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A conceptual framework of the human dimensions of urban emission in East Asia cities

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Abstract

Eight East Asian countries are home to approximately one-quarter of the world's urban population, and by 2050, the combined urban population of these countries is expected to increase to 1.29 billion from 881 million today. Thus a central challenge for East Asian cities is how to pursue more low-carbon urbanization pathways. One of the key messages of the new chapter on urban mitigation of climate change in the IPCC Fifth Assessment Report is that certain urban form characteristics, especially co-located high population and employment densities coupled with mixed land use, can result in lower per capita urban emissions. However, East Asian cities already have some of the highest urban population densities in the world, suggesting that altering urban form alone will be a limited mitigation strategy for these places. Here we present a conceptual framework of the underlying factors that shape urban form and affect the use of urban space in East Asian cities. The main thesis of the framework is that urban form is the outcome of historical legacies and modes of governance, and that the use of urban space is deeply influenced by social norms and cultural attitudes. Especially for cities where urban form is established or difficult to change, the framework helps to identify factors that interact with urban form to enable low-carbon urban behavior. The framework offers a solution space for climate change mitigation and sharing of lessons learned that are applicable for East Asia, one of the most rapidly urbanizing regions in the world.

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1. Introduction

Cities today face extraordinary challenges due to sprawling growth of urban areas and the consequence of impacts on energy consumption and greenhouse gas (GHG) emissions¹. The current urbanization trends across multiple dimensions marks urban areas expansion and urban population growth on a scale unprecedented in all of human history—more than half of the world population live in urban areas today and projected to increase to 66% by 2050. It has been pointed out that the phenomena is tightly linked with the increase of GHG emissions and requires more climate change mitigation action^{2,3}. East Asia, one of the most rapidly urbanizing regions in the world which accounts for one-quarter of the world's urban population², is currently facing the urgent challenge of pursuing pathways toward low-carbon societies. The urban population in East Asia has grown rapidly from 580 million in 2000 to 780 million in 2010⁷, showing an increase of 34 % in just 10 years. However, despite East Asia's large urban population, only 36 percent of its population lives in urban areas, suggesting more decades of urban growth to come²³.

The research needs and policy changes for ensuring the low-carbon development/emission pathway to support municipalities of fast transforming cities to avoid repeating the development mistakes that have occurred in industrialized nations, and to adapt the existing long life lock-in infrastructure stock are imperative worldwide focuses⁴. The Chapter 12 in the Working Group III of the Fifth Assessment Report (AR5) of the Intergovernmental Panel on Climate Change (IPCC) addressed the importance of proper urban form (i.e. high urban density, land use mix, connectivity, and accessibility) which will lead to lower urban GHG emissions³. However, urban areas in East Asia are 1.5 times denser than the average of the world's urban areas²³. In addition to population density, East Asian cities also have high land use mix in the world, suggesting that altering urban form alone will not be enough for mitigating GHG emissions for these places. Therefore, it's necessary to elaborate the framework proposed by IPCC AR5 to further incorporate the sociological understanding of the use of urban form and the underlying factors which affect urban emissions in East Asia.

In responding to climate change, cities alliance as well as climate change mitigation network has been encouraging knowledge and experience sharing of locally developed mitigation strategies for developing more sustainable and resilient cities. Yet, at present most cities lack even a rudimentary screening way to frame the suitable site-specific climate change mitigation implementation contexts: sociological understanding of the human dimensions of urban form is always excluded. It is urgently needed to develop a framework to identify “mitigation sister cities” for mitigation learning across cities with similar social and cultural contexts. In this paper, we propose a conceptual framework, extending from IPCC AR5 and including the underlying causes of emission-related urban form to offer a new solution space for GHG mitigation and sharing of lessons learned in East Asian cities.

2. Reconsideration of links among underlying factors, urban form, and emissions in East Asia

2.1. The urban context of East Asian cities

East Asia is defined in this study to include the countries and societies which share Confucianist ideals and tradition, such as Taiwan, Japan, South Korea, China, Macau, Hong Kong, Singapore and Vietnam that at a very general level, a set of common features can be identified that distinguished the countries of East Asia from the Western model⁶. In the past three decades, the second-highest increase in population growth in the world occurred in East Asia (Fig. 1a). In terms of economic growth, East Asia has emerged as the manufacturing center of the world, achieving the highest economic growth in the world. In 2008, the Gross Domestic Product (GDP) capita growth rate index reached a peak 5.4 times higher than in 1980 (Fig. 1b). During the same period, East Asia also stands out with its increasingly huge GHG emission, consequently implying serious environmental risks in East Asia (Fig. 1c).

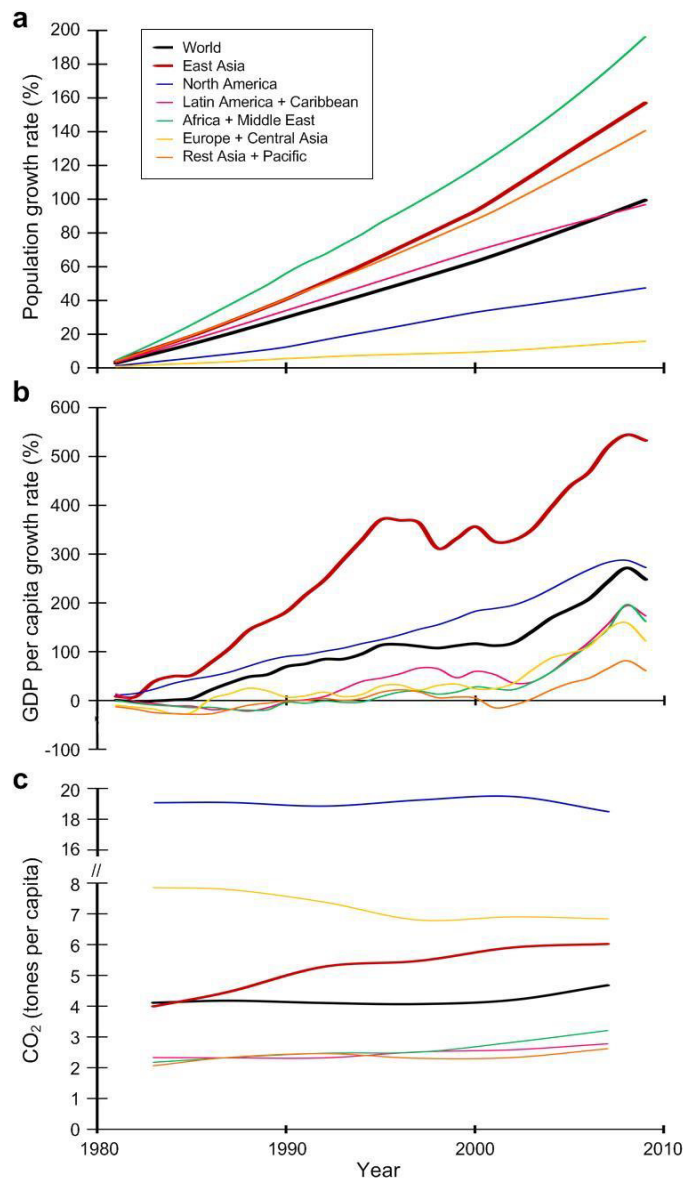
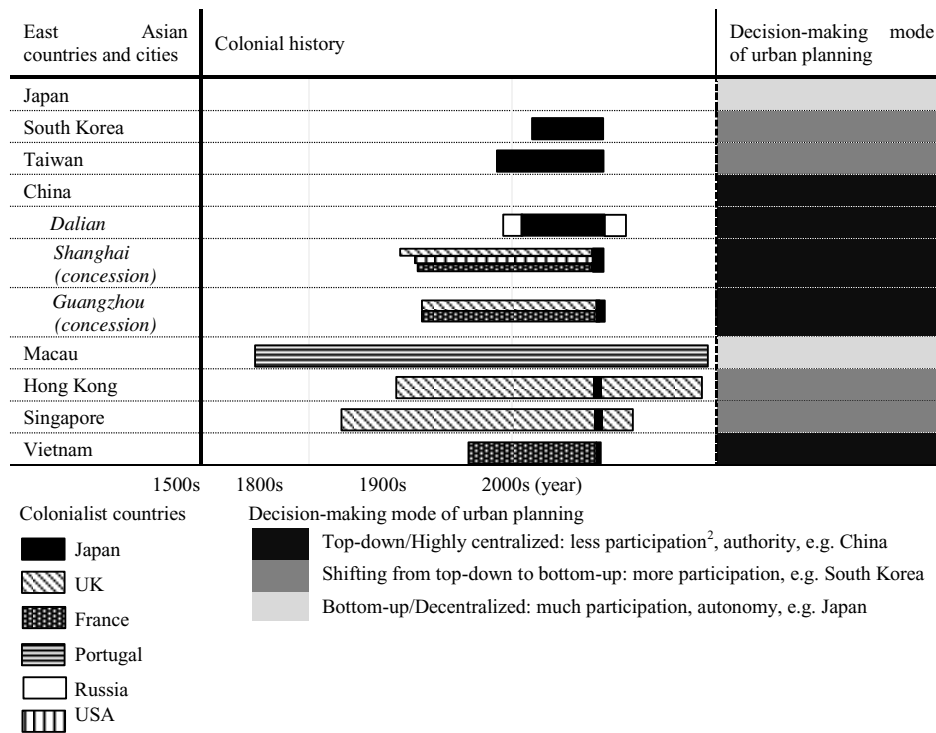


Figure 1 Estimates of (a) population growth rate, (b) Gross Domestic Product (GDP) capita growth rate and (c) CO₂ emission in different continents between 1980 and 2010, according to the World Bank report.

East Asian cities not only inherit a strong Confucian cultural tradition¹⁰, but also share the similar urban context from the perspectives of colonial history and governance. Most of the planning systems of East Asian countries have been influenced by their colonial past and several of their present urban challenges have colonial roots⁸ (Table 1). In the parts of governance and public participation, since the 1990s, although a number of East Asian countries have adopted decentralization policies to empower local governments, and encourage participation in policy-making at all levels of governmental departments (Table1), the local government administrations still suffer from limited capacity to enforce the building codes, urban environmental controls, and urban form plans currently⁸.

In a nutshell, most East Asian cities with high density and high land use mix have shared some similarities in cultural, historical experiences and governance, and are currently increasingly facing rapid urbanization and huge GHG emissions. It is crucial to elaborate the simple view proposed by IPCC AR5 to further consider other underlying factors that affect urban emissions in East Asia.

Table 1 Colonial history and governance decision-making mode of urban planning in East Asia.



2.2. A conceptual framework for underlying factors of urban emission in East Asia

The aim of proposing this new framework is to enable better understanding of the interrelationship among the implicit factors that influence on the East Asian society and have interacted with urban form to affect GHG emissions. Unlike the implicit model proposed in current IPCC AR5, showing simple linear relationships between urban form, human behaviors and emissions (Fig. 2a), the use of urban space related to emissions in East Asia is interacted with urban form and human behavior deeply influenced by cultural, historical and governance factors. The framework, here, will be built on one core (socio-built environment interaction, which emphasizes on the internal conformational dynamics of both human behavior, norms and use of urban space, and urban form), and two components of human dimensions (background conditions, i.e. culture and history, and interventions, i.e. governance) have an underlying structure solidifying the core. Then, combined effects will influence urban form related to emissions (Fig. 2b). The socio-built environment interaction proposed here is not an ego formation phenomenon, but rather influenced by human dimensions (i.e. culture, history and governance.) Since urban occurs in specific locations, any analysis must take account of local history and culture⁶. The benefits brought by this background condition interface should not be underestimated.

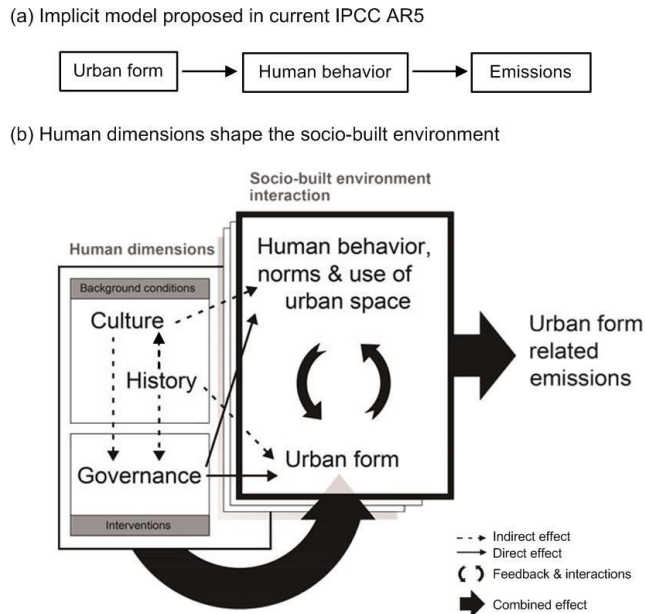


Figure 2 Schematic showing the components of (1) the implicit model proposed in current IPCC AR5 report, and (b) the human dimension and socio-built environment interactions for urban form related emissions. Arrows indicate the main flows of information.

Culture, generally, has an indirect influence on urban form through its direct influence on the practice of urban planning and on the human behavior, norms and use of urban space¹⁰. Cultural influences play a crucial role on not only evolution of urban form but also social norms which frame human behavior related to GHG emission. As such, cultural influence is important to how a society responds to the climate-related risk²⁴. East Asian regions have inherited a strong Confucian cultural tradition¹⁰, advocating two key characteristics in human social life: frugality and harmony. The former leads to individuals' desires for both time and money savings while the latter show a high tolerance for East Asian people in use of the narrow space, both which further imperceptibly shape urban form in East Asia toward high connectivity and high land use mix. Moreover, based on the characteristics, the number of multigenerational households boosted as the most common norm in East Asia in comparison with other regions in the world result in significant differences in household consumption and energy use efficiency³. Besides, Confucianism also has a long-term effect on the planning practice in the governance systems of East Asian cities¹⁰. Confucianism preaches obedience by governing every relationship including kinship, demographic relationships, relationships with colleagues, and paternalistic leadership¹¹, which is highly helpful to policy implementation. The paternalism, existing in Confucius philosophy how to structuring Chinese society, implicates the decision-maker is cast as an authoritative person in the urban planning process^{10, 12}. Although decision-making mode of urban planning has been changing to encourage more public participation, it is not difficult to find high amount of obedience observed to superior orders (i.e. both local and central governments) in the East Asian societies. Carbon emission controlling strategies are promoted with top-down approach, but the local climate governance, e.g. in China and in Japan, has inherited the political characteristics of traditional centralized administrative system and reflects the emergence of bottom-up activities in which adaptive management should be involved. Both some EACs face difficulties in advancing from 'making plans' to 'taking action'²⁷.

As another important factor in the background conditions of human dimensions, history, as a facilitator and distributor, makes eight East Asian countries over a distance of 50,000 kilometers across the Earth experience waves of immigration and colonization over the past centuries. The influences of history on culture in East Asia mainly include the spread of Confucianism through Chinese diaspora and colonial legacy.

Confucianism spread to Japan and Korea around the 8th century^{13, 14} and became diffused into Southeast Asian society through the Chinese diaspora throughout the years leading up to the 16th century¹⁵. Until the modern era, Confucianism was adopted as official philosophy in Korea and Japan¹⁶. In terms of history influence on governance, the institutions of urban planning in East Asia cities have been shaped by their colonial past and several of their present mitigation challenges have colonial roots associated with urban form and the behavior of using urban space. For instance, Hong Kong and Singapore follow British-style urban planning system, major urban form in Taiwan is based on Japanese planning history. South Korea became a protectorate of Japan. Although Japan has not colonial history, it transferred Euro-American planning experience to regulate the urban growth as well as to design their built environment⁹.

Colonial urban planning legacies historically affect the governmental institutions on urban development then shape the urban form of a city^{25, 26}. From the urban form perspective directly, the most apparent feature affected by history is the street outlay/road pattern. For instance, under the rule of Japanese, the grid system was applied for the road configuration replacing the uneven shape of the blocks and the irregular length or width of the roads that was developed from rice farm load during the agricultural Qing dynasty.

Governance is surely a directly formidable “force” in any urban development (notably, here, governance is different from the decision-making mode in Table 1 making much of who can participate urban planning and construction). The principle governance interventions shaping human behavior is through legal and regulatory responsibilities and authorities. For example, the urban policy of subsidizing public transportation system for providing low tariff have encouraged the travel behavior of the citizens to choose Metro or Bus system instead of private vehicles and scooters in the Taiwan’s megacities. In mainland Chinese cities, commonly, the public administrations at different departments belonging to different governmental levels encourage citizens’ environmentally friendly behaviors using catchy slogans and/or apparent banners in public space in order to continuously remind the public about energy saving in daily life and use of zero- or low-carbon transportation system as much as possible²¹. By means of urban planning instruments and land regulations like in Taipei, Tokyo and Singapore, the urban governance can easily manage and shape urban form and infrastructure with climate change mitigation expectation, such as re-zoning land use and increasing mixed land use to create more convenient living environment as well as to stimulate commercial activities²². In Taipei and Tokyo, the Transit-Oriented Development (TOD) is embedded in the center of main building, while infrastructure improvement around transit stations and along corridor stimulates area development and increase connectivity and density toward urban containment. Conclusively, governance in East Asia has considerable internal authority, administrative discretionary power and executive ability.

We propose that feedbacks and interactions between human behavior, norms and use of urban space, and urban form is pulling each other and constantly fine-tuning. The combined effects of human dimension and of socio-built environment interactions will be the impacts on urban related emissions in the real, which we expect a greater value than present understanding and estimations based only on the effects of urban form.

3. Exploring the urban mitigation space: Opportunities in East Asia

The framework proposed in this paper extends from IPCC AR5 to offer a solution space for climate change mitigation and sharing of lessons learned that are applicable for East Asia. Currently there are many climate change mitigation strategies being proposed and developed locally, and also growing number of networks to share mitigation knowledge. However, there are many lessons learned but little understanding of what should or could be applied to different contexts. The proposed framework helps to identify “mitigation sister cities” regionally and provides some aspects to be able to understand, compare, and apply lessons learned and strategies across cities with similar contexts.

We also argue that the human dimension factors in East Asia mitigation should draw more attention. Individuals may have high carbon emissions behaviors in low carbon urban form due to their social norms. If cities don't consider the human factors explicitly, pursuing urban mitigation strategies that rely on urban form alone are likely to be ineffective. In contrast, if cities consider these human factors, they can create the conditions that enable low-carbon urban behavior in places where changing urban form is not possible or difficult. Therefore, current social norms in East Asia lead to low carbon emission should be preserved such as multigenerational household can decrease the need for more buildings and commuting, which reduces embodied energy use. Frugal living style advocated by Confucianism also helps to reduce energy and material use.

Besides, governance is an efficient entry point for East Asia mitigation because its powerful intervention toward socio-built environment interaction under the unique background of East Asia's culture and history. Governance can modify people's behavior and public opinion through changing social norms in a short time. For instance, in 1996, Taipei City Government promoted a new trash system named "keep trash off the ground" program- trash trucks make stops to pick up garbage at designated times and places allowing residents to throw their trash directly into the trash truck, and the recycling trucks accept only certain items on certain nights. It successfully improved garbage sorting and reduced trash amount in the following few years by changing civil littering behavior. Therefore, for the place like East Asian cities where changing urban form is difficult, modifying human's behavior through changing norms by governance might provide a new solution for climate change mitigation.

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