cooperation Agency (JICA)
	C. Businesses and commercial enterprises	8. Commercial/developers (business & industry)	20	Vins Group
		9. SWM; GI (producer) companies	21	Hanoi sewerage and drainage one member state-owned limited company (HSDC)
			22	Sewerage service and specialized material production enterprise
			23	Koipa JSC. (Vibuma–Permeable paving material supplier)
			24	Phu Dien Ltd. (Unbaked bricks supplier)
	D. NGOs, CSO	10. Local NGOs	25	Vietnam green building council (VGBC)
			26	Research institute for social environment transformation (ISET)
			27	Vietnam chamber of commerce and industry (VCCI)
		11. International NGOs	28	International center for environmental management
	E. Academia	12. Researchers	29	National university of civil engineering (NUCE)
		13. Universities	30	Hanoi architectural university (HAU)
			31	Vietnam–Germany university (VGU)
	F. Local stakeholders	14. Urban population	32	Hanoi residents
		15. Local communities	33	Local communities

Source Authors

wastewater rather than the drainage and collection systems. Therefore, although natural resources and environment ministry is comparatively at the same level of power as construction ministry, their level of interest, especially in terms of rainwater management, can be supposed to be lower than that of construction ministry. Other departments at the municipal level, except DOC, that fall into this category, have the same reason. Due to the weak coordination mechanism of the departments, departments such as DONRE and DOP have shown a lower level of interest in SWM and GI applications. However, the power and influence of these stakeholders are still high, so they should always be carefully observed and well-managed. In case of development of a future project about GI in SWM of Hanoi, it is rather important to draw the attention and increase the level of interest of these 'context setter' stakeholders.

The majority of stakeholders fell in the 'subject groups,' consisting of stakeholders from groups B-Research Institutes, C-Private Sector, D–NGOs/CSOs, and E-Academia. The 'Subjects' are stakeholders who hold considerable interest in SWM and GI, but their level of influence on this field appears to be somewhat insufficient. Since one of the primary functions of groups B and E is to provide specialist advice, support, and education at a national level, many studies and research projects have focused on SWM solutions. However, as reported by several stakeholders in these groups, the budget for research on nature-based solutions is surprisingly limited. The lack of engagement from the business sector also creates a critical constraint on seeking the funding for sustainable drainage or GI research. Meanwhile, another obstacle is that many pieces of research did not meet practical or commercial needs. Despite piloting a research project on sustainable drainage for two years, the National University of Civil Engineering (NUCE) had to stop because it lacked funding.

Similarly, with the D group, the third sector organizations (voluntary and community organizations) often show interest in sustainable development, conservation, social issues, and education. All three of the local NGOs, namely, the VGBC, ISET, and VCCI, have conducted several studies and conferences on green solutions, particularly in GI. They have shown a keen interest in the issue, but their voices remain unheard or do not cause significant changes in the system.

The notable stakeholders in the subject group are C9. 21 HSDC and C9.22 Sewerage service and specialized material production enterprise. They are state-owned companies, and they are assigned to manage the properties of urban drainage systems as directed by the Hanoi People's Committees. For that reason, they are supposed to have a high level of influence and interest. In fact, the operation of the HSDC is based on an asset management mechanism and an annual work order from the central government, which are paid directly from the city budget. Regularly, the budget is strictly planned and allocated for investment in upgrading and optimizing the operation of the systems. This disallows any additional funding for research and new technology application. Therefore, even though the responsibility of these two stakeholders in SWM is crucial, their circumscribed activities mean that the level of their influence in GI particularly is considered insignificant. Moreover, the level of interest of these stakeholders is also weighed lower than that of the B, D, and E groups. The reason for that was inferred from their work plan, which only deals

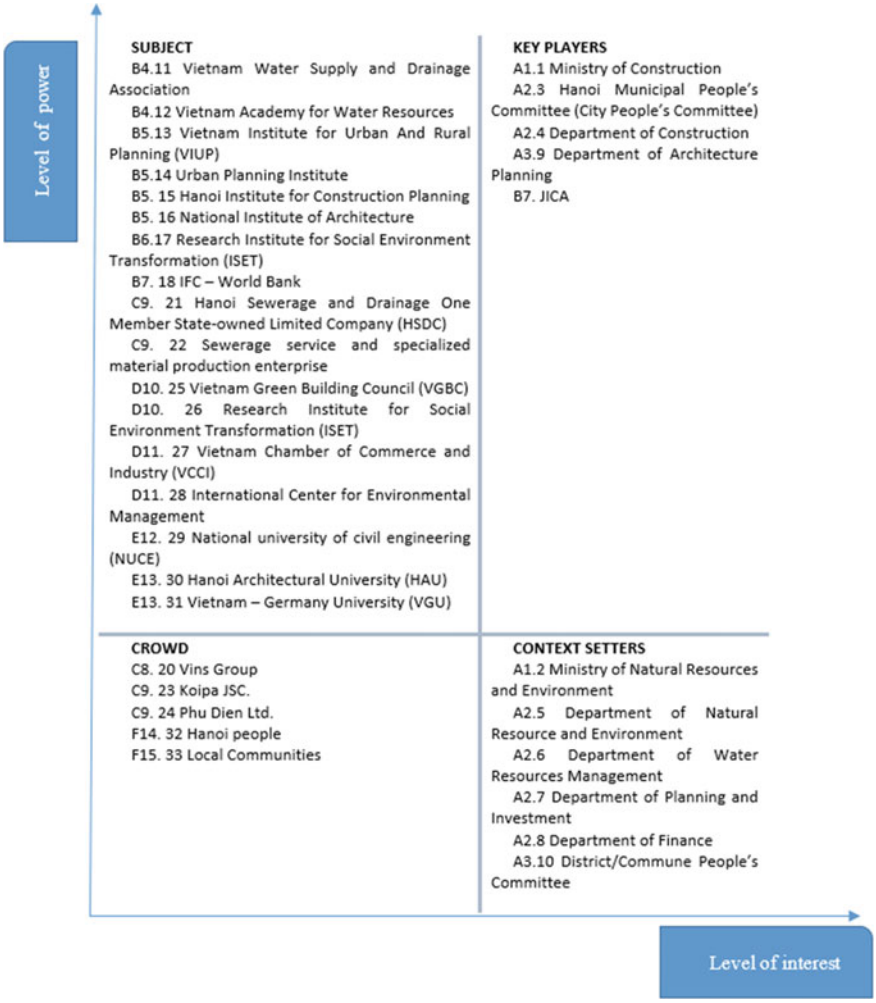

Fig. 4 Power-interest matrix (*Source* Authors)

with drainage in the event of flooding and offers solutions that stop at dredging and maintaining the piping systems. However, this conclusion does not infer that they have not had any interest in the issues.

The most surprising finding of the study is that most of the stakeholders from group C, the business sector, include developers for urban construction, while the green enterprises were categorized into the 'Crowd' group. A representative from one of Vietnam's largest private conglomerates has shown very limited interest in SWM and green solutions. They said 'drainage infrastructure should be the responsibility of the governors and regulators, at the project scale, the drainage system should only comply to the national standards and requirements. There aren't any incentives for

green solutions, so apparently, we do not want to invest in any which may cost extra costs and time.'

On the other hand, the SWM and GI (producer) enterprises are considered to be 'passively participating in the green market.' The two enterprises that participated in the interview both claimed that they provided their product but did not have any strategies for promoting the green market, such as a communication campaign or research and studies. They also did not join any professional associations or receive any incentives from the government for providing green solutions. Lastly, the local stakeholders (group F), including the urban population and local communities, were placed in the 'Crowd' group. Although they are directly affected by urban floods, all of the interview participants in this group did not consider themselves part of the solution. According to the local community members, the infrastructure could only be provided either by the government or by the developers; as they put it, 'there are not any possible solutions for the urban flooding' at the household level.

4.3 Stakeholder Relationships

The actor linkage map (Fig. 5) represents our investigation of the nature of linkage among the involved parties, which are currently organized and interconnected in the existing network. It works as a starting point in discussing the relationships and the flows of information in the system, giving rise to a discussion of desirable mechanisms used to transmit information. The direction of the arrows depicts the flow of information, while their width indicates the relative intensity of the flow. It is crucial to keep in mind that this map represents the current situation rather than an ideal situation, and it specifically applies to the SWM context in Hanoi.

It is clear from the map that all stakeholder groups are interconnected, and not one stands isolated from the others. In fact, during the interview process, by using a snowball sampling method, most of the personal contacts between representatives of the stakeholders already exist. These represent an essential resource for stakeholder input during future projects.

Logically, the Regulators and Governors' group was identified as the focal point of the map. Other parties have to receive the information flow from this group. However, when coming to other actors, these links are weaker, particularly between the business groups and the rest. This relatively weak link between the stakeholders and the business groups may contribute to the lack of practical and private funding for GI research. As such, the lack of collaboration between public and private stakeholders can pose a significant problem for future GI development projects.

Similarly, although the planners and academia/engineers still work closely in implementing drainage projects, the influence of academia and engineers to drive innovative, new types of GI projects seems limited, with a lack of participation by key individuals from that community. Last but not least, the connection of the NGOs with other actors is also relatively weak. NGOs and CSOs, despite their weak connections with other stakeholders, are critical actors, particularly in advocacy activities for GI

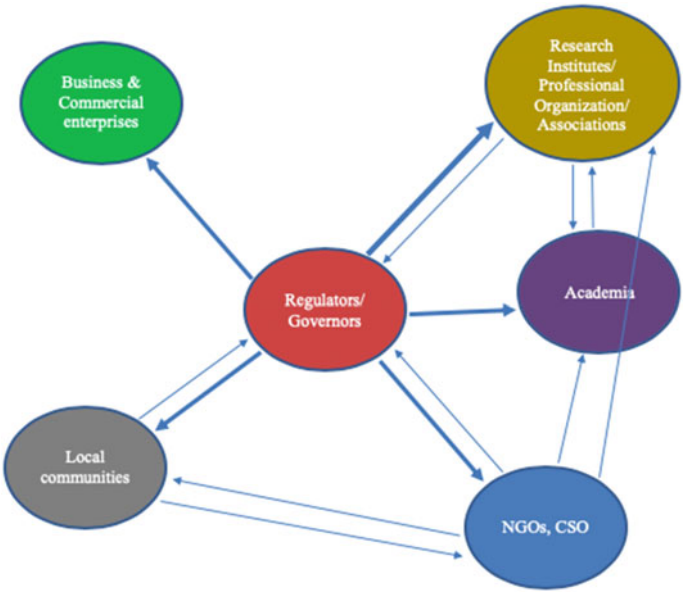

Fig. 5 Stakeholder relationship (*Source* Authors)

policies and raising public awareness. NGOs should work to conduct conferences and workshops that will engage a wide range of stakeholders and help popularize the use of mainstream GI practices.

5 Concluding Thoughts

5.1 An Overview

Hanoi is facing a severe urban flooding challenge; the primary causes are the rapid urbanization and population growth, the degradation of current drainage systems, and the inadequacies in urban planning and urban water drainage planning. In terms of stormwater management, the study notices that there are inadequate legal frameworks in managing the rainwater in Hanoi. Most of the urban areas in Hanoi have combined sewerage and drainage systems, which collect both rainwater and wastewater via pipeline collection networks or drainage canals. There are a few newly developed urban areas which have introduced separate sewer and drainage systems. Most of the municipal sewage is untreated. Thus, both stormwater and domestic wastewater are discharged together into nearby water environments such as rivers, lakes, and canals. In these cases, stormwater-related problems are even more threatening. Combined sewer overflow events release pollutants, sediments, pathogens, and diseases, as well

as create adverse impacts on transportation and commercial activities. Moreover, much of stormwater management efforts in Hanoi fall into traditional engineering solutions, which are designed to facilitate quick drainage of stormwater away from urban areas. These conventional approaches have been argued to be very passive and even ineffective. Meanwhile, there is not enough concern for the adoption of GI.

Green infrastructure, on the other hand, has been increasingly recognized as an alternative to sustainably manage the stormwater, particularly in an urban context. As the results of one of the study objectives of examining the perception of stakeholders regarding GI concepts have shown, the planners and researchers generally expressed a positive attitude toward GI. However, there was a wide variation on the actual meaning of the concept for many stakeholders, who conflated it with other terms. This is expected, given the widespread use of the term in the current literature. Still, this lack of clarity on definition results in differences in understanding the GI practices, making it hard to identify their potential application in solving stormwater issues in Hanoi. For that reason, this study suggests that the definition of and jargon surrounding GI, especially how it relates to stormwater management, must be narrowed, refined, and clarified.

To explore the possibilities of GI application into urban stormwater management in Hanoi, a wide range of professions and stakeholders were analyzed and interviewed. Out of the 52 stakeholders identified at the initial phase of our analysis, 33 key stakeholders were classified and analyzed according to their expediency to be involved in future GI measures or approaches. Regulators and governors were recognized as the most critical group of stakeholders in this group. The majority of stakeholders fell in the 'subject groups,' and are stakeholders who hold considerable interest in SWM and GI, but their level of influence on this field appears to be somewhat insufficient. Although a pre-existing social network between the groups of stakeholders exists, the intensity of the flow of information and cooperation between these groups is uneven. Our study concludes that the nature of the relationships between the stakeholders is crucial for creating opportunities or imposing restrictions for the potential of GI application.

5.2 Recommendations: Five Proposed Strategies to Foster the Integration of GI in SWM

Based on the drivers and barriers identified by stakeholders, five main approaches are proposed to foster the innovation and integration of green infrastructure in the stormwater management system in Hanoi.

1. Assuring a more active promotion of GI at all relevant levels
2. Capacity building, training, and education for GI
3. Promoting information exchange and cooperation mechanisms among stakeholders
4. Developing/revising technical standards and guidelines for GI application

5. Developing a pilot project and assessing costs and benefits

First, the lack of political will toward GI practices could be seen as the most significant barrier. Other issues can be more easily addressed if Hanoi's government leaders obtain a better understanding of opportunities associated with green infrastructure. Hence, to overcome the political obstacles, local governments and municipalities need to ensure a more active promotion of GI at all appropriate levels via the development of comprehensive promotional materials, such as GI factsheets. Similarly, communication campaigns, geared toward both policymakers and private actors and informing them of the direct benefits and co-benefits of GI compared to gray infrastructure within their respective fields, should be actively implemented. Finally, the promotion of GI can be done via sectoral workshops, meetings, and conferences to gather valuable insight on current barriers to further GI application, engage key stakeholders in discussions, and test-run the promotional materials.

Second, as soon as the GI concept is widely recognized, several focused target groups should be formed to cultivate a deeper level of understanding via capacity building, training, education, and outreach concerning GI. At the outset, to provide the necessary background material and increase GI uptake, 'Train the trainers' training is necessary to 'pass on the message.' Other strategies should involve inclusion of 'GI' ideas within existing sectoral training or the creation of tailored training modules for different sectors: for example, urban planning or infrastructure engineering. These efforts can be further strengthened by promoting cross-linkages between groups of stakeholders, exchanging reports and other information, organizing formal or informal meetings, and so on. Last but not least, research on GI should be intensively promoted.

Third, GI is interlinked with several sectors, including transport, energy, agriculture, forestry, natural resources, water resources, regional and land-use policies, climate change mitigation and adaptation, and disaster risk management/reduction. Compared to single-purpose, conventional infrastructure, GI is very much relevant for a whole set of sectors. Therefore, the success of GI projects is likely to rely on stakeholder engagement and a robust cooperation mechanism. Moreover, GI measures require a wide range of reliable information ranging from policies to costs and benefits of practices to highly technical input from designers and engineers. For that reason, a strong information exchange mechanism is a necessity. As previously discussed, there should be an engagement strategy based on the interest/influence of the stakeholder groups. The method for engaging the stakeholder groups varies, but basically, it should aim to increase the level of interest for the Context Setters group and empower the Crowd group, so their voices can be heard (Fig. 6).

Fourth, a drive to change the law in order to incorporate some of the above recommendations is relatively unrealistic, since this is a complex, expensive process. For that reason, in the context of Hanoi, the present focus is to revise the technical standards and/or interpretation guidelines, which could assist municipalities in integrating GI practices. However, each of the sectors has its own standard, and they often operate in isolation from the others. Thus, it is crucial to improve the way GI is

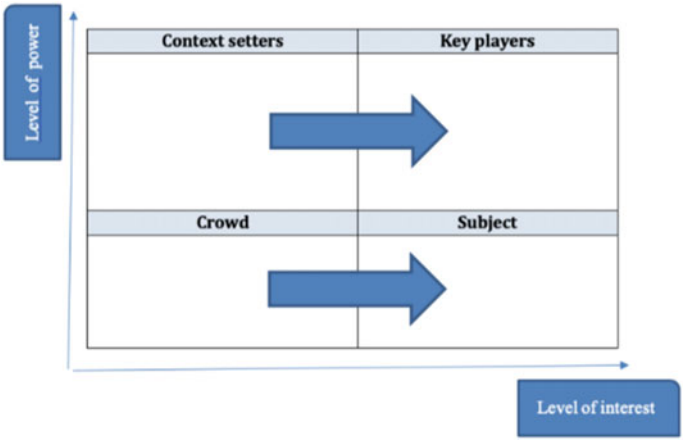

Fig. 6 Stakeholder engagement strategy based on the interest/influence stakeholder matrix (*Source* Authors)

integrated into a national standard. Indeed, there is a valuable opportunity for collaborative action and harmonization across sectors in incorporating GI into national standards on performance, procedure, and methodology. Establishing new green infrastructure implementation units that cross traditional bureaucratic boundaries can be a promising strategy toward overcoming institutional limitations.

Finally, there is always a need to understand and comprehensively analyze the costs and benefits of GI, especially compared to conventional solutions. Some municipalities and developers among the interviewees expressed a reluctance to integrate GI into their infrastructure projects or policies because they suspect that it could cost more than gray infrastructure in the short-term (in terms of design and construction) or even long-term (maintenance costs). For that reason, a review of existing projects in place or even a pilot project can play a crucial role in demonstrating the potential for green infrastructure approaches.

Appendix

See Tables 2 and 3.

Table 2 Pre-interview focus group participants

Name	Organization	Title
T.T.T.H	Urban Development Agency_ Ministry of Construction	Expert
N.T.T	NUCE	Lecture & Researcher
T.T.H	Cologne university of Applied Science – ITT Cologne	Researcher
U.N	Cologne university of Applied Science – ITT Cologne	Lecture & Researcher

Source Authors

Table 3 Groups of stakeholders

Stakeholder groups	Stakeholder Sub-groups	Description	Power/Influence over
A. Regulators/governors	1. National government	National, regional and local governments involved in policy, law enforcement, and incentives	Businesses, developers, constructors, local stakeholders
	2. Municipal government		
	3. District/commune government		
B. Research institutes/professional organization/association	4. Water resource institutes	Provide specialist advice and support on a national level	Government, businesses, local stakeholders
	5. Urban development & planning institutes		
	6. Environmental research institutes		
	7. Development institutes		
C. Businesses and commercial enterprises	8. Commercial/developers (business & industry)	Private individuals and businesses interest in or/and involved in SWM or GI/nature-based solutions, water credit, etc	Government, producer enterprises; users/beneficiaries
	9. Investors		
	10. SWM; GI (producer) companies		
D. NGOs, CSO	11. Local NGOs	Third sector organization (voluntary and community groups) interest in sustainable development, conservation, social issues, and education	Government, businesses
	12. International NGOs		
E. Academia	13. Researchers	Individuals conducting research on GI and SWM related issues	Government, businesses

(continued)

Table 3 (continued)

Stakeholder groups	Stakeholder Sub-groups	Description	Power/Influence over
	14. Universities	Organizations providing education and/or conducting research on GI and SWM related issues	
F. Local stakeholders	15. Urban population	People who use the GI for numerous purposes such as tourists, visitors	Government, businesses
	16. Local communities	Local groups involved in either a semi-formal or formal way to run and/or manage their local stormwater and/or GI	

Source Authors

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Open Space Use Under Elevated Road Infrastructure: Ho Chi Minh City, Vietnam and Bangkok, Thailand

Le Thi Thu Huong and Le Thi Kieu

Abstract In big cities in Southeast Asia, the living quality of their citizens is negatively impacted by a lack of green spaces. Seeking vacant land to develop more green spaces is the conventional solution to this issue; however, it is not applicable when land availability becomes more and more limited. Instead, optimizing the capacities of existing open spaces can be a better alternative for green development and certain additional public functions. Therefore, this paper aims to carry out a case study research on open spaces under traffic infrastructure and identify opportunities for renewal or further development. Due to the similarities in urban density, demand for green space, and potential ways to utilize the unused spaces under roadways in the cities, Ho Chi Minh City, Vietnam, Bangkok, and Thailand were chosen as case studies for this paper. The study found that in both cities, many spaces under bridges and highways can be further developed into public green spaces. Certain conceptual solutions are proposed for the selected spaces to diversify their landscape as well as improve their functions. These solutions, even at the conceptual stage, ultimately will help increase the cities' greenery to improve their environment.

Keywords Open space · Ho Chi Minh City · Bangkok

1 Introduction

Open spaces play a vital role in urban areas, particularly in urban health. Since people's health is likely to be impacted by their surrounding environments, the lack and poor quality of open and green spaces in dense cities can highly restrict their well-being, as it does not support developing healthy lifestyles such as spending

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time outdoors, walking, playing, and so on (Lestan et al. 2014). In the urbanization context of developing countries like Thailand and Vietnam, land in urban areas has been rapidly occupied for construction and development. Such urban growth creates a serious pressure on the limited land resource of big cities where the population increases rapidly and exceeds their capacity to accommodate. The open spaces used for leisure activities, public interaction, recreational opportunities, and greenery in the cities, therefore, are limited, which negatively affects quality of life for their residents.

Using vacant land to develop new public open spaces is one of the traditional and common solutions; however, it is not feasible or applicable when land becomes scarce in cities like Bangkok and HCMC. This problem, therefore, requires alternative planning and developmental approaches independent of land availability. Utilizing underutilized or unused open spaces is among these approaches. Existing open spaces are reviewed and optimized for renewal and development based on their capacities and characteristics. With this approach, this paper aims to carry out case study research on the underutilized or unused open spaces under elevated transportation infrastructure like roads and bridges in selected districts in Bangkok and HCMC and to explore the characteristics of these spaces, identify possibilities for renewal or development, and propose some conceptual solutions to improve their usage.

In Sect. 2, the paper reviews the definitions, categories, roles, and issues of open spaces in the urban development context. The methodology in Sect. 3 then explains how the study areas were selected in the two cities and which methods have been used to collect data and information. The results of data collection and analysis are presented in Sect. 4, which includes the exploration of open spaces under elevated roadways in Bangkok and HCMC, their characteristics, and ways they could be utilized for different purposes. Several ideas for the utilization and development of these spaces are discussed at a conceptual stage. The conclusion section highlights some important points of the paper, which emphasize the multi-stakeholder approach in urban renewal to move toward sustainable urban development.

2 Open Spaces and Urban Development

2.1 Open Spaces: Definition and Categorization

Definition of open spaces. Referring to its applications, open space has been conceptualized in several ways (Mehhdi et al. 2017). In relation to urban design studies, Carmona (Carmona 2010) defined external public open spaces by their functions, including "recreational opportunities, wildlife habitat, venues for special events, and the opportunity for the city to breathe." Besides the connection of open spaces to public activities and quality of public health, other scholars considered open spaces important elements in urban planning that support placemaking and quality of life, especially in health-related aspects (Lestan et al. 2014). This paper uses an extension

of one of the most common definitions, which describes open space as any piece of land with no structure directly on it (Mehhdi et al. 2017). This extension allows the authors to review the open spaces under the elevated roadways.

Categorization of open spaces. There are two main approaches to categorizing open spaces: typology and classification (Nochian et al. 2015). While typology considers the types of spaces such as parks or squares (Ezennia et al. 2017), classification concerns the characteristics of the spaces that name their uses and values. Due to multiple factors, these characteristics vary from the catchment hierarchy (determined by serving area, size, level of use, and significance), to function (recreation, sport, or nature) (Department of Sport and Recreation 2012) and landscape/ environmental setting (Nochian et al. 2015).

2.2 Open Spaces: Definition and Categorization

Roles of open spaces: Open spaces play a vital role in urban areas, particularly in urban health. Since people's health is likely to be impacted by their surrounding environments, the lack and poor quality of open and green spaces in dense cities can highly restrict their well-being as it does not support developing healthy lifestyles such as spending time outdoors, walking, playing, and so on (Lestan et al. 2014). Therefore, an open space network should promote an active lifestyle by providing safe and esthetically pleasing spaces that are spatially distributed within a neighborhood. They should be accessible and satisfy the sporting and recreational needs of the residents in that neighborhood (Ezennia et al. 2017).

Common issues of open spaces in urban areas. Despite their importance, open spaces in the urban environment have a wide range of issues due to several causes. A study by Ukil (Ukil 2017), which summarized the terms used in urban design with their definitions, also mentioned "underutilized" and "unused" (see Table 1). Accordingly, underutilization is the term given to spaces that are utilized less than fully, or below their potential uses, while unused spaces are those that are not being used at all. In other words, the "underutilized" term is in between the optimal "used" and the completely "unused" space.

Besides issues related to utilization, there are some other problems of open spaces commonly found in urban areas. As accessibility to open space is the right of every citizen, improper spatial distribution sometimes causes a limited number of visitors as well as increases social exclusion of different groups of people. In other cases, barriers such as hidden and lack of entrances, limited amenities and facilities, environmental pollution, and unsafety also negatively impact how welcome residents feel to use the spaces.

Common solutions for the utilization of open spaces. Issues of underutilized and unused open spaces in urban areas can be solved by functional optimization. Besides optimizing existing functions, multiplying the use of open spaces in terms of the following physical, economic, and social factors is another common approach. Physical factors involve accessibility, facilities, lighting, landscape and recreational

Table 1 Terms and definitions of different situations of open spaces in urban areas (adapted from Ukil (2017))

Terms	Definitions	Scope of attributes
Abandoned	Properties left behind intentionally and permanently when they appear that the former owners do not intend to use them	Legality
Disengaged	The action or process of withdrawing from involvement in an activity or situation pertaining to a piece of land	Activity
Interstitial	Spaces between structures or objects	Physics
In-Between	Spaces between two extremes or two contrasting conditions	Physics
Marginalized	Spaces relegated by the society to a lower or outer edge	Activity
Residual	Spaces left over after a process of social transformation	Activity
Redundant	Spaces that are more than what is usual or necessary	Usage
Surplus	Spaces (or parts of a space) exceeding the portion that is utilized	Utility
Underutilized	Spaces utilized less than fully or below the potential use	Utility
Undeveloped	Spaces that have not been developed	Physics
Uninhabited	Spaces having no people living in or using them	Activity
Unproductive	Spaces that are not producing or capable of producing	Activity
Unused	Spaces that are not being used	Usage
Unwanted	Spaces that are not being used by people because they are not wanted by the people around them	Activity
Vacant	Lands that are not being used at the present time but may have utilities and infrastructure in place	Legality
Vestigial	Forming a very small remnant of something that was once greater or more noticeable	Activity
Void	Spaces that are essential a vacuum in the fabric of the land	Physics
Waste	Spaces that are completely useless because nobody is fond of using them	Usage

space, and safety. Seats, spaces for food and beverage service, and amenities are positive factors, while negative factors tend to be certain undesired climatic conditions. Social factors enhance mutual contacts between people through activities such as festivals and parades organized at the open spaces. Economic factors concern commercial activities, including flea markets, vendors, farmers markets, and are also critical to bring visitors to the places (Nathiwutthikun et al. 2012).

3 Methodology

This paper is a qualitative study using a mixed-method approach, including mapping, observation, and illustration. Mapping with Google Earth is used to locate the study areas in two cities and their elevated roadways and river or canal systems. The initial

selection of spaces under the elevated roadways and bridges was based on Google Street View, which allowed us to determine the relevance of these spaces to the study objectives. The final selection used a different set of criteria (including space dimension, current usage, and physical characteristics), which will be illustrated through diagrams or photos along with explanatory text in subsequent sections. Below are the descriptions of the selected case studies.

3.1 Bangkok

Bangkok is the capital and biggest city in Thailand with a high rate of urbanization. One of the significant features of Bangkok is the road network and density with different grades. The road system stretches all over the city with a range of types, grades, and dimensions; many roads are elevated, especially in the inner city, to ensure better traffic flow at the road junctions. Additionally, in response to the high demand for mobility, layer upon layer of elevated roadways and trainways are common at traffic nodes in this city. This phenomenon accounts for the availability of many open spaces under the elevated road infrastructure, most of which are underutilized or unused.

Among 50 districts in Bangkok, three inner districts, Phaya Thai, Din Daeng, and Huai Khwang, were selected for this study (Fig. 1) due to their location and diversity of traffic networks, as well as the availability of open spaces under the elevated roads. The total area of the three districts is 33.29 km2. The road network has been highly developed in this area, and many types of traffic ways, including roads at several grades, highways, the Bangkok Transit System (BTS) railways, and train railways, are found in this region. Due to their location in the inner districts with high land-use density, some are elevated, thereby constructing a complex system of roadways, which, in turn, creates a range of open spaces under the traffic nodes.

3.2 Ho Chi Minh City

Ho Chi Minh City (HCMC) is the biggest city of Vietnam, with rapid urbanization. Similar to Bangkok, development of this city has resulted in a complex system of roads, with some segments elevated to avoid traffic congestion, creating open spaces under the roads. Moreover, because it lies downstream of Dong Nai—Saigon River, HCMC is characterized by a dense network of rivers and canals. To connect different parts of the city, several bridges were built across these waterways, and therefore, some open spaces can also be found under the bridges.

Among 24 districts in HCMC, three inner districts were included in this study: District 1, Binh Thanh, and Phu Nhuan (Fig. 2), due to their location and the available open spaces under elevated roads and bridges. The total area of three districts is 33.52 km_2. Due to its dense system of rivers and canals, several bridges have been

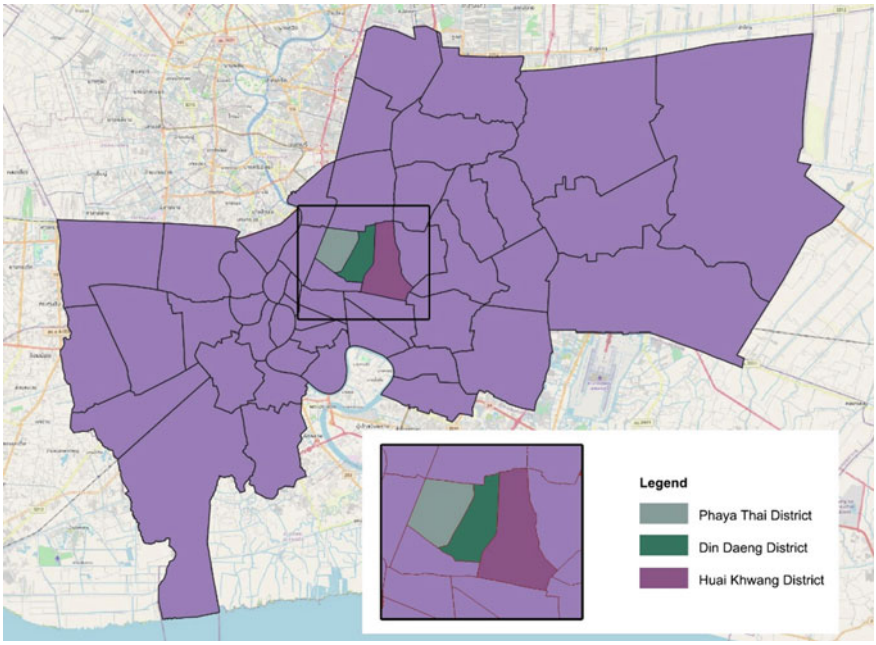

Fig. 1 Study areas in Bangkok (*Source of map* Geographic information technology center, Bangkok (BMA GIS Center), at http://www.bangkokgis.com/, edited by Authors, 2019)

built over these waterways. Since these are the inner districts where land is limited and traffic demand is high, roads with different elevations or grades are also developed at some junctions. These two factors create some open spaces under the bridges and roadways. In addition, as the first metro line of HCMC will partly cross over Binh Thanh District with its above-ground route, some spaces under the railway may also become open spaces after completion of the railway in the next few years.

4 Study Results and Discussion

4.1 Open Spaces Under Elevated Roadways in Bangkok and HCMC

Summary of the studied open spaces in both cities. According to the aforementioned characteristics of the study areas in both cities, several open spaces under the bridges, roadways, and railways are found in the areas. Their locations and types are summarized in Table 2 and marked in Figs. 3 and 4 below, in which the selected spaces in Bangkok are under the elevated expressways while those in HCMC are under

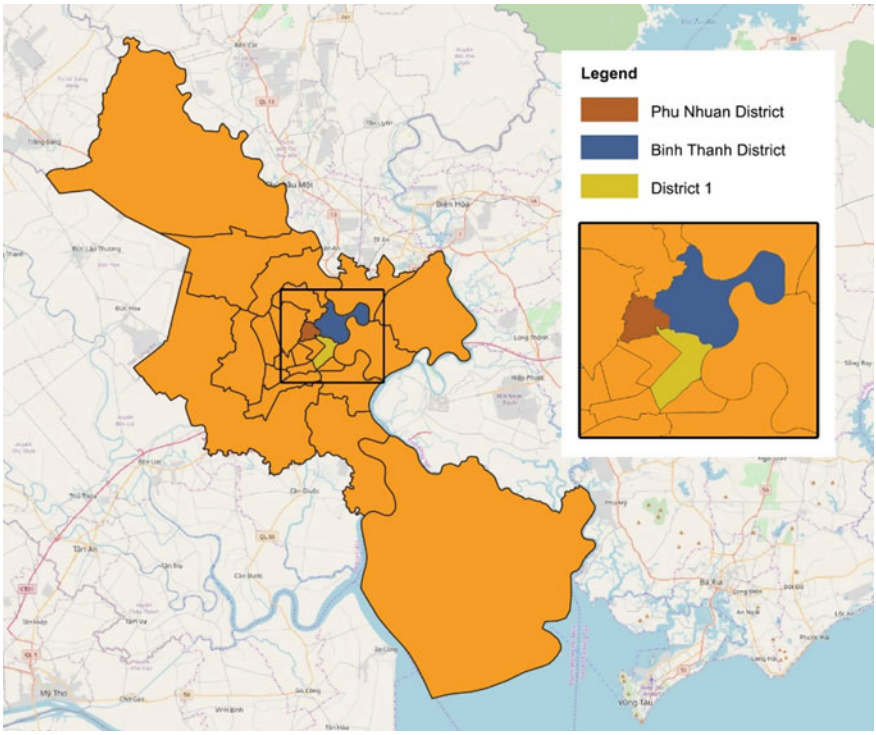

Fig. 2 Study Areas in HCMC (*Source of map* Center for application of geographic information system of Ho Chi Minh City (HCMGIS), at https://portal.hcmgis.vn/, edited by Authors, 2019)

the bridges. This selection is due to the differences in main elevated transportation infrastructure as well as the type of open spaces underneath in each city.

Characteristics of Selected Open Spaces in Bangkok and HCMC

Forms. Many open spaces under the elevated roadways in Bangkok are linear and continuous (Fig. 5) because the roadways stretch for long distances. At the traffic nodes, the spaces under the elevated junctions are large and sometimes quite complex due to various grades of the roads above. The forms of spaces under the elevated roadways, in general, are quite diverse depending on their location, dimension, and the elevation of the roads above them. The ground surfaces of these spaces are also different, either covered with grass or soils and small rocks.

In the case of HCMC, the spaces are located under roadways of bridges crossing the rivers and canals. Since these waterways are not very wide, the bridges are not very high, and the ramps leading to the bridges are relatively short. The spaces under these bridges are therefore quite small and sometimes fragmented to create a U-turn road for motorbikes or a pathway for pedestrians (Fig. 6).

Current usage. Current usages of the open spaces included in this study in both cities range from non-functional to mono- and multi-functional. The normal or most

Table 2 Summary of locations and types of the studied open spaces (Authors, 2019)

Cities	Districts	Studied locations and types of spaces
Bangkok	Phaya Thai	Space under Sirat Expressway, the railway along Thanon Kamphaeng Phet 5 Road, and at two traffic nodes
	Din Daeng	Space under Chalerm Mana Nakhon Expressway and Din Daeng Road
	Huai Khwang	Space under expressways including Sirat, Ram Inthra – At Narong and their traffic node
Ho Chi Minh City	District 1	Space under bridges including Nguyen Van Cu, Ong Lanh, Calmette, Bui Huu Nghia, Hoang Hoa Tham, and Kieu and under the train overpass
	Binh Thanh	Space under bridges including Bui Huu Nghia, Thu Thiem, Sai Gon, Kinh, Binh Trieu, and Binh Loi
	Phu Nhuan	Space under bridges including Hoang Hoa Tham, Kieu, and Cong Ly

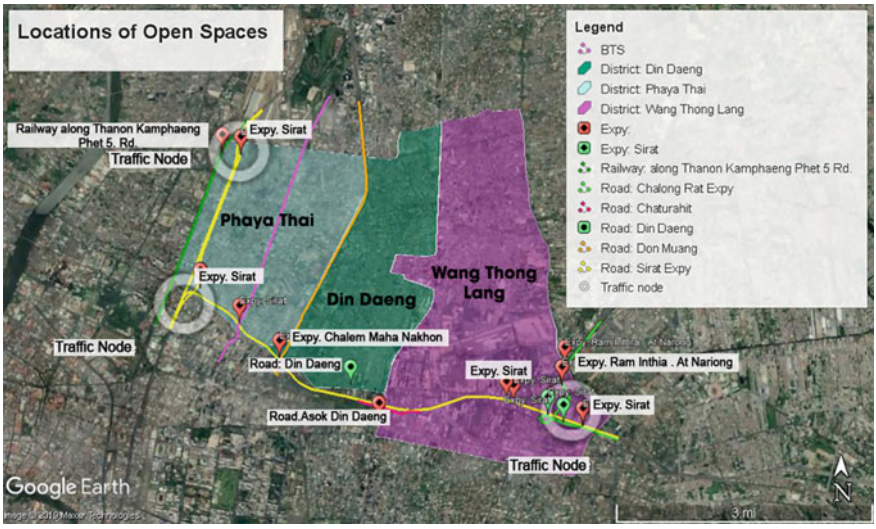

Fig. 3 Study open spaces in the case study of Bangkok City (Google Earth, edited by authors, 2019)

popular functions found in both cities are pure green landscape, walking path, and exit of the pedestrian crossing. Other uses of the open spaces include parking of vehicles, commercial activities, and storages, most of which are unofficial, and some are even illegal (Fig. 7).

Other physical attributes. The quality of many of these open spaces, especially those without any function, is relatively poor, due to a lack of planning and appropriate management by the authorities. Broken materials and garbage make some messy and

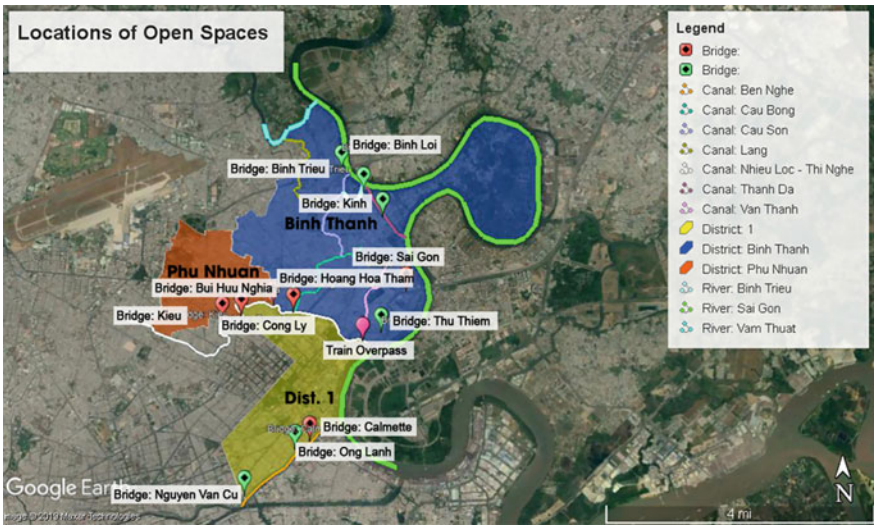

Fig. 4 Study open spaces in the case study of Ho Chi Minh City (Google Earth, edited by authors, 2019)

Fig. 5 Typical space under elevated roadways of Bangkok (Authors, 2019)

Fig. 6 Space under Bui Huu Nghia Bridge, HCMC (Authors, 2019)

dirty. A few other spaces are inaccessible due to closed fences; however, some people still store their belongings there, and garbage is also thrown around by residents living nearby (Figs. 8 and 9).

In some cases, the condition of two sides of the road is not equal. For instance, under Hoang Hoa Tham Bridge (Phu Nhuan District, HCMC), the side facing Nhieu Loc Canal is in better condition with greenery and a walking path (Fig. 10), while the other side is dirty with trash and bare soil and is partly blocked, as described above (Fig. 9).

In addition to negative features of open spaces in both cities, there is evidence of more efficient use of spaces under the elevated roadways where greenery has been planted and other development has taken place. However, they still have certain possibilities for further improvement such as planting more trees to increase the green coverage (Fig. 11) and diversifying the green spaces with various types and heights of plants (Fig. 12).

Fig. 7 Space under Ram Inthra Expressway in Bangkok is currently used partly for street food vendors and partly for construction material storage (Authors, 2019)

4.2 Proposals for the Utilization of Spaces Under Elevated Roadways in Bangkok and Ho Chi Minh City

Based on potential capacities of the open spaces under elevated road infrastructure as described above, many are currently misused, underutilized, or remain unused. As discussed above, underutilized spaces refers to those spaces which are utilized below their potential uses or not fully utilized, while unused spaces are those that are not being used at all (Ukil 2017). In the context of planning for urban renewal and development, these underutilized and unused spaces should be adjusted and integrated into the development of urban fabrics, especially aiming to enhance the green coverage of cities for a better living environment. Based on our research, two possible approaches for optimal utilization and renewal of open spaces under elevated road infrastructures in the two cities are offered below, which may have relevance for other cities in this part of Asia as well.

The first approach is to create an inventory of successful strategies employed by planners by examining basic elements of existing well-designed open spaces in the city. Particularly, landscape design at these spaces enables maximization of their advantages as well as minimization of their disadvantages. For example, a sense of tropical open green spaces can be conveyed by diversity in plant type, density, and

Fig. 8 Open space under Cong Ly Bridge, HCMC (Authors, 2019)

height as in Fig. 13. For smaller spaces, the visual features are enhanced by growing little plants together or decorating the wall under the bridge, as in Fig. 14. Other greenery designs or art can also be added to improve the esthetic of roads.

The second approach is to learn from successful cases in other cities. Both Bangkok and HCMC can also learn from each other as the cities share similar geographies and urban contexts. In order to make those spaces more useful and revitalized, a few conceptual solutions are proposed below based on practices elsewhere.

The Underpass Park in Toronto, Ontario, Canada, is a good example of effective use of space under a road. Located at the nodes of Richmond /Adelaide Street and Eastern Avenue, Underpass Park occupies 1.05 hectares, 0.6 hectares of that covered by the overpassing roads. As a part of Waterfront Park, a transformation was implemented to turn a dark and neglected highway underpass into a lively park that helps connect nearby residential areas.

Thanks to the development, informal parking and illegal activities are no longer found here. Instead, space created by the elevated transportation infrastructure has been developed for community gatherings with urban furniture, sports amenities, and a children's playground (Fig. 15). It has also been decorated with wall and ceiling art (Fig. 16) despite the changing weather (Theresa 2017).

The development has increased the attractiveness of this space and added value to it. The open spaces have become safer and more inviting. Thanks to the variety of public activities that it offers, such as music performances and skateboarding

Fig. 9 Space under Hoang Hoa Tham Bridge, Phu Nhuan District, HCMC (Authors, 2019)

events, the space has become recreational and helps to connect the surrounding communities (2016 ASLA Professional Awards 2016). The transformation from an unused grey land to a green, lively open space helped Waterfront Park become recognized by LEED with a Gold Certification for Neighborhood Development (ND) (Hussein 2014). Lessons learned from the park have been included in the urban design guidelines for urban spaces for children at Toronto (Nasr et al. 2017).

Besides the new facilities, Underpass Park has also been defined by a lighting system and vegetation, which make it more welcoming. Similarly, from a poorly-lighted open space, the Garscube Landscape Link along the Garscube Road in Glasgow, Scotland, also illuminated an art installation there for a well-designed whole. Moreover, urban regeneration in Glasgow also increased runoff surfaces adding terrace plants (Ng 2013).

In addition to the permanent changes of underutilized and unused spaces either by planting trees or improving facilities, to meet the demands of urban citizens for activities, functions can be added to these spaces. One example is turning the under-flyover open space into a gathering space for cultural and community activities, as shown in A13 Green Project, United Kingdom. As an art-led regeneration project, there included a series of art-related events under the A13 flyover in Canning Town, United Kingdom, which was a formerly underutilized space (Fig. 17). This project has successfully turned a hotspot for antisocial behavior and public drinking into an urban "green" area attracting locals and visitors for events such as music festivals and

Fig. 10 Space along the canal under Hoang Hoa Tham Bridge, Phu Nhuan district, HCMC (Authors, 2019)

movie showings (Fig. 18). This success has shown a promising potential of this space in placemaking through additional activities as well as encouraging consideration of the long-term development of this open space (Bagwell et al. 2014).

Benefits of the development. Regeneration of underutilized and unused open spaces in the context of the rapidly urbanizing and densifying Asian cities can be expected to bring added values to urban development in a variety of contexts. From an ecological standpoint, the addition of plants under the elevated road infrastructure can benefit the urban ecosystem services in multiple ways. For example, they may help mitigate urban heat island effects and contribute to improving the water runoff system, thereby helping to reduce the urban floods that plague these cities almost yearly. In addition, these plants provide friendly niches for birds and insects, creating higher urban ecological diversity. From the social perspective, by providing more spaces for recreational and physical activities, as well as creating more green spaces, urban health is generally improved in both mental and physical senses. Moreover, with proper management, the new facilities, especially those used for art exhibitions and performances, can also help increase the identity, aesthetic appeal, and livability of nearby neighborhoods. These spaces can be turned from empty or unsafe ones to more secure and productive spaces where their added functions may enhance or restore the connection among the surrounding communities. Last, some economic benefits may be gained by reducing the land waste and increasing the land value to

Fig. 11 Simple layout of greenery under the bridge along Din Deang Road, Bangkok (Authors, 2019)

Fig. 12 Appealing design under Thu Thiem Bridge, HCMC (Authors, 2019)

Fig. 13 Variety in type, height, and density of plants in an open space under the bridge along Rama 9 road, in front of Alley 55 (Authors, 2019)

Fig. 14 Growing plants and wall art under Bong bridge, HCMC (Authors, 2019)

Fig. 15 Sport amenities at the Underpass Park, Toronto, Ontario, Canada (Chris Tyler, 2011, reproduced under the creative commons attribution-Share Alike 2.0 Generic license)

Fig. 16 Art exhibit at the underpass Park, Toronto, Ontario, Canada (Rick Harris, 2015, reproduced under the creative commons attribution-Share Alike 2.0 Generic license)

the surrounding neighborhoods. Certain economic activities, such as advertisement and selling local products, can also be promoted in some of these spaces if suitable and allowed by the city authorities.

Fig. 17 Poorly-used open space under the A13 Flyover, Canning town, United Kingdom (Danny Robinson, 2007, reproduced under the creative commons attribution-Share Alike 2.0 Generic license)

Fig. 18 Free musical event under the A13 Flyover, United Kingdom (The brick box, 2014, reproduced under the author's permission)

5 Conclusion

The study shows that both Bangkok and HCMC have several underutilized and unused open spaces under the elevated roadways with different forms, characteristics, and usages. In terms of form, both cities show diverse forms of space. While Bangkok has more linear and continuous spaces under the elevated roadways and spacious spaces under the elevated junctions, the spaces in HCMC are quite small and fragmented in a few cases as they are located under roadways of bridges crossing small rivers and canals. The ground surfaces of these spaces are also different, either covered with grass or soils and small rocks. The current usages of these spaces in both cities range from non-functional to mono- and multi-functional types, of which some are unofficial or even illegal such as parking and storage of unused stuff of the households living nearby. The quality of many of these spaces, especially those without function, is relatively poor, due to a lack of space planning and appropriate management practices by the authorities. Nevertheless, there is evidence of more efficient use of spaces under the elevated roadways where greenery has been planted, even though just with simple trees and basic pavement, and therefore, diversifying the green spaces with various types and heights of plants can be one simple solution.

The findings after investigating two cities show that there are several possibilities for further improvement of underutilized and unused spaces under elevated road infrastructures. Based on their existing conditions as well as referred from the successful practices learned from other countries, this paper, therefore, proposes conceptual solutions to make these spaces more useful and revitalized. These proposals vary in forms of functions, activities, and values added to the spaces that may be flexibly considered based on particular context and characteristics. The solutions not only aim to enhance the green coverage of cities for a better environment, to diversify the urban fabrics, and improve the cities' image, but also create a certain sense of places for those revitalized areas.

Since the existence of these underutilized and unused spaces is not only a waste of urban space but also may harm the urban image and living quality of the surrounding areas, the renewal and development of these spaces, to a certain extent, can effectively solve these issues. Several benefits of such developments are highlighted from the ecological standpoint, social perspective, as well as economic values to not only the areas but the cities as a whole. However, to achieve that, application of the proposed solutions in this paper requires location-based studies to get more specific data about the sites and to bring more ideas and initiatives from various stakeholders involved. The stakeholders may include the authorities, urban planners and designers, surrounding communities, developers, as well as organizations that work in the public sphere. This multi-stakeholder approach to urban renewal would utilize the wasted urban spaces and bring multiple benefits for the cities to move toward sustainable urban development.

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Potentials for Vertical Gardening in Cities: A Case Study of Shophouse Facades in the Inner City of Da Nang, Vietnam

Le Thi Kieu and Stefan Schäfer

Abstract Insufficient green areas often cause negative impacts on the environment, public health, and even the economic development of a city. Due to land scarcity, it stands to reason that greenery in the city should be developed not only on horizontal spaces but should also utilize vertical spaces. Accordingly, vertical gardening—a strategy that allows vertical urban surfaces to be utilized—has been investigated as an improvement option for facades in built environments. This paper aims to investigate areas that vertical gardens might cover, as well as their benefits in context of an urban neighborhood in Da Nang City, Vietnam. To this end, our research focuses on the utility of greenery development for the study area, potential locations for vertical gardens based on an inventory of building facades in the neighborhood, and the possible values gained from such development. Based on a set of mixed methods of data collection and analysis, our study explores the usefulness of greenery at different urban scales (building—neighborhood—city) that may have implications for similar urban environments within and beyond Vietnam. The green coverage produced by vertical gardening is expected to bring multiple environmental, economic and social benefits to dense cities in Asia, while requiring consideration of cost and maintenance, risk management, judicious selection of plants, and involvement of stakeholders.

Keywords Vertical garden · Green city · Vietnam

1 Introduction

Due to economic growth, many Asian cities have undergone rapid urbanization that quickly upsizes their areas and populations. On one hand, this results in more jobs as well as financial opportunities for these cities; on the other hand, there are several problems rooting in the dense urban areas that have multiple social and environmental impacts on them (Wang et al. 2019). One of the commonly found issues in such

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areas is the lack of green spaces that contributes to the "Urban Heat Island" (UHI) effect (Oke 1982), decreases the diversity and services of urban ecology, negatively impacts urban health and living quality (Coppel and Wüstemann 2017), and increases socioeconomic inequalities (Łaszkiewicz et al. 2018). Therefore, greening cities by planting more vegetation is encouraged with various actions and strategies, especially in the tropical climate zone (Jaung et al. 2020).

Due to land scarcity, it makes sense that strategies for the "greening" of cities should consider not only all the available horizontal spaces but also the vertical ones. Hence, vertical gardening becomes one of the solutions to provide more green space to urban areas. It also helps minimize the negative imprint of buildings on the land by partly compensating for the loss of greenery their existence caused.

Located in Central Vietnam, Da Nang is a major port city and the largest urban center of the region (Ostojic et al. 2013). Urban planning policies during the last two decades have caused rapid urbanization that has contributed significantly to its socioeconomic development as well as its spatial urban structure (Huong et al. 2013). However, the transformation of agricultural and forest land into urban land has caused a major loss of the city's greenery coverage within a short time. As a result, the surface temperature of the city is higher than before, which reflects an increase in the UHI effect, especially in dense areas (Dang et al. 2015). Therefore, it is crucial to seek solutions that will provide or return the greenery in the urban areas, thereby helping to mitigate the adverse impacts of rapid urban expansion.

To explore the potential of vertical gardening in an urban area, this paper aims to study the optimal space that vertical gardens can cover, as well as the benefits of such gardens to the neighborhood, by a case study of the shop houses' facades on a typical business street in Da Nang, Vietnam. As such, our research focuses on the utility of "green development" (i.e., the cultivation of greenery in the urban areas) in the context of the study neighborhood, the selection of potential areas to grow vertical gardens based on an inventory analysis, and a review of the benefits gained from such development.

2 Research Methodology

The study was carried out at the neighborhood level on Hung Vuong Street, Hai Chau 2 Ward, Hai Chau District, Da Nang City, Vietnam. It is a business street in the city center (Fig. 1).

Among the 63 buildings in the study area, there are 50 shop houses that face the street (the gray color areas in Fig. 2) and house about 185 residents (Kieu 2016).

Details on the research methodology are presented in Table 1.

To model the shop houses, data were collected and synthesized from various sources as follows. Plotlines and buildings lines of the houses were extracted from a land-use map from Urban Management Office of Hai Chau District, Da Nang City (Fig. 2-left). To create a 3D model, relative dimensions, including the uniform height

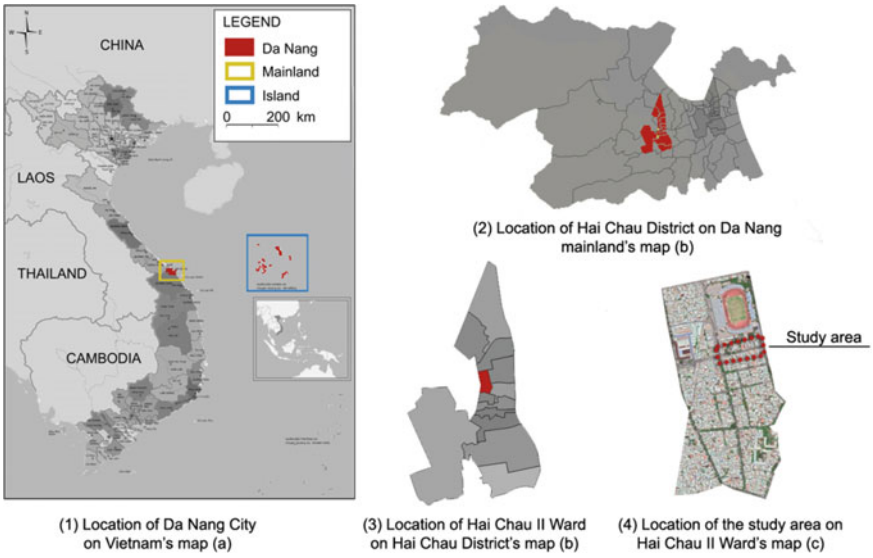

Fig. 1 Location of the study area (Adapted from various sources of figures **a**: Public domain at https://commons.wikimedia.org/wiki/File:Map-of-Vietnam-Divisions.svg; **b** Extracted from open data at https://hub.arcgis.com/datasets/e-stat::vietnam-boundaries-2016-vnm-phuong-simplify/explore; **c** Satellite image from Google Maps 2020)

for each store, maximum balcony extension, and minimum setback are referred from the local building regulations, which are summarized in Fig. 3.

Accordingly, building mass is modeled and adjusted using Sketchup software (Fig. 4). Details on their façades are illustrated regarding their existing materials and their surface dimensions captured by observation and used to support the findings of the second research question in 3.2.

3 Results and Discussion

3.1 Utility of Green Development at Multiple Urban Scales

The usefulness of green development, which in this paper focuses particularly on urban greenery, is rooted at multiple levels, namely the city, the neighborhood, and the individual building.

Utility at City and Neighborhood Scales. Da Nang is one of the most rapidly growing cities in Vietnam. From 1990 to 2016, the total built-up area of the entire city and the impervious surface areas of six inner districts have been increasing, corresponding with the reduction of forest land area (Dang et al. 2015; Linh and Van Chuong 2015; General Statistics Office of Vietnam). Particularly since 2003,

Fig. 2 Study shop houses on Hung Vuong Street, Da Nang City (Left: Adapted from the land-use map provided by the urban management office of Hai Chau District, Da Nang City; Right: Adapted from Google Maps, 2019)

Table 1 Research methodology

Study foci	Details of the studied issues	Sources of data	Methods
1. Utility of *green development* in the study area	Ecological issues of urban expansion in the recent decades (from 1990)	Relevant literature on the changing land coverage and land surface temperature	Literature review and data processing using origin software
	The inadequate presence of green areas at neighborhood scale	Satellite image from Google Earth	Map analysis using ImageJ software
	The lack of greenery at building scale	Photos front the study site	Observation and photo analysis
2. Potentials for development of vertical gardens based on façade inventory	Definitions and categories of vertical garden	Relevant literature on vertical garden	Literature review
	Potential façade areas and types of vertical gardens to be developed	Inventory of existing facades, including dimensions and materials	Inventory analysis based on modeling and observation data
3. Possible benefits gained from the development of vertical gardens	Environmental, economic, and social benefits of vertical gardens developed in study area	Literature and findings from research question 2	Literature review and calculation of possible benefits when relevant

after being recognized as a First Class City, Da Nang has undergone a massive urban expansion as an obvious result of fast growth in socioeconomic conditions during that time (Dang et al. 2015). Land-cover and land-use changes over the decades in Da Nang are illustrated in Fig. 5. Even though the mentioned sources of references have some gaps in data collection, i.e., data for some years are missing, and forest land areas in 2009 are different in the two sources (a) and (c), the data reflect a common trend as described.

The significant loss of greenery (forest land), as well as increases in imperious and built-up surfaces due to rapid urbanization, has contributed greatly to a change in the city's urban heat profile. In the 20 years since 1990, its land surface temperature (LST) increased from 38 °C to 41 °C (Linh and Van Chuong 2015). Together with the growth in impervious surface area in the inner districts, the differences in LST of built-up and its surrounding areas have gradually increased from 7.3 °C in 1990 to 11.9 °C in 2014. This high LST partly reflects the growth in intensity of the heat island in the city that was recorded as 4 °C warmer than the ambient temperature in the period of 1970–2011 in a study on heat stress (Opitz-Stapleton and Hawley 2014).

To deal with the heat island effect, as well as other negative effects caused by climate change, actions toward sustainable urban development are highly essential and appropriate in the current context of the city. Regarding the decision on an

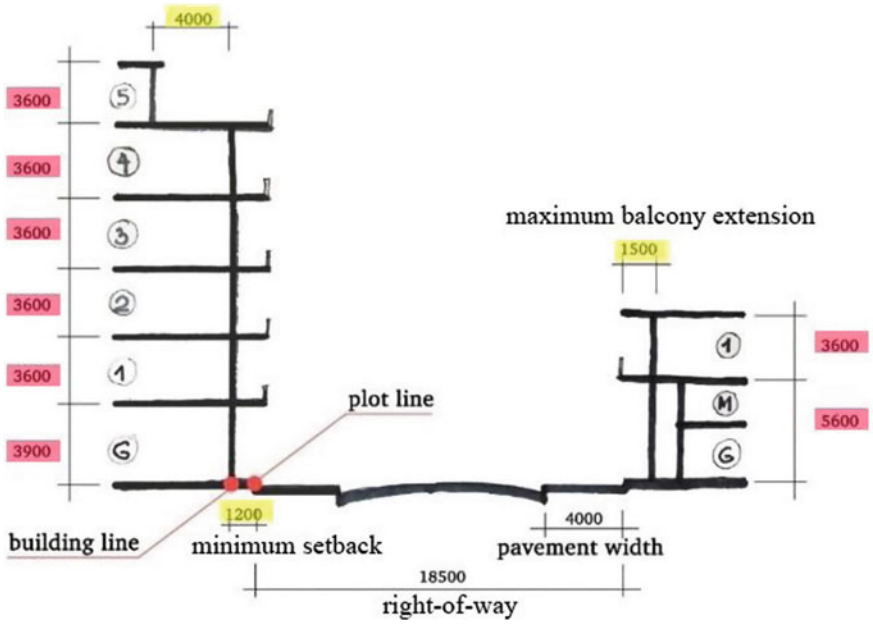

Fig. 3 Illustration of local regulations on building dimension Kieu (2016)

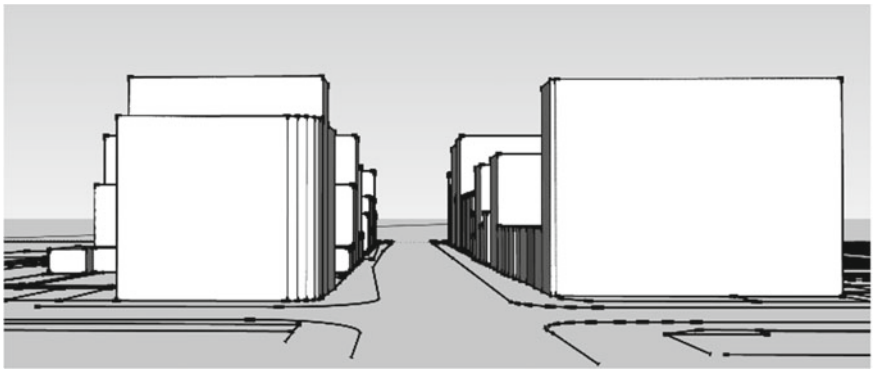

Fig. 4 Building mass after extrusion

adjusted master urban plan of Da Nang toward 2030 with a vision to 2050 (Prime Minister 2013), Da Nang City is expected to make a strong move toward sustainable growth. "In the strategy for the near future, Da Nang aims to be sustainably developed towards an environmental and livable city," according to the Da Nang Urban Planning Institute (Da Nang Urban Planning Institute 2013).

Despite some related projects carried out in recent years, green space is still insufficient in the city center. Currently, the average area of green space per capita

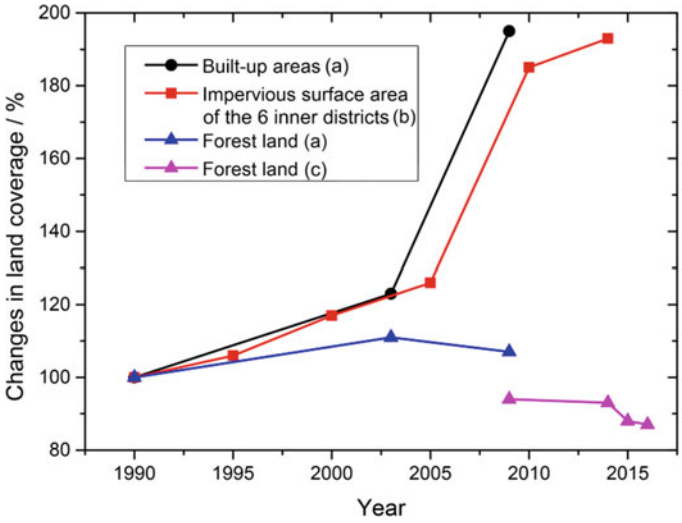

Fig. 5 Urbanization in Da Nang in 1990–2016 reflected through the change in land coverage (Authors processed the collected data from **a** Linh and Van Chuong (2015), **b** Dang et al. (2015), and **c** Ostojic et al. (2013); Dang et al. (2015); Linh and Van Chuong (2015); General Statistics Office of Vietnam) with a reference to the total area of the city (1283 km^2) given in Ostojic et al. (2013) and illustrated the graph using Origin software)

in the city is about 4 m^2, about half of the minimum requirement (7–8 m^2) (Do et al. 2018). As of January 2020, the built-up area (except road surface) within a radius of 300 m from the study area accounts for 80.9% of land coverage (Fig. 6-right). In this area, green spaces are rarely seen with only two roadside trees having recognizable canopies (Fig. 6-left). As a result, a high LST (exceeding 32 °C) was found mainly in this area and its surroundings (Dang et al. 2015).

Utility at Building Scale. Living in the dense urban area, owners of the shop houses often build their houses up to the density and height allowances in order to reach the maximum area for a mixed-use of commerce and residence. These townhouses are designed as "tube-houses," which are characterized by several floors stacked on a long and narrow land plot. Electricity bills and building dimensions in this area reflect a positive correlation between annual energy consumption and gross floor area. Green area is rarely found around these houses (Kieu 2016).

The shop house facades are covered mostly by glass, advertisement boards, and aluminum wall (Fig. 7). These materials are not friendly to thermal comfort and also cause a high demand for energy consumption for cooling.

Briefly, as our research has revealed, the need for green development, particularly from the perspective of vertical gardening, results from the lack of green spaces in the study area at multiple scales, from city to neighborhood and building. To figure out the impacts of vertical gardens on the neighborhood, the potential areas are investigated below.

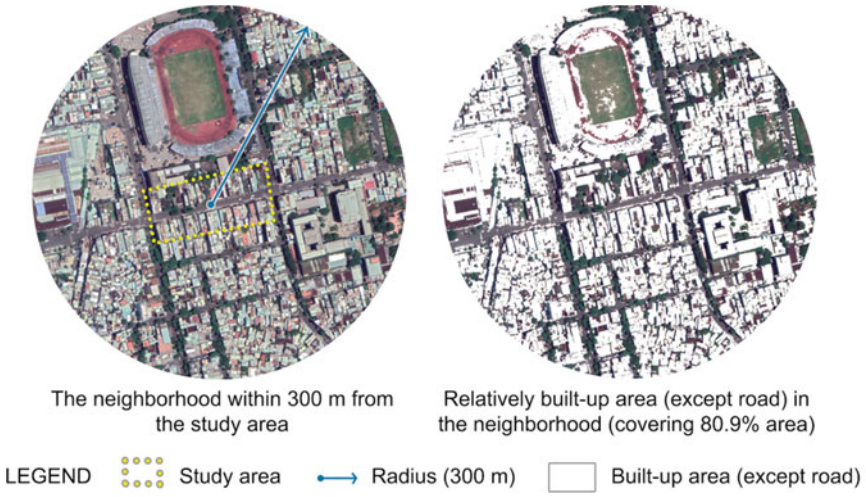

Fig. 6 Relative coverage of built-up areas (except road area) within a radius of 300 m from the study area (Adapted from satellite image from Google Maps 2020 and processed with ImageJ software)

Fig. 7 Facades' inventory

3.2 Potential for Vertical Gardens in the Study Area

Types and Scopes of Vertical Gardens. Throughout the development of green facades, there have been several terms used for vegetated vertical facades, according to Köhler (2008). In this paper, the term *vertical garden* is used to describe vegetation growing along a vertical surface. Depending on their characteristics, such as construction, benefit, cost, and maintenance, there are various ways to categorize these vertical gardens (Manso and Castro-Gomes 2015; Medl et al. 2017). Synthesizing different ways of classification from these sources, this paper reviews three types of vertical garden, as shown in Fig. 8.

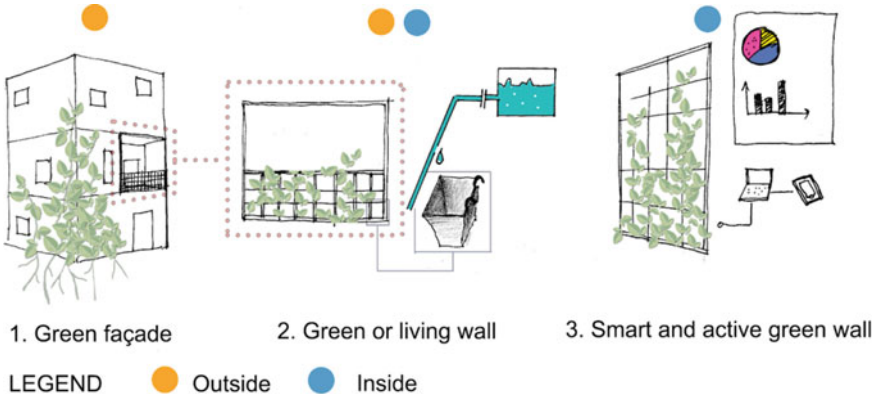

Fig. 8 Types and scopes of use of vertical garden

Green Façade. On a green façade, vegetation is rooted in the ground and climbs up using a supporting structure. In some cases, vegetation can be planted on the upper floors or the roof and grows downward. The plants' roots may or may not grow on the façade. It takes time to get vegetation growing all over the façade, and this type of vertical garden is normally used for outside walls.

Green or Living Wall. A green or living wall is created by planting pots placed on a grid as a supporting system. It is often assembled with an irrigation system that waters the garden. The pots can be pre-grown and replaced. Thanks to these advantages, it is possible to use this system to cover the wall surfaces rapidly with high flexibility for decoration purposes. This type of vertical garden can be used for both inside and outside walls.

Smart and Active Green Wall. Smart and active green wall is the latest innovation in vertical gardening. It has most features of a typical green wall and some extra functions due to the application of artificial intelligence and technology such as sensors and a self-lighting system. The wall can act as a natural air purifier, as well as a humidifier, and can be installed on a wheelbase and moved around freely. It is more common to see this type of green wall in inside spaces rather than in outside spaces.

Potential Spaces for Vertical Garden Development in the Study Area. Potential spaces for vertical garden development in the study area were investigated based on an inventory of building facades, as well as the requirements for different types of such gardening.

Among the three types of vertical garden mentioned above, it seems impractical to grow the green façades in the area due to the lack of ground availability. To deal with this limitation, a shallow layer of soil can be added to grow certain types of plants. As noted above, in addition to climbing from the ground floors, plants in this system can also grow from the upper floors upward or downward. Growing green façades upward from the ground requires a wide vertical surface on the ground floor to grow on or against, which is less available in the study area.

On the other hand, there is a greater potential for green walls in the study area because they can freely stand, thanks to a supporting structure. Since this structure and the pots require space, balcony and loggia are the suitable areas for these gardens. In the study area, after eliminating the surfaces covered with advertisement boards and the ground floor's façades that are in use for commercial purposes (yellow color), the remaining area is considered applicable space to install green walls as vertical gardens (green color) (Fig. 9). In the study area, the vegetation is grown on small-scale residential building facades, so application of the smart and active green wall, heralded as the latest innovation in vertical gardening, is not suitable for this area due to its limited application scale, high cost, and maintenance requirements.

As per our research, over 30% of the total façade area of 3118 m^2, as measured in the study area, can be used for green walls which would account for 1158 m^2. This potential area represents approximately 17% of the study site area (7013 m^2). On an average, this area of green walls would provide an extra 6.26 m^2 of green space for each person living in this area, which would help compensate for the lack of green space found in the city center.

Fig. 9 Inapplicable (yellow color) and applicable (green color) surfaces for a vertical garden (Illustrated in SketchUp software with data from observation)

3.3 *Possible Values Gained from Vertical Garden Development*

The development of vertical gardens in an urban setting may bring multiple positive effects, including environmental, economic, and social benefits.

Vertical gardens can be used as passive energy-saving systems in summer due to their functions in shadow production, thermal insulation, and evapotranspiration (Pérez et al. 2011). Several studies since the late 1990s have consistently demonstrated these benefits.

According to a climate booklet for guiding urban development in Stuttgart (Reuter and Kapp 2012) which mentioned the remarkable results from a study by Rath and Kießl (1989), leaves on a façade fully covered by vertical green systems can reflect or absorb between 40 and 80% the radiation received, depending on the greening amount and type. Moreover, compared to those of non-greened walls, daily temperature amplitude of a greened wall can be reduced up to 30 °C on a hot summer day due to air cushion and evaporation. Another report from Peck et al. (1999) cited a similar finding from Minke et al. (Minke and Witter 1983) that temperature fluctuation of a façade with a layer of plants ranges between 30 and 5 °C, while a façade without plants can be heated up to 60 °C and cooled to −10 °C. Similarly, the observed temperature amplitude of leaf-covered external walls in summer in an experiment in Southern Africa was reported as the smallest among various types of wall coverage (Holm 1989). Depending on building orientation, the average surface temperature of greened walls in summer is 1–2 °C lower than those of non-greened walls (Rath and Kießl 1989). An experiment carried out at the University of Toronto showed that vertical gardens are cooler than light-colored bricks and walls (Bass and Baskaran 2001). The observation by Holm (1989) also showed that mean temperature of greened walls is 2.6 K lower than mean air temperature during summer.

The shading effects of vertical gardens can help reducing energy used for cooling by decreasing heat transfer from the outer environment to interior spaces. A study of Canadian cities (Bass and Baskaran 2001) found a reduction in energy used for air-conditioning of at least approximately 23% and up to around 30%. Cited from (Gaudet 1985), every additional degree (F) of summer heat causes 5–7% higher energy demand for cooling (Peck et al. 1999). As found by Opitz-Stapleton and Hawley (2014), there were about 186 days per year when the heat index in Da Nang equaled or exceeded 34 °C (93.2 °F) during 1970–2011. Therefore, if the mean air temperature of the hottest days reduces by 1 °C (from 34 to 33 °C, or from 93.2 to 91.4 °F) thanks to vertical gardens, it can save 9–12.6% of energy needed for air cooling in summer. In the meantime, less use of air-conditioning also reduces greenhouse gas emission and anthropogenic heat to the urban environment, helping mitigate heat island effect. Moreover, the cost saved in energy consumption can be considered a medium- to long-term payback for investment in vertical green systems.

Due to photosynthesis, vertical gardens absorb solar heat, as mentioned above, and produce oxygen, which plays a vital role in urban health. According to Peck et al., hourly consumed oxygen by a human being equals the oxygen production of

25 m^2 of leaf surface area (LSA) at the same time (Peck et al. 1999). In the study area of this paper, sunny hours account for 51% of annual hours (Weather Atlas 2019), so if we assume that only ivy is planted in the study area, we can calculate the number of people who benefit from the oxygen production of the ivy there (Table 2). According to this table, with a 1158 m^2 wall covered by 10 to 25-cm thick ivy, the emitted oxygen in the study area can supply 70–274 people with oxygen. Considering that 185 people live in the shop houses in the study area, this production is a significant contribution to the environmental quality of the area.

Another positive impact from vertical gardens is their potential role in interrupting rainfall and delaying runoff, even though studies on these effects are still limited. These gardens may also offer additional habitat for animals in dense cities, which helps to preserve urban biodiversity (Peck et al. 1999). Moreover, through testing with different layouts of vertical gardens, Wong et al. (2010) have figured out a noticeable noise reduction capacity of certain systems that varies from 5 to 10 dB for low to middle frequency range. Since the living spaces of houses in the study area are located not far from the street, the vegetation layer also helps to reduce traffic noise. In terms of social benefits, the white noise from wind movement through leaves of vertical gardens and regular contact with the natural settings can generally enhance psychological well-being (Ulrich et al. 1991; Peck et al. 1999; Grinde and Patil 2009). Moreover, vertical gardens also contribute to the appearance of buildings.

However, vertical gardens need logistical and other considerations and maintenance under certain circumstances. The supporting structures of these gardens on the facades must avoid blocking the escape way of residents in emergencies. The selection of plant types is also important due to climatic conditions. They might be vulnerable to fire risk in the hot summer months if they are left dry and possibly to tropical typhoons from late summer to early winter. Even though vertical gardens can compensate for the loss of greenery in urban areas to some extent, they cannot recover all the effects caused by these limitations (Betzler 2016).

Table 2 Number of people benefited from oxygen production by ivy in the study area

Criteria	Thickness of ivy layers (cm)			Notes
	10	15	25	
LSA per square meter of the planted ivy (m^2)	3	5	11.8	Referred from Peck et al. (1999)
LSA of the entire greened walls (m^2)	3474	5790	13,664	The total area of greened walls is 1158 m^2
Number of benefited people in the daytime per day	139	232	547	Every 25 m^2 of LSA provides enough oxygen for one person in the daytime
Number of benefited people per day on average	70	116	274	The calculation concerns the nighttime (50% time of a day in average) when the green walls produce no oxygen

4 Conclusion

In this paper, we have explored the need for and the utility of green development at multiple urban scales, from city to neighborhood and building, at the study area on Hung Vuong Street, Da Nang City. Based on an inventory of the shop house facades, green walls (one of the three vertical garden types) were determined to have more potential for the study area. Green walls could cover about 30% of the façade, 17% of the land surface used for building, and provide an extra 6.26 m^2 of green area per resident. With the additional vegetation, the vertical gardens are expected to bring multiple environmental, economic, and social benefits to the study area via their shading and cooling effects, thermal insulation, oxygen production, runoff delay, urban diversity preservation, noise reduction, and white noise creation. These positive effects are expected to compensate, to some extent, for the lack of urban green space in the study area, as well as to mitigate the negative impacts caused by this limitation.

Despite various benefits gained from such development, the implementation of vertical gardens may have some barriers due to cost, maintenance requirements, risk management, and especially the investment willingness from the homeowners. Besides that, the impacts of the gardens depend largely on the type of plants. Therefore, further studies on these issues, such as vegetation typology and preferences of the involved stakeholders, should be carried out in order to investigate the feasibility of bringing this green solution into application.

In this study, the development of vertical gardens is considered in context of a small-scale neighborhood in a medium-size town but already shows certain potentials and positive effects. Therefore, it is promising to apply the concept of vertical gardening at similar or even larger urban scales in other cities. In the context of urban development in Vietnam and in other Asia countries, this green solution has the potential to greatly mitigate the UHI effect and the other impacts caused by rapid urbanization. Even though the methods used in this paper can be adopted in similar studies, it is important to carry out further contextualized feasibility studies to explore the benefits and barriers for such application. In the future, if vertical gardens are developed widely, some of their barriers such as installation cost and maintenance requirements can be eased, which may interest more homeowners and investors in this green solution. At the upper end of the building-neighborhood-city spectrum, cities could further benefit from well-planned vertical gardens due to the synergistic effects brought about by such wide-scale green areas amid the built environment of rapidly urbanizing Asian cities.

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The Effect of Urban Vegetation Patterns on Land Surface Temperatures in the Bangkok Metropolitan Region

Mingkwan Nantavisai and Danai Thaitakoo

Abstract Land cover change and climate change lead to rising land surface temperatures. An abundance of research demonstrates that urban vegetation, known as green infrastructure, can reduce land surface temperatures. However, there is little research determining how the spatial structure and pattern of urban vegetation affects land surface temperature. This research focuses on investigating the effects of urban vegetation patterns on land surface temperatures by comparing classification maps, spatial patterns of vegetation, and the land surface temperature contour maps. Eight areas that have similar land cover ratios but different spatial patterns have been selected. The results show that large vegetation patches reduce surface temperature better than small vegetation patches. A large vegetation patch has the ability to decrease surface temperature only in the patch itself, and at a distance of 60–120 m surrounding the patch. However, built-up and bare soil areas that reside next to the green patch still retain a high surface temperature. On the other hand, the maximum temperature of areas comprising the small vegetation patches is lower than the large patch. Overall, small, scattered vegetation patches reduce the surface temperature not only on the patches themselves but also in a wider area. It seems that small, scattered vegetation patches benefit the urban areas by reducing land surface temperature more than a large vegetation patch. However, both large and small, scattered vegetation patches should be combined to most efficiently decreasing urban land surface temperature. The findings of the research can be applied to Bangkok's green infrastructure planning to improve the quality of life for the people and make the city more resilient.

Keywords Urban vegetation · Green infrastructure · Landscape ecology · Land surface temperature · Spatial pattern of urban vegetation · Land cover classification

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1 Introduction

The urban ecosystem has diverse landscape elements that have been created by both nature and man (Forman and Godron 1986). Land cover in city areas is composed of built-up vegetation and water patches, each of which has different effects on the urban environment (Forman and Godron 1986). Over the past 20 years, rapid urbanization and expansion, especially in regard to land cover changes in Bangkok, have had many impacts on urban environments, including water and air pollution, urban flooding, and a rise of the land surface temperature. Green infrastructure is the key to mitigating these environmental impacts (Forman 2014; Huang et al. 1990; McBride 1977; Nowak and Crane 2002). Green infrastructure helps to manage stormwater by providing spaces for water run-off and by retaining the rain with tree crowns (Guevara-Escobar et al. 2007). Green infrastructure helps to decrease the amount of carbon dioxide in urban climates and improve air quality (Forman 2014; Huang et al. 1990; Nowak and Crane 2002). Moreover, green infrastructure has a significant impact on decreasing the urban Land Surface Temperature (LST) (Fig. 1) by absorbing solar radiation and providing shade for the built-up areas (Alavipanah et al. 2015; Srivanit et al. 2012). Around 60–90% of solar radiation will be filtered by the dense foliage, meaning that only about 10–40% will reach the ground (Boukhabl and Alkam 2012) (Fig. 2).

Although research supports the contention that urban vegetation patches, the main component in green infrastructure, have an important role in improving urban environmental quality, especially in reducing LST, there is no research available to determine *how* the spatial structure and pattern of urban vegetation affects LST. This leads to questions as to whether the spatial structure and pattern of urban vegetation affects LST and if so, how it occurs. Therefore, classifying each type of land cover is essential for understanding the relationships between the spatial structure and pattern of urban vegetation, and ecosystem services. This study investigates the effects of urban vegetation patterns on LST by comparing land cover classification maps, spatial patterns of urban vegetation, and surface temperature contour maps, which explore the relationship between LST and common land cover indices

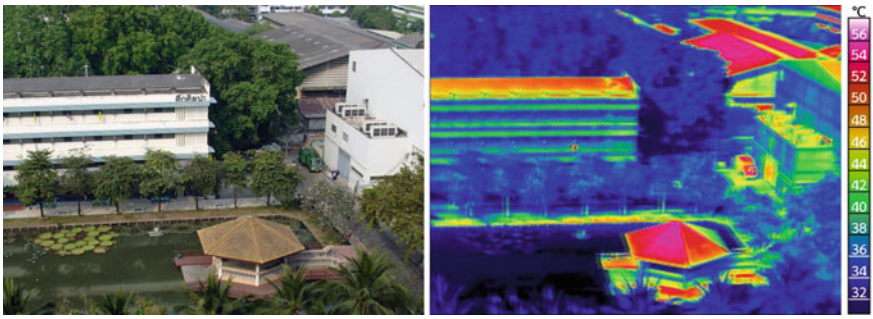


Fig. 1 The effect of different surfaces on surface temperature (Authors)

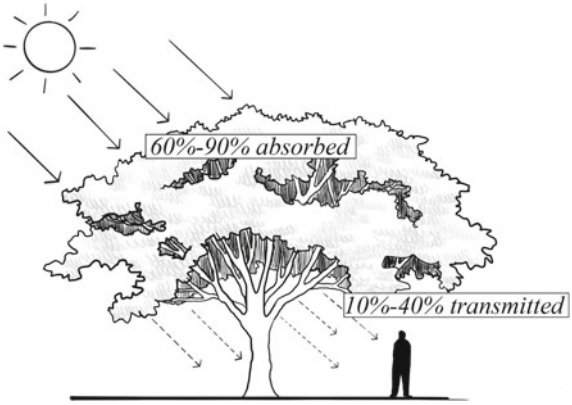


Fig. 2 The effect of vegetation on surface temperature (Modified from Boukhabl and Alkam 2012)

(i.e., Normalized Difference Vegetation Index (NDVI), Modified Normalized Difference Water Index (MNDWI), Normalized Difference Bareness Index (NDBaI), and Normalized Difference Built-Up Index (NDBI)). This knowledge could be used as preliminary information for planning and designing the urban ecosystem pertaining to ecological processes, which, ultimately, would have positive effects in general, and provide a better quality of life for people living in urban areas.

2 Material and Methods

2.1 Study Area and Materials

The Bangkok Metropolitan Region (BMR) has a variety of land cover types, such as dense built-up areas, tree-covered areas, and shrublands. Moreover, there are many types of patterns or arrangements of vegetation, which can be used for analyzing the relationship between the spatial pattern and structure of vegetation and LST. Consequently, this research uses the Bangkok Metropolitan Region to determine the effect of spatial structure and urban vegetation patterns on LST using Landsat OLI data with no cloud cover, acquired on January 20, 2015. The spatial resolution of Landsat OLI images is 30 m in multispectral bands, and for thermal bands, it is 100 m.

2.2 Land Cover Classification

The classification system is adapted from the High Ecological Resolution Classification for Urban Landscapes and Environmental Systems (HERCULES) (Cadenasso et al. 2007), because HERCULES considers the characterization of ecological

Table 1 Land cover classification system of this research

Elements	Land cover type	
Type 1	Trees	Ecological elements of urban ecosystem
	Shrubs and ground covering vegetations	
Type 2	Water	
Type 3	Built-up and bare soil	

elements of the urban landscape. Moreover, this classification system also distinguishes between structure and function, making it suitable for use in this research. This study classifies the land cover, both man-made and natural, into three elements: (i) vegetation types (trees, shrubs, and ground covering), (ii) water bodies, and (iii) built-up land (including bare soil) (Table 1). Based on this classification, a map of the land cover was constructed (Fig. 7).

The study uses LANDSAT satellite data to classify urban vegetation and land cover using NDVI (Normalized Difference Vegetation Index) and MNDWI (Modified Normalized Difference Water Index) to identify land cover types. NDVI and MNDWI are useful indexes by which to recognize vegetation information and water features respectively. Valid results of NDVI and MNDWI are presented in Figs. 3 and 4, respectively.

The NDVI is expressed as follows (Weier and Herring 2000):

$$\text{NDVI} = \frac{(\text{NIR} - \text{RED})}{(\text{NIR} + \text{RED})}$$

where NIR is a near-infrared band (0.7–1.1 μm), RED is a red band (0.4–0.7 μm).

Valid results of NDVI fall between −1 and +1. The NDVI of an area containing a sparse vegetation canopy will tend to produce positive values at around 0.2–0.4 while dense vegetation canopy will be characterized by values at approximately 0.5–0.8 (Weier and Herring 2000). The water feature will show slightly negative NDVI values (Weier and Herring 2000). In Fig. 5 (ii), vegetation is pictured as an index of

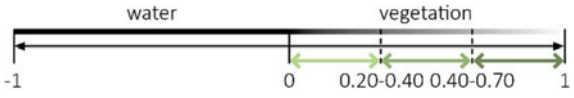


Fig. 3 Valid results of NDVI

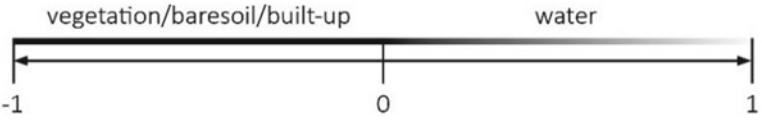


Fig. 4 Valid results of MNDWI

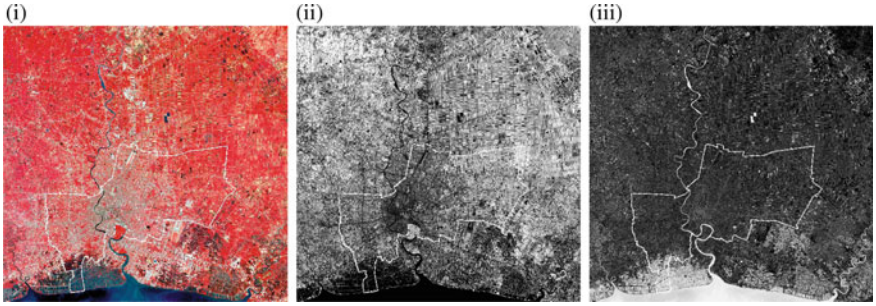


Fig. 5 **i** Color infrared imagery of Bangkok metropolitan region, **ii** NDVI imagery of Bangkok metropolitan region, **iii** MNDWI imagery of Bangkok metropolitan region

greenness. In places where foliage is dense, the index is high, represented in white. Regions where few plants grow have a low vegetation index, shown in gray.

The modified NDWI (MNDWI) can be expressed as follows (Xu 2006):

$$\text{MNDWI} = \frac{(\text{GREEN} - \text{SWIR})}{(\text{GREEN} + \text{SWIR})}$$

where GREEN is a green band (0.5–0.6 μm), SWIR is a shortwave infrared band (1.55–1.75 μm).

The results of MNDWI also fall between −1 and +1, and water bodies will be classified by positive values (Xu 2006).

2.3 Selection of Study Sub-Areas

Eight sub-areas with different spatial structures and patterns of urban vegetation are chosen by using visual interpretation techniques. The dimension of each sub-area is 3×3 km^2 (9 km^2). (Fig. 6).

The study areas are divided into three groups; each group contains sub-areas that have a similar ratio of land cover, but their spatial patterns differ (Figs. 7 and 8).

2.4 Land Surface Temperature Contour Maps

This research chose LANDSAT thermal bands (TIR) to calculate LST. Each pixel value in satellite images is represented as digital numbers or brightness. Accordingly, the digital number of Landsat thermal data pixels needs to be converted into brightness temperature values (Kelvin) in order to obtain comparable data. The brightness

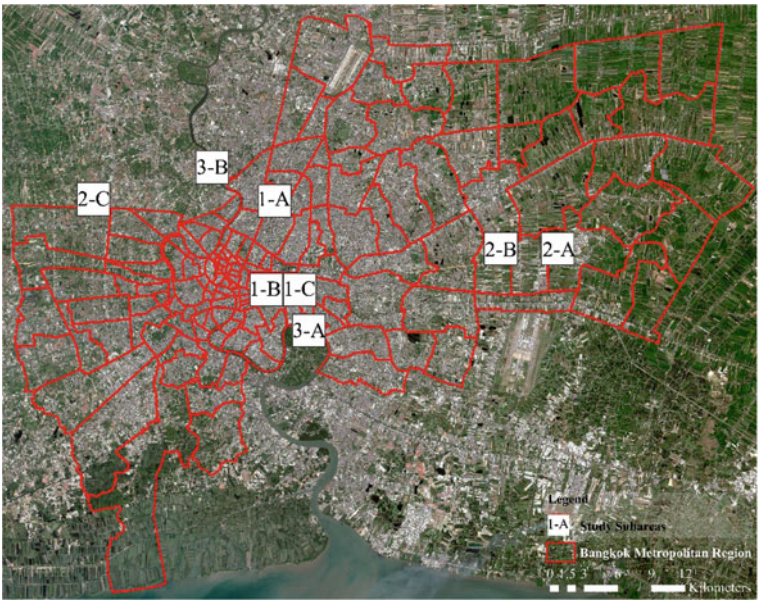


Fig. 6 The location of eight study sub-areas in the Bangkok metropolitan region (adapted from ESRI 2019)

temperature images were then converted to LST contour maps of the study areas to compare with the data of the land cover classification map (Fig. 9).

3 Results

3.1 Land Cover Classification Map

The results of land cover classification, using NDVI and MNDVI to identify land cover types, were illustrated in the classification map, as shown in Figs. 10, 11, and 12. Each group has different sub-areas that are similar in land cover ratio but different in spatial structures and patterns. Group 1 depicts the highest ratio of built-up (and bare soil) land cover types, in which the area shown in 1-A comprises a large vegetation patch and large, built-up land patches. In contrast to the spatial pattern in 1-A, that in the sub-area of 1-C comprises many small, scattered vegetation plots and built-up patches (Fig. 10). Among the three groups, Group 2 shows the highest ratio of shrubs and ground covering vegetation (Fig. 11). The sub-areas in Group 3 reveal a large proportion of built-up areas, similar to Group 1. Additionally, this group includes large patches of water (Fig. 12).

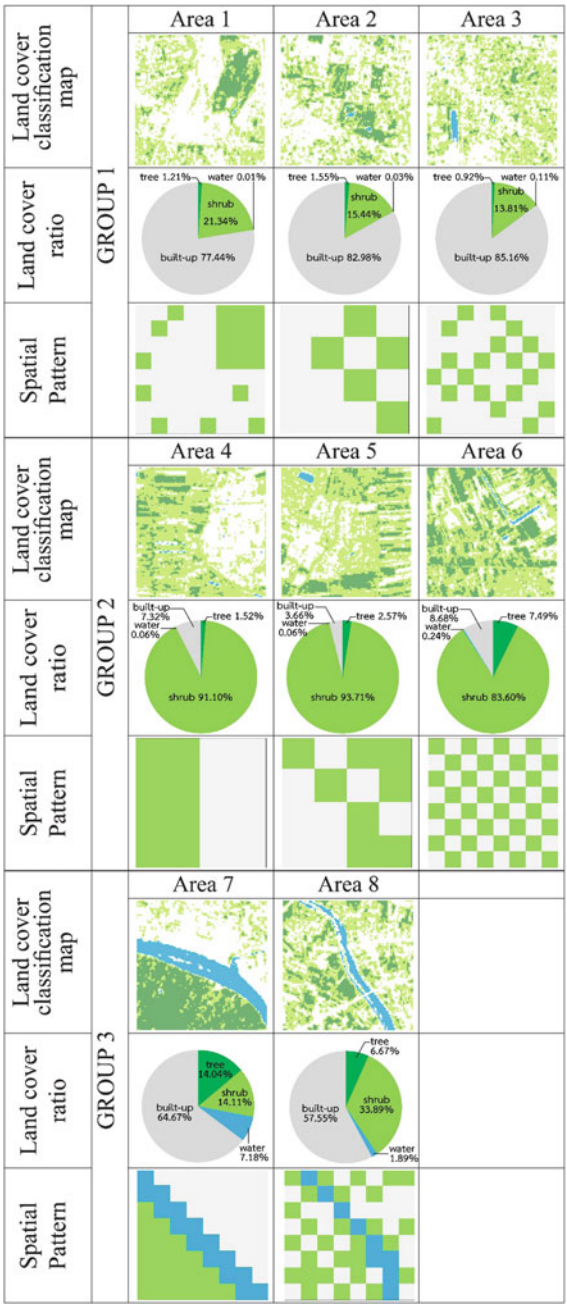


Fig. 7 Eight study sub-areas are divided into three groups

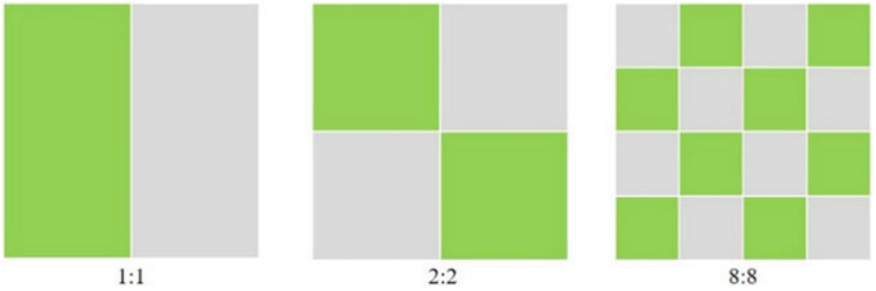


Fig. 8 Proportionally similar land cover scenarios with distinctive geometric patterns. In each, 50% of the area is built-up and 50% is vegetation

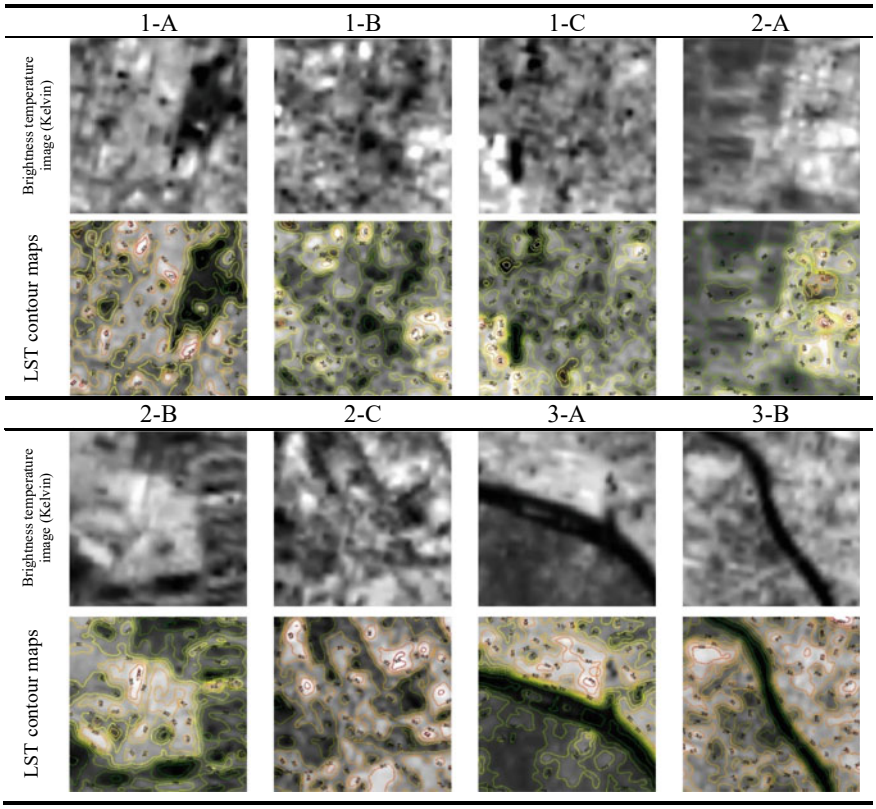


Fig. 9 Brightness temperature values (Kelvin) and LST contour maps of study areas

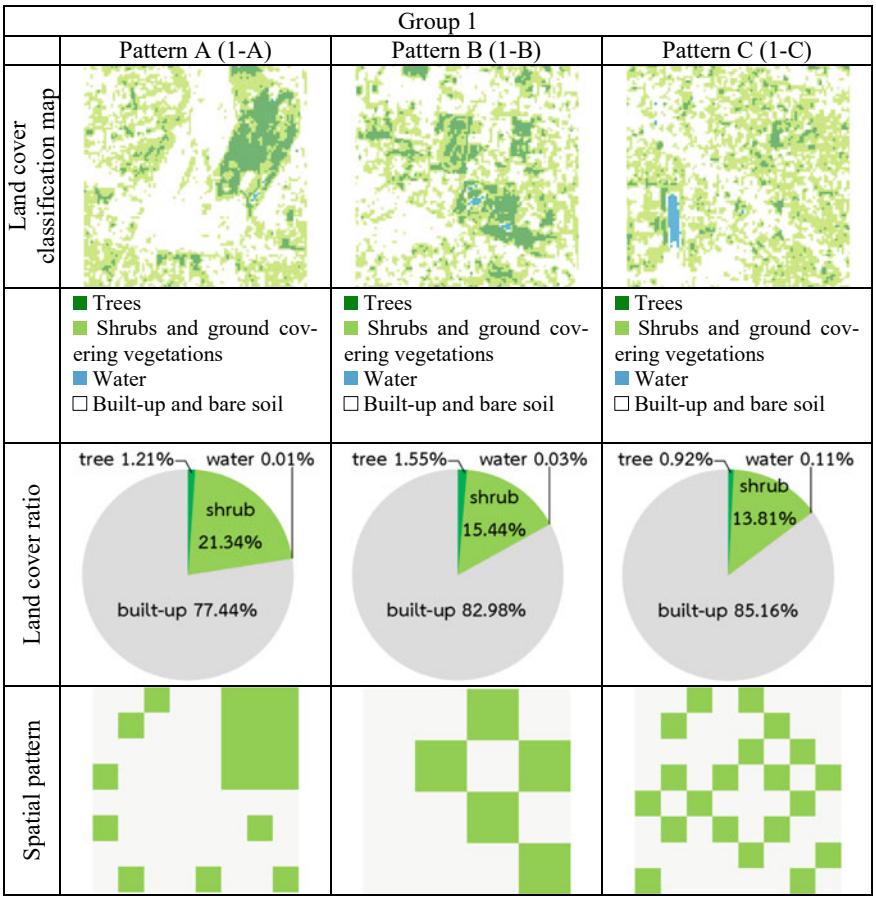


Fig. 10 Land cover classification maps and spatial pattern of study areas in group 1

3.2 Comparison of the Spatial Structure and Pattern of Vegetation with LST

The LST values in the sub-areas of the three groups with diverse land cover types and patterns are presented in Figs. 13 and 14. This study found that LST values in the areas with vegetation range between 296 and 300 K (22.85–26.85 °C) while LST values in the area with built-up and bare soil range between 296 to 304 K (22.85–30.85 °C): higher than in the areas with the vegetation and water patches (Fig. 15). Additionally, LST values of a built-up area at a distance of around 120 m from a large vegetation patch, range from approximately 296 K to 297 K (22.85–23.85 °C). It may be inferred that a large vegetation patch has the ability to reduce the surface temperature not only within the patch itself, but also at a distance of 60–120 m surrounding the patch (Fig. 17).

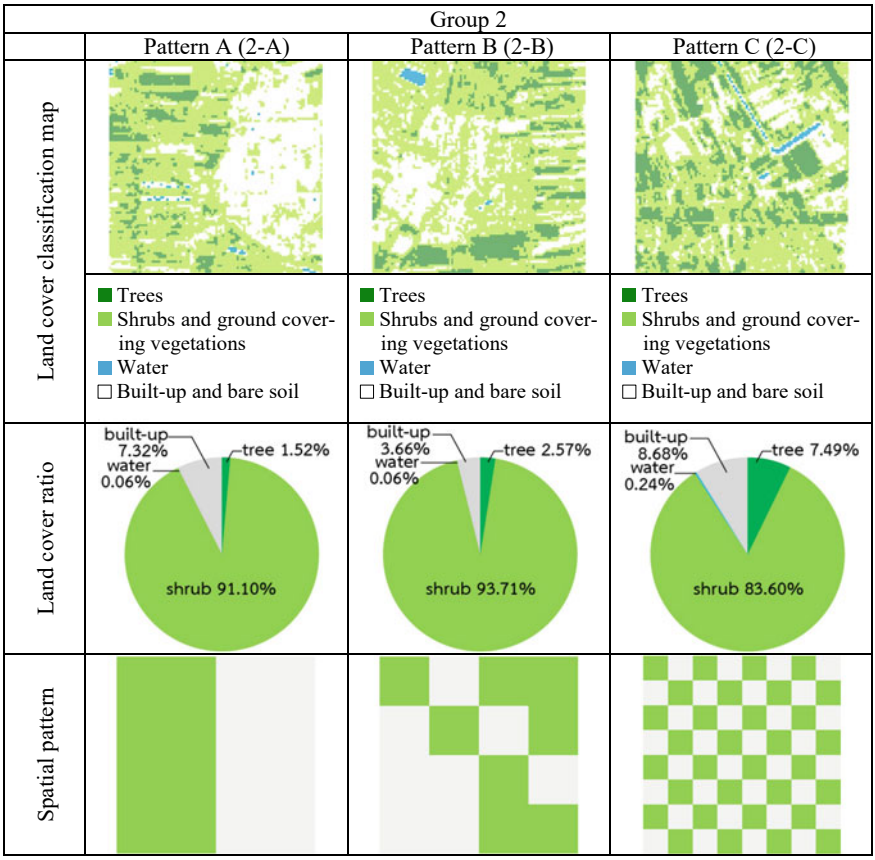


Fig. 11 Land cover classification maps and spatial pattern of study areas in group 2

The spatial structure and pattern of vegetation also have an effect on LST, as shown in Fig. 16. In the area comprising large patches of vegetation and built-up land (Area 1-A, 2-A, and 3-A), the range of LST between the maximum and minimum temperature are very wide. On the other hand, the characteristic of temperature differences of small vegetation patches pattern (Area 1-C, 2-C, and 3-B) is variable. The range of LST between the maximum and minimum temperature in the small vegetation patches pattern is narrower than the other. However, both of them are in the same vicinity (Fig. 16).

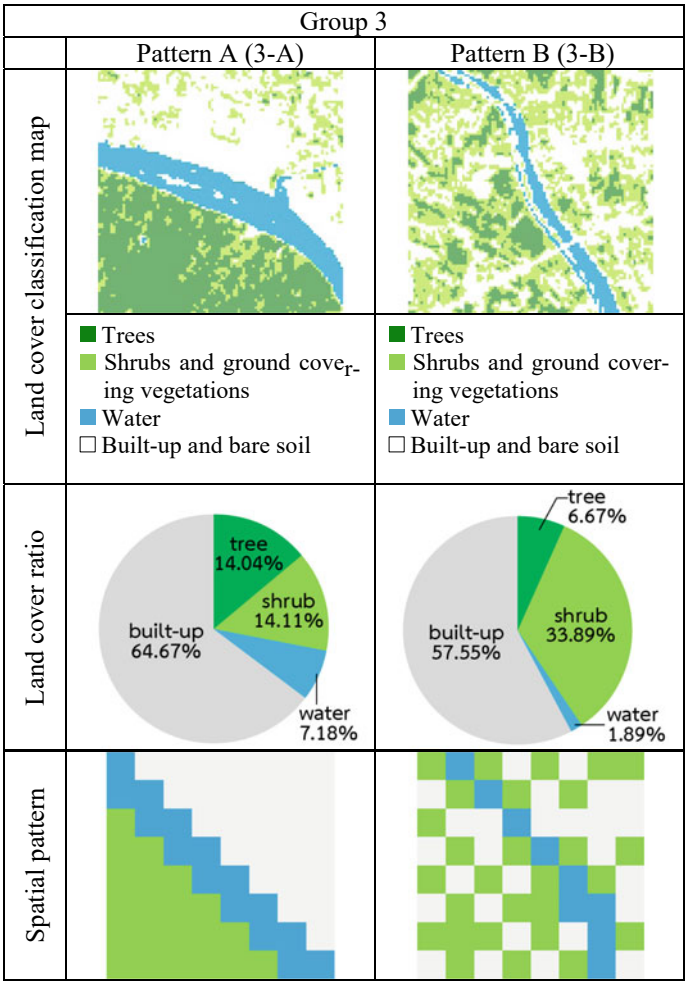


Fig. 12 Land cover classification maps and spatial pattern of study areas in group 3

4 Discussion and Concluding Thoughts

Land cover is an important factor that has a significant impact on LST and temperature range. Vegetation areas, especially tree patches, are approximately 3 °C cooler than built-up and bare soil area (Srivanit et al. 2012). Furthermore, large vegetation patches provide a cool island which extends to the surrounding area (Alavipanah et al. 2015; Amani-Beni et al. 2019). In this study, the Wachirabenchathat Park, in the area 1-A, is the biggest vegetation patch. The result shows that LST of the built-up area surrounding the park is affected by the distance from the edge of the vegetation patch (Fig. 17). Moreover, the range of LST, as shown in Fig. 16, implies that the

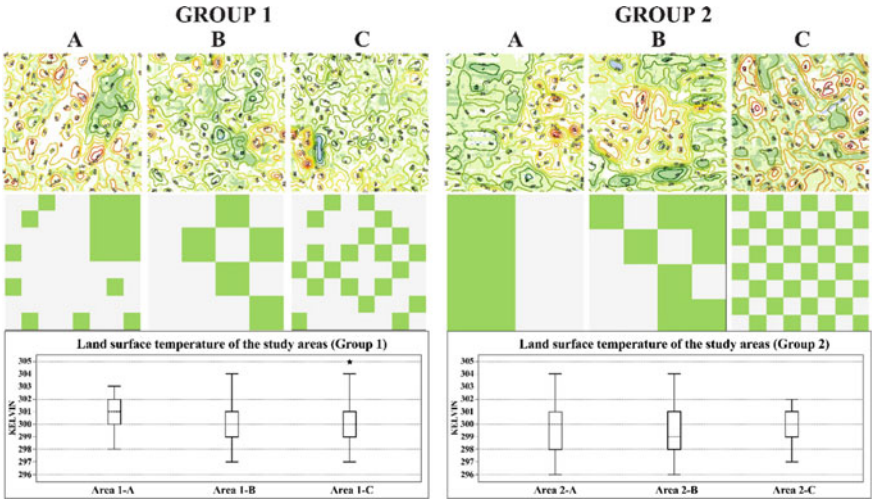
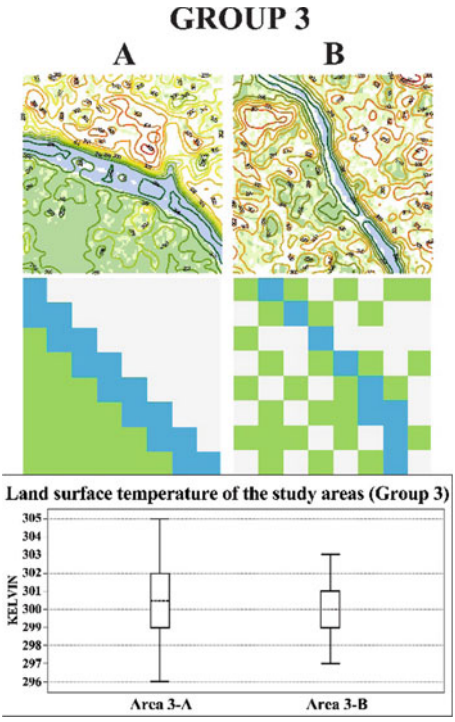


Fig. 13 Comparison of land cover classification maps, spatial pattern, and land surface temperature contour maps of group 1 and group 2

Fig. 14 Comparison of land cover classification maps, spatial pattern, and land surface temperature contour maps of group 3



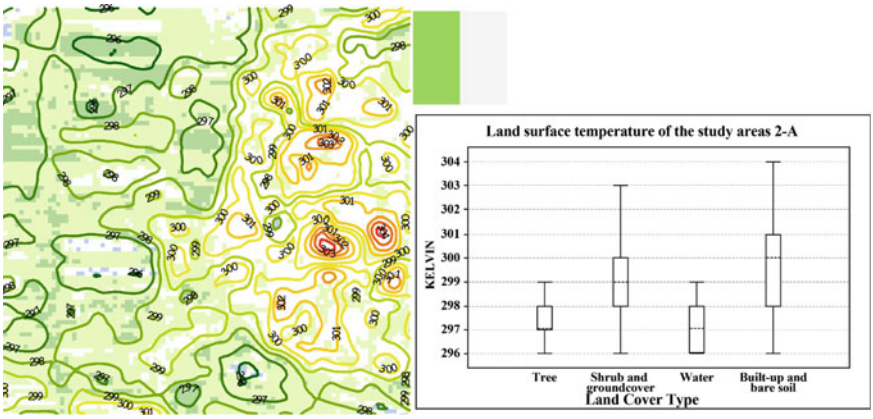


Fig. 15 LST of each land cover type in the study area 2-A

spatial pattern of urban vegetation has an effect on LST. The maximum temperature of areas composed of several small vegetation patches is lower than the large vegetation patches. It seems that small, scattered vegetation patches reduce the surface temperature not only on the patch itself, but also in a wider area.

According to thermal conduction in the law of thermodynamics, conduction occurs when two types of land cover have different temperatures and they are in contact with each other. Heat will transfer from the warmer to the cooler system until they are both at the same temperature. The rate of thermal conduction depends on the contact areas between the systems with different temperatures (Halliday et al. 2013).

In this study, the thermal conduction rate of small patches (pattern B) is faster because the small, scattered vegetation patches have more contact areas between warmer and cooler systems than one large patch (pattern A) (Fig. 18). This is the reason why the range of surface temperatures in the area with the spatial pattern B is narrower than pattern A (Fig. 16). Altogether, it can be tentatively concluded that the spatial patterns of urban vegetation affects LST. However, more study should be conducted to clearly determine the effect of spatial patterns on LST.

This study shows that each pattern has its own benefit. The urban vegetation patches benefit urban areas in reducing LST. The increased size of vegetation areas (green infrastructure), either pattern A or pattern B, has its role in decreasing LST (Fig. 19). This can be applied to set a policy to increase green area; for example, the Floor Area Ratio Bonus (FAR Bonus) and the Green Coverage Ratio (GCR) can be used to encourage the private sectors to increase the green infrastructure in their projects (Fig. 20).

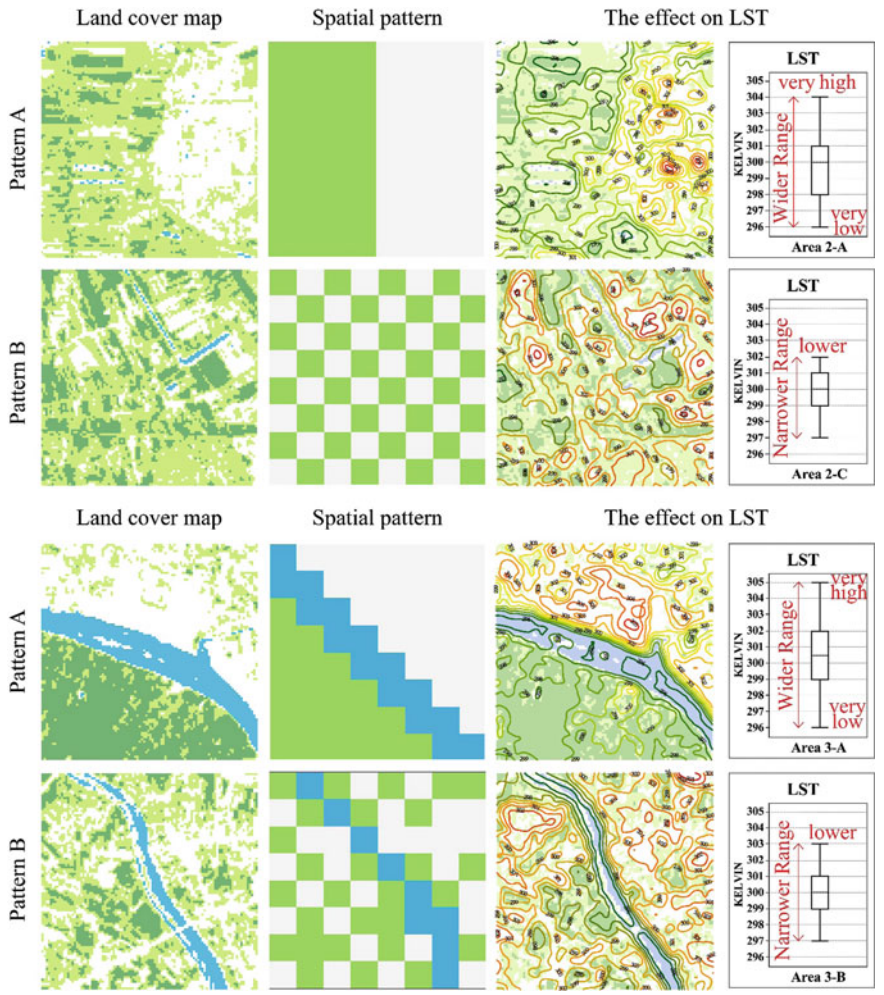


Fig. 16 Comparison of land cover classification maps, spatial pattern, and land surface temperature contour maps

As a conclusion, it can be stated that the effect of vegetation spatial patterns on LST should be considered for urban environmental planning and green infrastructure policies in order to effectively reduce the land surface temperature of urban areas. This will improve the livability index of cities, resulting in a better quality of life for all citizens.

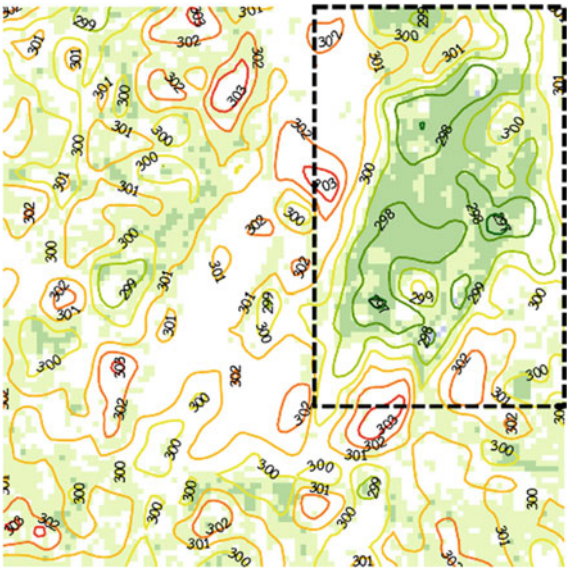


Fig. 17 The location of the Wachirabenchathat Park

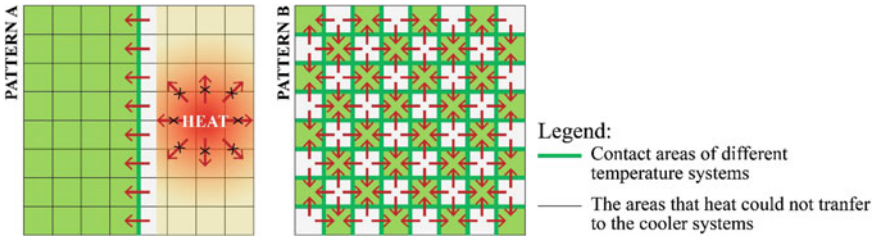


Fig. 18 Comparison of the amount of contact area of different temperature systems

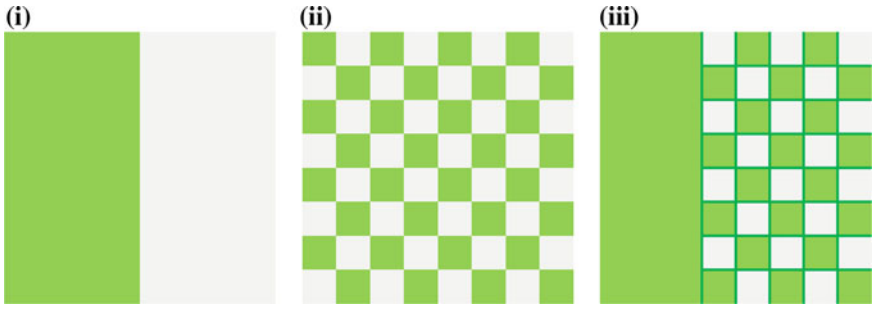


Fig. 19 **i** Land surface temperature in one large patch is very low but only in the patch itself. **ii** Land surface temperature in small patches is cooler than one large patch. **iii** Combination of patterns A and B with green link would be the best for an urban environment

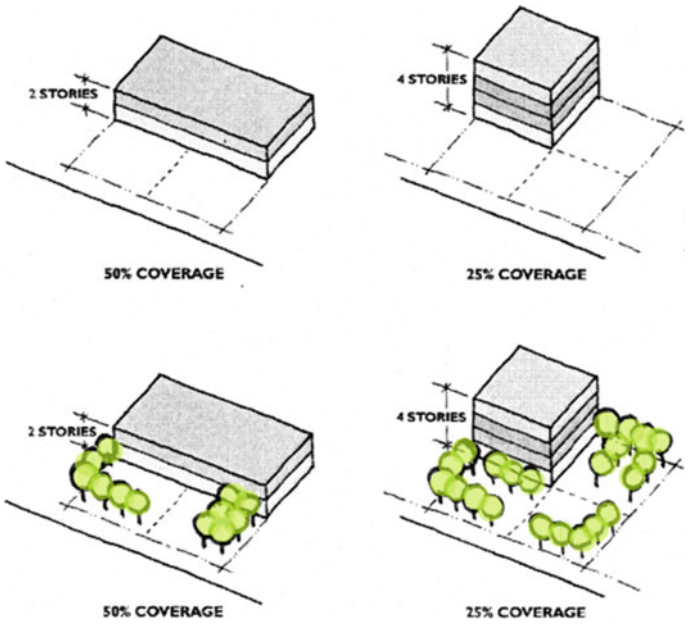


Fig. 20 Comparison of FAR bonus measure and GCR measure (Nantavisai and Thaitakoo 2016)

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Enhancing Urban Mobility Through a Powered Two-Wheeler Lane System: An Empirical Study in Ho Chi Minh City

Tuan Anh Vu, Nguyen Duc Huynh, and Hung Viet Khuat

Abstract In developing countries in Asia, especially Vietnam, powered two wheelers (PTWs) are a dominant transportation mode and often share lanes with automobiles. Though PTWs contribute the highest share of road accidents, they enhance urban mobility because of their high capacity. Separating PTWs from automobiles might help increase mobility, maximize capacity, and reduce or mitigate accidents. However, how to design and regulate PTW lanes in the local context has not been fully addressed. This paper aims to analyze the characteristics of PTW-only lanes in comparison with mixed traffic lanes to show the advantages or even necessity of introducing PTW lanes, as well as to recommend guidelines for designing PTW-only lanes in urban areas. To study the efficacy of PTW lanes, video-based observations were conducted on three PTW-only roads and one mixed traffic road in Ho Chi Minh City, Vietnam, to ascertain the fundamental relationships between traffic volume, speed, and density. A microscopic simulation model using VISSIM was calibrated to simulate the operational characteristics of traffic flows. The capacity of a PTW lane was then determined with respect to the number of lanes and lane width. The state of the practice on a PTW lane system was reviewed to establish a set of components and design and evaluation principles for the system in Vietnam. The study outcomes support efficient reallocation of existing road spaces and effective design of new roads for better urban mobility.

Keywords Powered two-wheelers (PTWs) · PTW lanes · Fundamental traffic flow diagrams · Road design · Vietnam

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1 Introduction

Powered two-wheelers (PTWs) have become a popular mode of transportation in urban areas of many developing countries because of high mobility and affordable prices. Approximately, 80% the world's PTWs are in Asia, of which more than 80% are in Southeast Asian countries. PTWs and automobiles share the same road spaces, leading to mixed chaotic traffic flows and traffic accidents involving PTWs. There is a strong need to separate PTWs from automobiles to enhance safety and improve road capacity. Road infrastructure in Asian countries, however, is still limited, thus hindering opportunities for increased use of lane separation for PTWs. This manuscript intends to address two issues. First, under what conditions should separate lanes for powered two-wheelers (PTWs) be designed? Second, what standards should be used to design separate PTW lanes? These questions could result in a timely contribution because 90% of road traffic in Vietnam is composed of PTWs, but the road system was designed based on the needs of car traffic. Thus, the system could be improved and facilitate improved movement of traffic with increased safety. Despite a number of studies on PTW traffic (Radin et al. 1995; Law et al. 2005; Putranto et al. 2011; Hussain et al. 2005, 2011), these questions have yet to be adequately addressed. This study aims to address such questions following a study framework shown in Fig. 1. The present study classifies PTWs into two types: small-displacement PTWs with cylinder capacity smaller than 150 cc that are the most popular in developing countries and large-displacement PTWs with cylinder capacity larger than 150 cc. The present study considers the small-displacement PTW as a basic unit in the investigation.

First, we review previous studies on the state of the art and the state of the practice on powered two-wheeler lanes in a number of countries including Vietnam, Malaysia, China, and India to provide information on regulations and design standards for PTW lanes in these countries. Second, we describe our empirical study in Ho Chi Minh City, Vietnam, which included a field survey and a micro-traffic simulation to understand how the PTW flows work and to comparatively check the impacts of PTW lane designs under specific traffic situations. Finally, we present a general guideline for the PTW lane design based on the results of a literature review and an empirical study.

2 The State of the Art and the State of the Practice on Powered Two-Wheeler Lanes

2.1 PTW Lanes in Vietnam

Despite the fact that PTWs contribute more than 90% of road vehicular traffic, they are still not considered a fundamental mode in road design specifications and standards. In the Vietnamese National Urban Road Design Specification (2007, abbreviated as

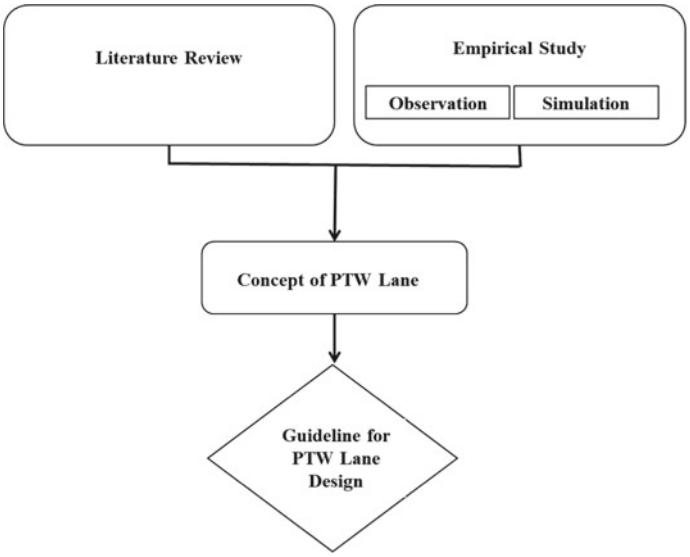

Fig. 1 Study framework

TCXDVN 104-2007), road class, design speed, number of lanes, and lane width are determined based on car traffic, not on the PTW mode of transportation.

In fact, TCXDVN 104-2007 was based on studies from developed countries and applied the car traffic concept to mixed traffic conditions. It does not reflect the impact of the conflict between PTWs and four-wheeled vehicles. Table 1 presents the lane width design standard for Vietnamese urban roads. As result, inappropriate designs, such as lane width, on urban roads may cause reductions in speed and capacity and increases in road accidents. On major roads, separated lanes for PTWs are sometime applied, but the number of lanes and lane width seem to be inadequate or not well designed. Figure 2 illustrates mixed lanes and separated lanes in Vietnam.

Table 1 Lane width design in Vietnamese urban roads

Road type		Desired speed (km/h)								Number of lanes	
		100	80	70	60	50	40	30	20	Minimum	Expected
Urban highway		3.75			3.5					4	6–10
Urban	Major street				3.5					6	8–10
Road	Minor street			3.5						5	6–8
Collection road					3.5		3.25			2	4–6
Internal road							3.25	3.0 (2.75)		1	2–4

Source TCXDVN 104-2007 (2007)

Fig. 2 Mixed lanes and separated lanes in Vietnam. *Source* Authors

There are several studies on traffic performance and the fundamental relationship between speed, flow, and density with mixed flows and separated flows. Minh et al. (2005) examined the relationship between PTW speed, volume, and headway under various road conditions. Observations were conducted on two exclusive PTW roads and two mixed flow roads. It showed that the exclusive PTW lanes had significantly higher average speeds than the mixed traffic lanes. Even with wider lanes, the average speed of mixed traffic is still lower than that of separated traffic given the same traffic volume.

2.2 PTW Lanes in Malaysia

On some expressways and highways, separate lanes for PTWs have been introduced. However, there is no design specification for exclusive or inclusive PTW lanes in Malaysia (Law and Sohadi 2005). The only guidelines available are for designing an exclusive PTW track, based on bicycle tracks.

Nevertheless, dedicated lanes for PTWs have been proved to be effective. Radin et al. (1995) found a significant reduction (39%) in PTW accidents when an exclusive road for PTWs was provided between the Subang International Airport and the towns of Shah Alam and Klang, Malaysia. This is considered the first PTW exclusive lane in the world. Law and Sohadi (2005) showed that an exclusive PTW lane needs a control width of 3.8 m (inclusive of a marginal strip of 0.4 m at both edges of the road) for two riders to travel side by side comfortably at a speed of 70 km/h. Sohadi and Barton (1997) found that provision of an exclusive PTW lane is highly cost effective in reducing PTW accidents in countries with high PTW use.

2.3 PTW Lanes in India

In India, PTWs are predominant on streets. Their use increased rapidly over the past three decades and in the early 2000s represented around two-thirds of all vehicles

(Badami and Iyer 2006). In most Indian cities, roads do not actually have separate lanes and vehicles do not follow the lane discipline because of a high number of junctions and high traffic flows of different vehicle types. There are some efforts to introduce dedicated lanes for PTWs. Visakhapatnam City, for example, has considered constructing exclusive PTW lanes on two important roads, where PTWs contribute to more than 50% of traffic volume. The project is estimated to have very good economic returns in terms of time and fuel savings (Raju et al. 2014).

2.4 Challenges

PTWs are a dominant transport mode in many Asian cities and will continue to grow in popularity because of their high mobility and low cost. But a major problem with PTWs is traffic accidents, particularly those involving conflicts between PTWs and automobiles. To help address this challenge, exclusive PTW lanes have been developed in a number of countries, such as Taiwan, Malaysia, and Vietnam. Previous studies have proved the benefits of introducing exclusive PTW lanes in terms of safety, travel cost, and speed. However, specific guidelines for designing and operating exclusive PTW lanes are yet to be set up in most developing countries in Asia. Currently, only Malaysia has developed a guideline for PTW track design, but those design parameters are not appropriate for PTW lane design. India has not yet developed a guideline for PTW track design, although it has made some efforts to introduce dedicated lanes for PTWs as trials. From a practical point of view, there is a need to develop design guidelines for exclusive PTW lanes to ensure PTW safety, speed, capacity, and riding comfort. Therefore, the present study aims to develop design guidelines for exclusive PTW lanes to ensure PTW safety, speed, capacity and riding comfort.

3 Empirical Study on Powered Two-Wheeler Lanes

3.1 Data Collection

To better understand the PTWs' characteristics under current traffic situations, field surveys were conducted at four locations in Ho Chi Minh City, Vietnam, in 2016. The aim of the field surveys was to figure out the fundamental dynamics of traffic flow and the relationship between traffic volume, speed, and density of PTWs in various situations. Traffic flows comprise various kinds of vehicles, including heavy vehicles, small commercial vehicles, cars, vehicles with small engines, motorcycles, bicycles, and so on. Normalized capacity is the capacity per meter wide of the vehicular lane (Nguyen 2020). Flow speed is the average speed of vehicles on a given segment,

measured under low-volume conditions (TRB 2010). Density is the number of vehicles occupying a given length of a lane or roadway at a particular instant. Platoon is a group of vehicles or pedestrians traveling together as a group, either voluntarily or involuntarily, because of signal control, geometries, or other factors.

The relationship between the fundamental variables of traffic flow, namely speed, volume, and density, is called the fundamental relation of traffic flow. The relationship between the speed and the flow can be postulated as follows. The flow is zero either because there are no vehicles or there are so many vehicles that they cannot move. At maximum flow, the speed is between zero and the free-flow speed. The speed–density relationship is linear with a negative slope. Therefore, as the density increases, the speed decreases. The speed reaches approximately zero when the density equals the congestion density (Mathew and Rao 2007).

Moreover, surveyed results are an input to a micro-traffic simulation model. The four road sections under survey include Pham Van Dong, Hoang Van Thu, Vo Van Kiet, and Truong Chinh. The characteristics of the road sections are depicted in Table 2. An illustration of the road sections is presented in Fig. 3.

Table 2 Characteristics of four surveyed road sections

Road Name	PhamVan Dong	VoVan Kiet	Truong Chinh	Hoang Van Thu
Lane type	Separated lane	Separated lane	Separated lane	Mixed lane
Survey day	01/Nov/2016	02/Nov/2016	14/Nov/2016	03/Nov/2016
Survey time	5:30 AM–9:30 AM	5:30 AM–9:30 AM	16:25 PM–18:25 PM	5:30 AM–10:00 AM
Weather Condition	Good	Good	Good	Good
Road direction	Thu Duc Market—Binh Loi Bridge	National Highway 1A—Thu Thiem Tunnel	Truong Chinh—National Highway 1A	Phan Dang Luu—Cong Hoa
Length of road surveying (m)	50	80	50	80
Lane width L1 (m)	3.00	3.00	3.00	2.20
Lane width L2 (m)	3.00	3.50	2.60	3.50
Lane width L3 (m)	–	–	2.50	3.50
Total of lane width (m)	6.00	6.50	8.10	9.20
Level of congestion at Peak hours	High	Middle	High	Middle
Number of samples	290	266	200	270

Fig. 3 Traffic flows on the four surveyed road sections. *Source* Authors

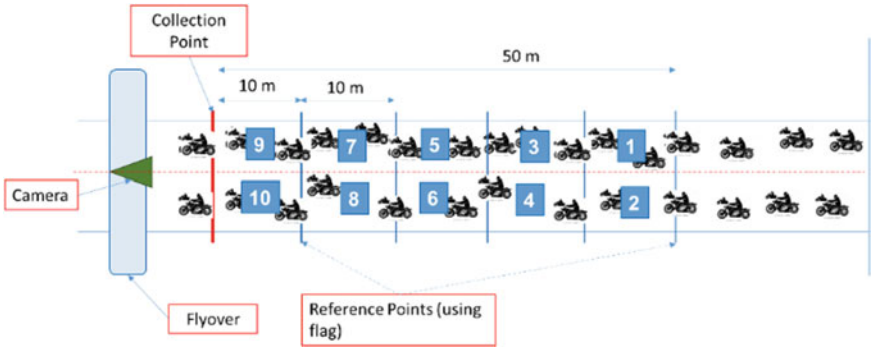

Fig. 4 Depiction of data collection method. *Source* Authors

Our method for traffic observation is as follows. The observed section is 50 m back from the collection point for the determined traffic direction. Within the section, subsections 10 m long were divided by the collection point and reference points. Figure 4 depicts the method for data collection on a two-lane road. Cameras were installed at a high position (e.g., a flyover) to cover the traffic flow on each lane of the surveyed road. By counting the number of vehicles in each lane within the observation section, traffic density can be calculated. Traffic volume can be determined by counting the number of vehicles passing the collection point during an observation period. Furthermore, flow speed can be determined by recording the time it takes a representative vehicle to move through the section.

The morning interval for surveying is 4.5 h, and the afternoon is 2 h. The hour that has the most traffic in each peak hour period was selected for the analysis.

3.2 Data Analysis

Cumulative speed distribution by lane

Figure 5 shows cumulative speed distributions by lane. Lanes are numbered from the right to the left of the moving direction. In the case of PTW-only roads, the speed on left lanes is always higher than the one on right lanes, reflecting the fact that slower

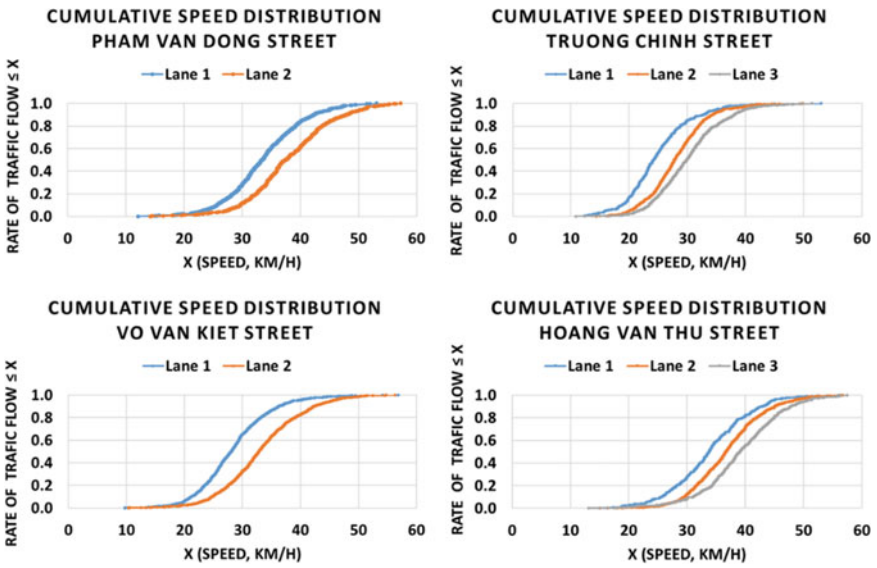

Fig. 5 Cumulative speed distribution by lane

PTWs tend to run in the right side of the road and the faster ones choose to run in the left side. More specifically, the operating speed at the 85th percentile on the slow lane (Lane 1) is around 30–40 km/h, and on the fast lane (Lane 2), it is around 35–45 km/h. This finding suggests that the road should be wide enough to allow fast PTWs to run on the left side.

PTW flow–speed–density relationship

Density–flow relationships are presented in Fig. 6. On the mixed traffic road, cars and buses were converted to equivalent PTWs by using the value of 4 for a car and 14 for a bus, the Vietnamese specification from TCXDVN 104-2007. It shows a linear relationship between the flow and the density. However, it does not show the maximum flow at which the curve starts going down (i.e., the congested condition). When comparing the volume between lanes at the same value of density, the faster lanes seem to have a higher flow than the slower lanes.

The speed may not depend on the flow, as shown in Fig. 7. Under the same density condition, speeds can vary widely depending on driver preference. This means that there are even slow and fast vehicles in the same lane.

Figure 8 shows the relationship between density and speed. The literature often shows that as density increases speed decreases, but under uncongested conditions, such a relationship is not seen. Drivers could choose their driving speed freely.

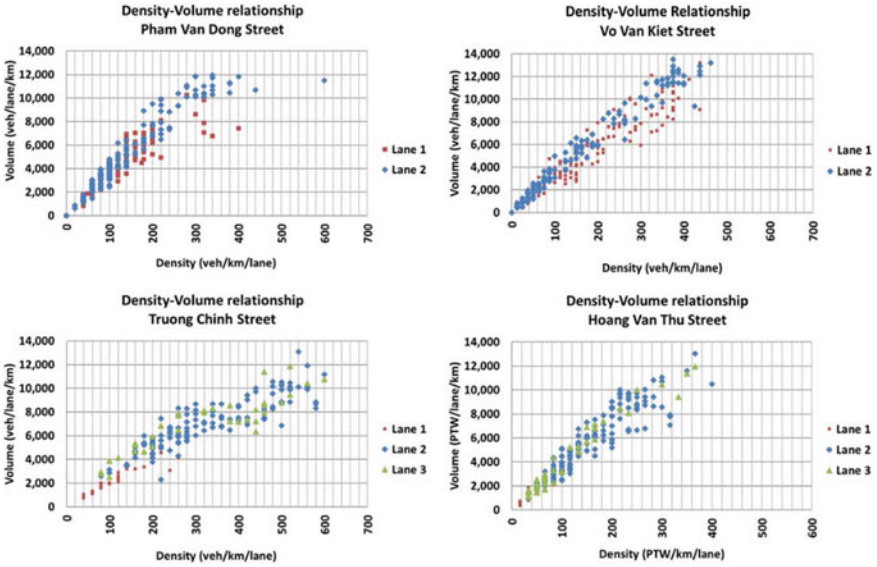

Fig. 6 PTW density–flow relationship

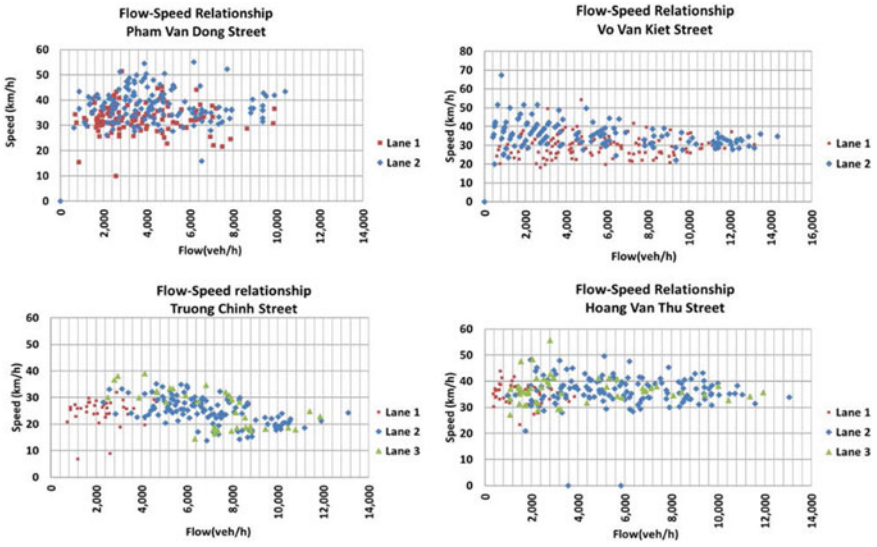

Fig. 7 PTW flow–speed relationship

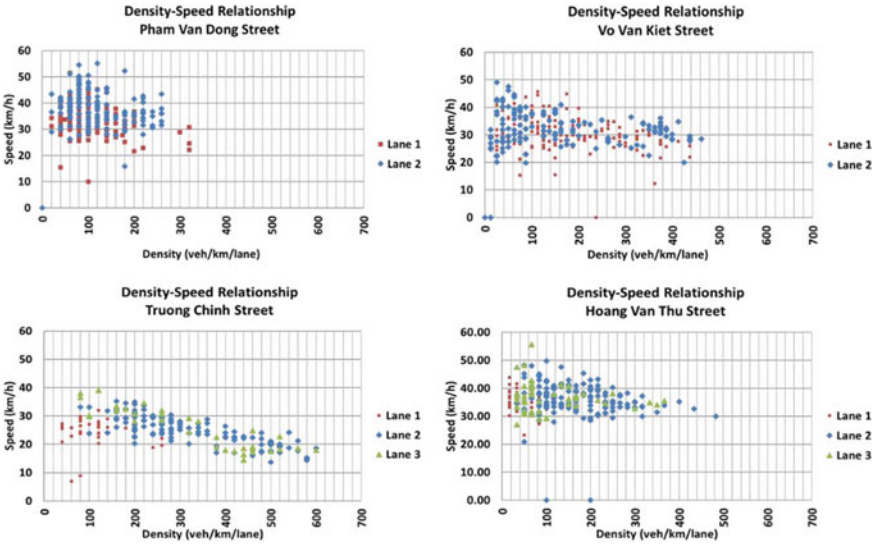

Fig. 8 PTW density–speed relationship

3.3 Simulation of PTW Lane Performance

Traffic simulation was conducted to fully understand the fundamental relationship of PTW flows and to support PTW lane design in a specific situation. Observational data was used to build the simulation model in the software VISSIM 5.40. The model was calibrated and validated by changing key parameters, including speed characteristics and driving behavior. To find out how lane width might influence capacity, scenarios were developed according to lane width, including widths of 1.7, 2.5, 3.0, and 3.5 m.

Figure 9 shows the simulated relationship between density and volume. The saturation flow rate on a 1.7 m road is much lower than that of other roads because PTWs run in platoons. On such a narrow road, there is not enough lateral distance for PTWs to overtake each other. Table 3 shows a comparison of normalized capacity between the scenarios. The normalized capacity of a 3 m road is the highest, while that of a 1.7 m road is the lowest. Road design in reality should avoid roads narrower than 1.7 m to protect capacity. In general, the 3 m-wide lane should be considered the best design option in terms of capacity. With narrower lanes, drivers tend to drive closer together. When the design lane is wider than 3 m, motorcyclists tend to go faster, so a larger space is required, which results in fewer vehicles crossing a cross-section than with a 3 m lane. However, lanes 2.5 and 3.5 m wide are also possible choices.

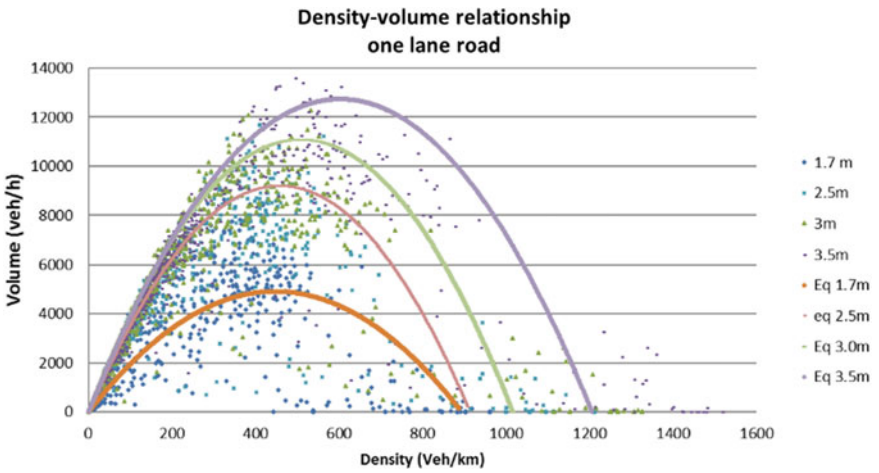

Fig. 9 Density–volume relationship on one-lane roads

Table 3 Capacity of one-lane road scenarios

Scenarios	Lane width (m)	Capacity (PTW/h)	Normalized capacity (PTW/h/m)
T1-S1	1.7	4,919	2893
T1-S2	2.5	9,213	3685
T1-S3	3	11,103	3701
T1-S4	3.5	12,738	3640

4 Guidelines for PTW Lane Design and Evaluation

This section explains general guidelines and design elements of a PTW lane system to ensure safety, mobility, capacity, and riding comfort. A PTW lane system includes dimensions of roadway sections and intersections and feature of auxiliaries.

4.1 Dimensions of Roadway Sections

The width of a PTW lane normally varies from 2 to 3.5 m. In this study, the results show that 3 m lane width can deliver the highest capacity. Radin and Edward (1997) and Law and Sohadi (2005) suggested a road of 3.3–5.2 m wide to improve the outcome of cost and benefit analysis. Law and Sohadi (2005) suggested an exclusive PTW lane 3.8 m wide, including a marginal strip of 0.4 m at both edges of the lane for comfortable side-by-side riding at a speed of 70 km/h.

In Taiwan, the width of mixed traffic roads ranges from 3.5 to 5.5 m and 4.5 m on average (Hsu et al. 2009). The rationale is that a base lane for automobiles is 3 m

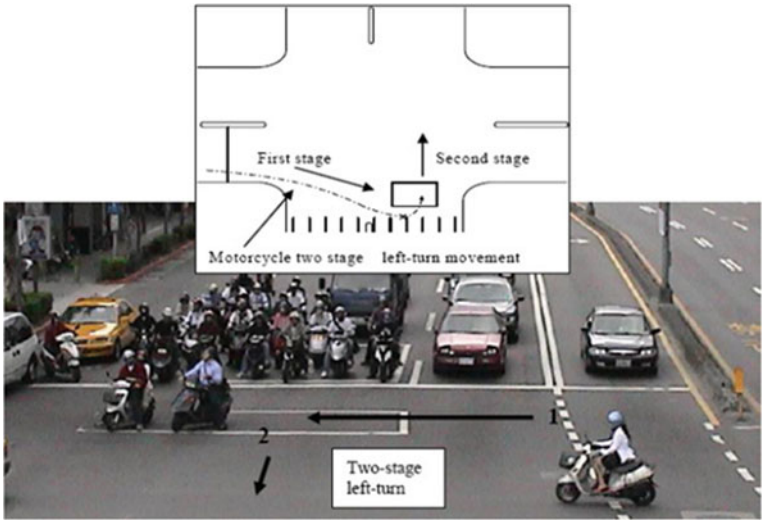

Fig. 10 Two-stage left turn for PTWs in Taiwan. *Source* Wang (2014)

wide and a driving dynamic width needed for PTWs is roughly 1.5 m. However, Hsu et al. (2009) suggested a narrower width (3.5–4.0 m) with consideration for safety and environmental concerns.

4.2 Dimensions of Intersection Sections

At intersections, PTWs usually have to mix with other vehicles. To accommodate safety and comfort for PTWs making a left turn, a two-stage left-turn regulation was implemented as it was first applied in Taiwan in 1984. According to this regulation, left-turning PTWs need to cross straight to a painted PTW-only box and wait there for a traffic signal as seen in Fig. 10 (Wang 2014). At intersections with limited space, it should be carefully investigated if there is enough room to implement a two-stage left-turn PTW waiting zone.

4.3 Road Auxiliaries

Pavement markings: Proper markings on the pavement should be set up to regulate, warn, and advise road users of dangers ahead of them. Pavement markings include lines, words, text, arrows, and other markings painted on the roadway.

Traffic signs: Traffic signs regulate, warn, and advise road users of the dangers ahead of them. Signs and their locations are of fundamental importance to users,

as they give ample time to act after seeing the signs. On PTW lanes with a design speed of 60 km/h, the signs need to be located at least 50 m from the point of danger. Guide signs, in particular, should be located 1 km from 500 m in advance of the turning roadway. Normally, PTW lanes can use all traffic signs; however, warning signs should be placed on the main road and at the entrance and exit of PTW lanes.

4.4 Evaluation Framework for a PTW Lane System

It is important to ensure that PTW lanes are designed to provide a safe, efficient, economical, and environmentally compatible traffic system. This subsection describes a general framework for evaluating the effectiveness of PTW lanes.

Safety criteria

Safety is a principal design consideration. The safety level of traffic flow between lane sharing and separate lanes must be considered the top priority. Other safety considerations include traffic flow, average speed, speed variations, the number of lane changes, and PTW accident frequency.

- **Traffic flow**: A higher traffic flow would create higher exposures and lead to a higher risk of vehicle collisions.
- **Average speed and speed variations**: Higher speeds lead to a greater risk of vehicle collisions and a greater probability of being seriously injured. A lower desired speed and small variations in speed increase safety.
- **The number of lane changes**: A lower number of lane changes contribute to a higher level of traffic safety.
- **PTW accident frequency**: Accident frequency is a key criterion of safety evaluation. A higher frequency from historical accident data would increase the need for lane separation between PTWs and automobiles.

Environmental criteria

The effect of PTW lanes on the environment may be consistent with the traffic flow. Separated planes for PTW lanes allow PTWs and automobiles to run independently and hence increase flow speeds. Speed changes occur more frequently in mixed traffic flows than in homogenous traffic flows and thus may contribute to reducing noise and emissions.

- **Exhaust emission**: The amount of exhaust emission could be considered a criterion in the evaluation framework. Lower amounts of emission improve the environment.
- **Noise emission**: Since noise has a significant impact on health, it should be considered a criterion for the evaluation.

Economic criteria

Economic benefits of separate lanes for PTWs include reductions in accidents, fuel consumption, and travel time. Costs are incurred in construction, operation, and maintenance of PTW lanes. To evaluate the effectiveness of PTW lanes from an economic perspective, it is necessary to quantify such benefits and costs. The traditional CBA method helps predict whether the benefits of an alternative outweigh its costs, and by how much relative to other alternatives (Cellini and Kee 2010). The higher ratio of benefits to costs shows the effectiveness of separating PTWs from automobiles in the local context.

5 Conclusions

This study has provided an overview of PTW lane practices in Vietnam, Malaysia, and India. PTW lanes have been shown to improve capacity, travel speed, and safety. The empirical study in Vietnam has developed the fundamental dynamics of PTW flow, speed, and density to set a scientific basis for planning, designing, and regulating road infrastructure in developing countries, where PTWs are popular. It found that a 3 m-wide road may have a capacity of up to 11,000 PTWs per hour, and a lane 3 m wide is recommended as a standard lane width for PTWs. It has also drafted guidelines for designing and evaluating PTW lanes to ensure safety, mobility (e.g., speed and capacity), and riding comfort. The results support efficient reallocation of existing road spaces and effective design of new roads for better urban mobility, especially in the context of rapid urbanization and development taking place in developing Asian countries. A next step of this study is to develop detailed guidelines on the design of road sections, intersections (including traffic signal control), and auxiliaries, and evaluate their effectiveness.

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Part IV
Concluding Thoughts

Asian Urban Transformation: Emerging Impressions and Future Research

George M. Pomeroy and Debnath Mookherjee

Abstract This volume represents a selection of contemporary research studies on aspects of Asian urban transformation by a diverse, multidisciplinary group of Asian scholars. In this concluding chapter, we offer a succinct account of our impressions gained from these contributions, along with a look to the future. Signs of shifting theoretical and planning paradigms relating to Asian urban transformation and a search for interconnections among the discourses, as discussed in chapters "Asian Urban Transformation: The Shifting Paradigms", "Planning Traditions and Urban Development in the Transformational Landscapes of Asia: An Overview of Presented Papers", and "Multifaceted Ideas and Approaches: An Overview of Presented Papers", are recognizable in many of the papers, albeit often implicitly. We observe that a phenomenon at the intersection of scholars, practitioners, and stakeholders may be taking place in many Asian countries, which may play a catalytic role in blurring dualisms and propelling these changes. We note a mix of five major foci, issues, and approaches that emerge in the volume, pointing to some common frameworks within the complex transformative patterns in the evolving urban landscapes of Asia. Together, they suggest the need for collaborative and comprehensive urban development research within the intra- and interregional contexts of Asian countries. To this end, we conclude with a proposal for an Urban Research Consortium, in the belief that a well-focused and concerted research base, as a prerequisite for informed and evidence-based strategic planning approaches to Asian cities and their hinterlands, can help meet the formidable challenges of a transforming Asian landscape.

Keywords Transformational dynamics · Participatory approaches · Urban research consortium · Urbanizing territories · Strategic planning

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1 Introduction

The global shift in trends of urbanization, as evidenced by the growth and spread of population in cities and regions, has introduced a new phase in Asia's urban development research and planning. The urban transformational phenomenon is a universal process, but its nature, pace, and consequences have varied over time and space. One of the fundamental questions (and its corollary query), raised by the shift in the urbanization trend from the developed to the developing countries of Asia is this: Are the transformational paths of the Asian countries supposed to follow those observed in the West and if so, can we follow the ways of the West in managing them? Despite some theoretical approaches that argue otherwise, there appears to be a growing recognition that Asian urbanization is a unique phenomenon. Asian urbanization is a complex set of diverse, intertwined, multidimensional phenomena, and a host of socioeconomic, political, cultural, historical, and other factors attributable to the 'time–space effects' can be said to account for much of its complexities. From this standpoint, even the term 'Asian urbanization' ought to be questioned. The diverse nature of the developmental processes and patterns, growth trajectories, environmental challenges, and coping mechanisms experienced within and among the individual Asian countries defy facile generalization. The urban transformational process in various Asian regions cannot be viewed as a uniform, linear, sequential, and Western template-based process, but as a messy, uneven, non-linear one facing an onslaught of *simultaneous* and uneven challenges in diverse time–space scenarios unwitnessed in the history of urbanization. Many of these challenges, in the form of the undesirable consequences of urbanization on the urbanizing territories, are evident in the academic literature, media reports, and more importantly, in the day-to-day observations and experiences of communities. The 15th Asian Urbanization Conference provided us the motivation to undertake this project to unpack some of the intricacies of the transformational phenomena by exploring a set of papers that illustrate various aspects of the emerging patterns in the context of some Asian regions.

Before individual contributions were presented in Parts II and III of the volume, an overview of some of the paradigm shifts taking place in urbanization concepts was offered in the Introduction to the volume (Part 1). As discussed, some of the indications of these shifts in approaches to the time–space variations in the urban pathways and patterns are reflected in a tendency to move away from path-dependency by looking for more individualized solutions and to search for common grounds among diverse conceptual strands such as sustainability and livability in the context of land and infrastructure, among others. Similar observations on the evolution of planning traditions toward more integrative or hybridized approaches are made in the introduction to Part II, which discusses the chapters in terms of their (typically implicit) theoretical frameworks and draws attention to how they represent a wider cross-section of theoretical perspectives. At the same time, areas of consilience are recognized, particularly with respect to the concepts of livability and sustainability. A question raised, but not addressed, is how planning-related research can inspire

and inform further innovations in planning theory. The introduction to Part III also recognizes this search for a more integrative approach to finding innovative solutions to livability concerns that would also be sustainable and comes to the conclusion that 'As cities and their components keep growing and changing, the search for sustainably optimizing urban livability requires a more integrative approach to the different aspects of sustainable development.' Together, the studies point toward signs of changes in urban and planning theories and concepts that have a direct bearing on all other related discourses pertinent to Asian urbanization. Arguable as it may be, it can perhaps be stressed that these changes have been aided by studying 'what cities tell us', primarily through theoretical and applied research. A wealth of knowledge within and across these realms has thus been produced in recent decades in the context of Asia, which also reflects some of the conceptual shifts taking place among the academic and planning communities.

2 At the Intersections of Scholars and Practitioners

In this context, it can perhaps be ventured that concurrent to the conceptual shifts and playing an important catalytic role in them, a phenomenon at the intersection of scholars, practitioners, and stakeholders may be taking place in many Asian countries. Tentatively for this discussion, and for want of a better term, we refer to this as a form of 'sociological transformation'. Our interpretation of this phenomenon acknowledges that knowledge production and social inquiry are conducted within communities of scientists, complete with flaws and foibles (Diesing 1991) and that the sociology of scientific communities has a profound impact on the generation of knowledge. Several specific 'factors' loom large, and we feel that it is critical that they are acknowledged and understood because of their potential roles in driving the discourses on Asian urban transformation and urban developmental planning for the foreseeable future. Before noting a few examples of such factors, however, a few words to explain the premise of our thinking (as non-sociologists) may be in order.

The roles of social factors, communities (of 'scientists'), and/or human actors as the source(s) and influencer(s) in the production process of knowledge ('science'), and whether that influence extends to the 'content' or not, have long been widely discussed and debated within the fields and sub-fields of sociology, primarily among macro and micro-sociologists (Giesing 1992, 149–181). The intricacies and nuances of this discourse, such as the arguments advanced by the Mertonians and the anti-Mertonians, and their diverse interpretations, are beyond our scope (and expertise).[1] Suffice it to say that the general sociological idea of a close connection between conceptual development over time and space and the social influence on human

[1] A wealth of literature is available for the reader interested in pursuing this line of thought. As social scientists from outside the field of sociology, we were intrigued by Diesing's (1991) insightful (as well as likely arguable and provocative) treatment of the dynamics of macro and micro-sociology as reflected in practice, especially in terms of understanding the role of social factors in the context of the multi-faceted transformational dynamics that appear to be taking place in Asia.

actors living and learning in the wider society, as well as interacting within their narrower communities of shared interests, traditions, institutions, or values, has long resonated with our thinking, which, in turn, is also supported by our observations. The following words, broadly interpreted, explain part of this connection as we see it:

> Science is an activity of human beings acting and interacting, thus a social activity. Its knowledge, its statements, its techniques have been created by human beings and developed, nurtured and shared among groups of human beings. Scientific knowledge is therefore fundamentally social knowledge. As a social activity, science is clearly a product of a history and of processes which occurred in time and in place and involved human actors (Mendelsohn 1977, 3–4, as cited in Diesing 1991, 149).

Viewed from this perspective, it can perhaps be argued that one important factor behind the explosion of new ideas and the shifting outlooks across discourses on subjects such as the trajectories and patterns of Asian urbanization, and urban and regional planning strategies involving land, infrastructure, livability, and sustainability, is the expansion, growth, and development of the universities and other academic institutions in Asia, particularly the 'rise of graduate education and university research' (UNESCO 2014). The increases in capacity, both in general terms (more institutions with better funding), intellectual terms (better education, curricula, and training), and resources for cross-fertilization of ideas, may have helped to develop and innovate upon ideas, even to the point of supplanting the Euro-American dominance of the intellectual discussions.

A second and closely related factor is the development of social capital among stakeholder communities (including university-based, governmental, and civil society) and across disciplinary boundaries, both within and between metropolitan regions, countries, and multi-national and international contexts. A plethora of conferences, symposia, academic exchanges, and collaborations provide ample evidence of such social capital, as does the emergence of topical journals and book publications emanating from these activities.[2] Just a few of the illustrative institutions include the Asian Urban Research Association (AURA) Conference series (including the 15th Asian Urbanization Conference, where the initial versions of the papers selected for this volume were presented), the Asian Planning Schools Association (APSA), and the Asian Geography Specialty Group of the American Association of Geographers (AAG).

Closely paralleling the first two factors is an emerging tendency toward the dissolution of disciplinary boundaries, as observable in the academic literature. Urban studies are inherently interdisciplinary; geography is rich in cross-disciplinary engagement, and planning employs theories, concepts, and ideas from other disciplines, often termed 'theory in planning' (as opposed to 'theory of planning').

[2] It should be remembered that these academic engagements are in keeping with the traditions documented by scholars such as Norton Ginsburg, Ted Koppel, Terry McGee, Dean Forbes, Michael Douglass, and many others who helped formulate, reformulate, and shift ideas on Asian urbanization, especially pioneering in their approach of looking beyond the cities into the extended metropolitan and *desakota* areas and city-regions of Asia.

Another factor is the emergence, recognition, and acceptance of broader notions of civil society, along with expanded notions of governance and public participation. Across many areas, including environment, sustainability, community development, and planning, many grassroots and nonprofit organizations have emerged to fill the voids where little or no institutional capacity exists. In some communities, civil society organizations are the leading entities in addressing issues and martialing change.

The signs of a shifting of the theoretical and planning paradigms relating to Asian urbanization and those of a 'sociological transformation' taking place at the intersections of the communities of students, academics, and practicing planners in Asia (influencing, and being influenced by the former) are encouraging. Together, they can be expected to foretell the emergence of a vibrant and cohesive, multi-, inter-, and trans-disciplinary discourse on, and a multi-sectoral, participatory, and interactive approach to, Asian urbanization. However, as the stakeholders (and the academic, planning, and popular literature) would tell us, and also as revealed in several chapters of this book, there are many intertwined and complex issues with scalar and contextual variations that defy simple, short-term, or single-focused solutions, which may cast a shadow on this rosy picture.

From this standpoint, the empirical studies across the 31 chapters of this volume inform us of the many traits, insights, commonalities, and differences in the patterns within and among the Asian countries, improving our understanding of the many intricacies of complex urbanizing phenomena. Collectively, they point to the dynamic transformations occurring across the fields of urban theory, urban and regional planning, and sustainability. Coming as they did out of a conference and taken together, these empirical studies range widely in topical focus, perspective, scale, and scope. They rarely are direct or explicit in presenting or addressing the transformations or even their respective theoretical underpinnings, yet implicit within them is evidence of the vibrant discussions and debates taking place across these and other intersecting realms. We contend that with a coordinated approach and a well-defined agenda, spatially diverse empirical studies such as these can be expected to aid in the production of further knowledge and in generating data to add to the inter-connected discourses toward developing new thoughts, planning, policy-making, and strategizing for future research on sustainable urban development. In this vein, in the next section, we briefly note a few thoughts or impressions derived from the empirical studies, concluding with a proposal for a concerted research approach.

3 The Empirical Studies: Insights into the Transforming Urbanizing Territories

The empirical studies in the context of various city-hinterland arenas—the very frontiers of the Asian urban transformational or transitioning territories—reveal diverse characteristics of the changing landscapes and the interlinked elements of the spatial

and socioeconomic features of the land, people, and settlements. Many of these elements are directly or indirectly related to the unintended consequences of urbanization affecting the quality of life of the residents and deterioration of the natural environment. The foci and the contexts of the individual contributions are discussed earlier in the respective introductions to Part II and Part III; only the impressions they have left with us are briefly noted below. As noted, we aimed to offer a metaphorical lens of varied theoretical and planning approaches and changing ideas to the reader for taking an analytical look *at*, and *beyond*, the individual research papers. In addition to being drawn to a particular theme addressed, a research venue explored, a methodology employed, or an outcome revealed from a contextualized standpoint, we hope the lens we offer motivates the reader to look for the 'bigger picture' transcending the immediacy of the space and time parameters.

The impressions we offer below[3] may supplement, corroborate, or even contradict those the reader may have gained out of the collection of works. That is how it should be. That is how conversations start.

- *Land and infrastructure* appear to be at the center of focus of all or most of the papers, which echo the 'universal truth' that compared to the demand for land for shelter, food, amenities, infrastructure, and other needs generated by a growing and urbanizing population, supply always falls far short, both within and outside of the large cities in Asia. Generally, utilization of vertical scale prevails to meet the space demand for the city's core areas, whereas redistribution efforts of people and activities alter the horizontal scales of the urban built-up land. In contrast, changes in land use in the city-hinterland territories amid the expansive and scattered hybrid transformational landscapes tend to occur mostly at the horizontal scale, although the prevalence of skyscrapers (newly constructed or under construction) in the outskirts of many Asian cities is increasingly evident. At any rate, as reflected in the research focus of some of the presented papers, the search for optimal utilization of land for various purposes at both vertical and horizontal scales takes on a vital role in urban planning in and around these cities. Concurrently, as the studies show, issues such as unclear boundaries, ambiguities in land use and land regulation and guidelines including those on landowners' rights, gaps between land use policies and practice, land speculation loopholes, and others tend to plague planners and citizens alike.

  Somewhat surprisingly (although from the perspective of the 'sociological transformation' as discussed above, perhaps it ought to be less so), in spite of the engineering-intensive background of many of the scholars, a sizable number of papers speak to non-engineering or alternative solutions. These include suggestions for (a) regulating land use instead of building flood control mechanisms and considering 'green' infrastructure instead of relying on the traditional 'gray' infrastructure that has been traditionally pursued in urban planning in Asia, (b) inclusion of 'soft' or 'non-physical' infrastructure (e.g., educational, social, financial services; those involving human/social capital, etc.) into 'hard' infrastructural

[3] Not presented in any order of importance.

considerations (e.g., housing, roadways, sewage system, etc.), (c) integrating the various gray, brown, green and blue infrastructural categories in pursuing a trans-sectoral approach, as well as (d) exploring 'green' development (e.g., green façade, green vegetation, green/open space, etc.) from diverse sociocultural, ecological, and planning perspectives.

- *The traditionally dichotomous approaches to the territorial frame* (urban/rural, city/hinterland), have long been discredited in favor of considering the 'whole' entity, constituting the core city and the urbanizing territories. The argument is growing that this entity is not simply the sum of the parts; that the urban core and the lands at its outskirts should be considered together as one evolving system. The scale at which the transformational phenomena unfold, and the urbanizing features evolve, is a complex spatial hybrid entity with differing interlinked elements of sociocultural characteristics of people, as well as differences in governmental structures, land use rules and regulation, land ownership, and administrative functions of private and public agencies within and among Asian countries. Aspects of this understanding and its planning implications appear to be reflected in some of the studies, which is encouraging, as it implies a move toward more holistic approaches to the city and the hinterland as a territorial unit for planning.
- *Governance and jurisdictional issues*, in the forms of fragmentation, overlap, competition, and conflicts of interest across both horizontal and vertical scales, have made their presence known throughout the volume, not always explicitly. A common and age-old problem in tackling issues related to cities and urbanization has to do with scale and jurisdiction in governance. Many of the problems addressed within this volume are regional in nature, with no clear territorial demarcations, and not easily addressed at any one scale. It remains a problem to tackle issues in a comprehensive, collaborative, and complementary fashion without speaking to issues of scale and jurisdiction. Compounding this is the evolving nature of governance. Broader notions of governance involving greater stakeholder authority and the efforts of non-governmental organizations (NGOs) have tremendous advantages in achieving improved public engagement, creative and cost-effective programming, and a better understanding of issues. However, these evolutions may also bring greater complexity and longer horizons to planning efforts.
- *Collaborative and participatory planning ideas* (including integrating the target population in the planning/ designing process of specific amenities or infrastructure intended for them), instead of (or in addition to) top-down planning approaches, appear to be gaining recognition in Asia. While only a few papers have explicitly highlighted the need for a more participatory form of planning, the need for such an approach is implicit in others. Implicit also in many papers is the assumption that stakeholder engagement, and participation by (or at the very least, input from) an informed public in the planning process, produces not only better plans but also builds social capital and speaks well to 'planning with' versus 'planning for.' Interestingly, authorship of many of these chapters comes from engineering programs, which traditionally privilege technical expertise.

- Finally, *arguments for simultaneity over sequentiality* in addressing the Asian urban transformational phenomena appear more convincing as we study the contributions. The varied developmental concerns reflected across the spaces of the selected city-hinterland landscapes, as revealed in the presented papers, depict a multidimensional array of issues or developments differing in types, scales, and intensities, but which are occurring simultaneously or within a much shorter time span than experienced in the West. Although the research studies are not temporally oriented, this pattern supports the notion of simultaneity embedded in the compressed and telescoping urbanization hypothesis as discussed in Part I. While it may not be realistic now for this approach to *supplant* the sequential (and usually sectoral) approaches ('first things first,' 'one thing at a time') traditionally applied to addressing urban-environmental development issues, it may not be too unrealistic to expect it to at least *supplement* them (especially when approached from a trans-sectoral perspective) in the near future.

4 Looking Forward: A Concerted Research Approach

With the shifting of global growth trends in the twenty-first century, urban Asia has assumed special importance in research as illustrated in our modest attempt to study the urban transformational phenomena through the lens of empirical research in a handful of Asian city-hinterland scenarios. As is apparent by now, the different planning strategies and policy-making approaches adopted in various national contexts would have a better chance of success if based on comprehensive, systematic, and collaborative research and empirical examination of the city and its environs as integrated units of study. To devise a holistic research approach to the 'aggregated' territory of the city and the hinterland, a collaborative and integrated research plan is essential to the discovery of commonalities and variances in land and infrastructural issues that affect both the human quality of life and the health of the environment. The heterogeneity of concerns as revealed in the empirical studies repeatedly reinforces the need for fresh approaches to a more focused research agenda to better understand the complexities of the transformational dynamics across space and time. The presented studies, even though widely varied in their scopes, methods, and outcomes, portray a common theme running through them involving land use and infrastructure issues in light of livability and sustainability, which offer a broad-brush sketch of the continuing challenges born out of the rapid urbanization and large-city growth happening in Asia.

From this standpoint, we propose forming an Urban Research Consortium (URC) for undertaking a comprehensive, collaborative, and complementary research program to frame and address a collaboratively conceived research agenda. The membership structure of the URC may or may not have regional or national variations, but the decision on that, as well as the criteria for inclusion, should be consensually agreed upon. For example, membership may include institutions, and/or individuals or groups of researchers, academics, planners, and practitioners from among the

regionally cooperative participatory countries (e.g., in the South, Southeast, and East Asian regions). Metaphorically, we envision the member countries or regions as a laboratory, and the consortium as an incubator for spawning new ideas for policies and planning strategies, enhancing knowledge, addressing data issues, and generating new data.

The first task of the proposed consortium should be to produce an inventory, focused on gaining a broad understanding of the current state of urban and planning-related research in the participating countries or regions, for which it may draw upon the participating public and private universities and other organizations and agencies engaged in current research activities related to urbanization and development. A comprehensive inventory of social, demographic, infrastructural, and environmental features, as well as the associated planning documents, is essential to understanding the status quo, which includes questions such as: What concerns are being addressed, how, where, and what time frame are they being addressed, and what effects are they having (or are expected to have)?

Based on a robust understanding of individual countries' states of urbanization and development goals, as well as the state of the art of localized research and planning efforts and agendas, a focal group of researchers within the consortium would be well-positioned to select an appropriate urban agenda (UA) to pursue one or more thematically oriented, inter-connected lines of inquiry.

In addition to the urban agenda as agreed upon by the focus group, we suggest that the portfolio of the consortium also include a tiered set of two major agenda items, both of which will need to be considered together to be meaningful. The first agenda item we propose centers on the identity of the urbanizing territory (UT) as an inclusive territorial concept of the city and the hinterland as one aggregate (planning) unit. In other words, in addition to the urban core, as well as the spatially defined 'peri-urban' areas at the immediate outskirts of the city where the footprints of urban influence are more acutely manifested, our conception of the 'urbanizing territory' would include the more distal spaces in the hinterland where the urbanizing influences may be less evident, but which, nonetheless, demonstrate many functional and other characteristics of rural–urban interfacing with uneven pockets or patches of urbanity or rurality. This is what we see as the 'urbanizing territory'. We contend that strategic considerations for this entire space as a cohesive planning unit will have the potential to simultaneously address multiple issues such as resource allocation, governance, and jurisdiction, land use and infrastructure, environmental burden-shifting, as well as the trans-frontier (and other) equity concerns, which per both academic and planning literature, are crucial for successful sustainable urban and developmental planning. Per this line of thought, identifying the 'urbanizing territories' should be one of the first steps in the urban agenda. Identification of such consensually and deliberatively defined 'urbanizing territories' across the participating member countries of the consortium as a focus of research for the assessment of urban development and planning strategies, in cooperation with academics, planners, and practitioners, as well as public and private agencies, is essential to the inventory of ongoing research activities. This enables specific research themes to be grouped under a commonly adopted urban agenda and contextually adapted across regions.

At the initial stage, we do not envision such territory to be quantitatively measurable as one standard comparable territorial unit within the varied geographies of the Asian developing countries. Rather, such a conceptualization should be based on deliberated consensus among researchers, either on the delineation of such an areal unit through the adoption of certain commonly accepted criteria, and/or choosing an existing territory per the individual countries' standard criteria terminology such as *metropolitan area, extended metropolitan region, urban agglomeration, agglomerated region, urban–rural fringe, peri-urban region* and so on. Such and other like terms are used in different countries to denote core cities and their hinterlands at various scales; they are also often used interchangeably in the urban developmental literature. The purpose at hand is to identify an emerging functionally coherent and spatially contiguous areal unit comprising the urban core and its environs: the urban, peri-urban, and as yet non-urban spaces. This should be the research (and planning) focus, with the criteria for 'functional coherence' to be consensually determined at the outset.

Aspirationally, the results of such research activities focusing on the 'urbanizing territories', can then form the data set/basis from which 'common patterns' as well as 'variations' in the evolving transformational phenomena can be derived across space and over time. Those findings can then potentially form a basis for further cooperative research ventures leading to the production of research 'templates' for improving livability and finding achievable sustainable development pathways for the participatory countries of the consortium. Realistically, however, it is important to recognize that the difference between the consortium as another conduit to a utopian pipe dream and as an incubator for useful strategic information and ideas will depend on the next step—the second suggested agenda item—which pertains to the selection of the research themes.

A set of collaboratively and *deliberatively* selected specific research themes and sub-themes under the overall umbrella of the adopted research agenda(s), and in the context of the *urbanizing territories,* should be the central research focus for all members of the consortium at any given time. Early attention to standardization of all relevant variables (e.g., definitions/terminologies, methodologies, data, etc.) so all researchers are on the same page, would help ensure cross-national comparability and forestall much of the commonly encountered conflations and confusions in the literature. In this context, special attention will need to be paid to data issues that have plagued researchers in Asia (as elsewhere) for decades.[4] Availability and accessibility of pertinent and detailed data at spatiotemporally comparable and disaggregated scales are crucial for meaningful strategic planning, which merit close and concerted scrutiny. Needless to say, this and other themes adopted under the urban agenda, will need to be carefully defined, pursued, monitored, and evaluated for further actions on an ongoing basis.

[4] It can perhaps even be argued that the data situation at some quarters (e.g., sectoral breakdown of workforce data) may have taken a turn for the worse from the standpoint of details, as well as comparability across time (i.e., longitudinal studies for the same country) and space (across other Asian nations).

It bears clarification that our urban agenda proposal extends only to first, the identification of the 'urbanizing territory' for research (and ultimately for planning) purposes, and second, for the establishment of specific collaboratively adopted research themes. The outcomes of such research can obviously be neither prescribed nor predicted. It is to be expected that the variations observed in the transformational landscapes would reflect unique manifestations of local and regional traits and dynamics, falling outside of the scope of the joint ventures. Further investigation and assessment of these should primarily rest with the local and regional civic bodies, as well as governmental and non-governmental organizations (NGOs) of various sorts, who should be responsible for the allocation, preservation, renewal, and/or conservation of resources for the entire urbanizing territory as a planning unit. Communication, collaboration, power-sharing, jurisdictional/ administrative issues, and other such matters among these various entities are critical concerns that will need to be sorted out at national and sub-national levels within individual countries.

In the context of the multifaceted complexities of Asian urban transformation, planning for improving the livability and quality of life of the citizens while conforming to the basic principles of sustainability, is an enormously challenging task and a valid, if not critical, urban research goal. The contributions by individuals and groups of researchers and scholars across disciplines as presented in this volume attest to these challenges, and represent varied interests, ideas, and concerns. Our proposal is one way of channeling these elements together toward a livable and sustainable future in the belief that a well-focused and concerted research base, as a prerequisite for informed and evidence-based strategic planning approaches to the Asian cities and their hinterlands, can help meet these challenges.

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Correction to: Is Linh Dam Still a Livable New Town? How to Make It Work Well Again?

Nguyen Quang Minh, Ngo Thi Ha Thanh, and Ly Quoc Son

Correction to:
Chapter "Is Linh Dam Still a Livable New Town? How to Make It Work Well Again?" in: D. Mookherjee et al. (eds.), *Urban Transformational Landscapes in the City-Hinterlands of Asia*, Advances in 21st Century Human Settlements,
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The original version of this book was published with incorrect statement in the title of chapter "Is Linh Dam Still a Livable New Town? How to Make It Work Well Again?". The chapter title has been updated.

The correction chapter and the book has been updated with the changes.

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