1. Introduction: Megacities, Urban Form, and Sustainability

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Of the many changes to our world wrought during the twentieth century, one of the most profound was the transformation of human settlement systems. A century ago the vast majority of the world's population was rural, embedded in social and economic systems tied to agricultural production and living in dispersed, small-scale settlements. Now, for the first time in human history, more than half the world's population is urban, after a century of massive migrations from rural hinterlands to burgeoning cities. In this urban transformation of the globe, one of the most dramatic and momentous developments has been the emergence of giant cities, often referred to as "megacities."

In 1950 there were two cities in the world with a population of more than ten million people: New York and Tokyo. By 1975 there were three, with the addition of Mexico City. By 2007 there were 19 cities with populations of more than ten million, of which four were in developed countries and 15 were in developing countries. It is projected that by 2025 that number will increase to 27, of which 22 will be in developing countries (UNDESA 2008: 10). In 2007 megacities accounted for about 9% of the world urban population, but although they represent only a minority of global population, megacities loom disproportionately large in economic flows, political processes, social stresses, and environmental risks. It is therefore no exaggeration to suggest that megacities will play a central role the future of human civilization, and that meeting the challenges they present is a key to global environmental and social sustainability.

A basic premise of this book is that the urbanization patterns achieved during the next four decades will be critical to the long-run sustainability and livability of the globe, and that megacities are a central part of that challenge. Over that period it is projected that the world's urban population

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will grow by just over three billion from the current 3.29 billion in 2007 to 6.4 billion in 2050, and 95% of that increase will be in developing countries (UNDESA 2008: 3). Just as important is the fact that if current trends hold, by 2050 the urban transition will be largely completed – 70% of the global population will live in cities and the period of greatest urban growth and development will be over.

The next 40 years therefore present either a crucial opportunity to create more sustainable urban areas, or alternatively to dig ourselves ever further into the wasteful, unsustainable, unjust, and unhealthy patterns of urban development that have dominated in recent decades. This next period is critical, as the urban form patterns established during the transition from rural to urban are enduring. Basic patterns of urban form, once established, become increasingly difficult and more costly to alter.

Through 15 in-depth case studies by researchers around the world, this book examines many of the major challenges facing megacities today. The contributors, all prominent researchers on their respective cities, were invited to an International Workshop on Megacities in March 2008 by the Centre for Sustainable Urban Regeneration of the University of Tokyo to discuss, debate, and share ideas about contemporary megacity challenges. Participants were asked to examine contemporary issues at the intersection of urban sustainability, urban form, and governance in their megacity. Regrettably, one participant from China was unable to attend the workshop, and another was unable to contribute a chapter to this book.

This introductory chapter briefly outlines our understanding and working definitions of sustainability and megacities, identifies the distinctions between megacities in the developed and developing countries, and frames the major questions addressed by the contributors. Detailed case studies of 15 megacities form the main body of the book, organized in three major groups of cities: Asia, Europe and North America, and Latin America. The main findings are brought together in the conclusions chapter, which draws out the major sustainability issues of urban form, land development, infrastructure provision, and governance, and the linkages between these examined in the individual case studies.

1.1 A World of Giant Cities

Despite a flurry of research on megacities during the late 1980s and 1990s (Dogan and Kasarda 1988; Fuchs et al. 1995; McGee and Robinson 1995; Gilbert 1996), there has been relatively little such work recently, apart from

several excellent monographs on individual cities. It is clear that we need a much better understanding not just of how current megacities are changing, but also of how to make effective interventions in those changes. Production of the built environment is ultimately a social and political as well as an economic process, in the sense that it is the outcome of many millions of decisions and priorities. Learning better ways to make decisions together about the direction of urban change, in ways that foster greater livability for all inhabitants – not just the tiny minority who can buy their own protected enclaves – is one of the greatest sustainability challenges facing the globe.

In particular, rapid urbanization in poor countries has meant that key elements of infrastructure, such as water supply, waste removal, flood prevention, and rapid transit, which make giant cities more livable in developed countries, are often lacking for the majority of the population in these countries, leading to poverty, sickness, and preventable death on a scale scarcely imaginable (Davis 2006; Pieterse 2008; Brugmann 2009). Vast populations lack reliable and affordable access to clean drinking and washing water and live in informal settlements where basic public facilities such as water supply, sewers, and schools are non-existent. Although often economically vibrant and providing affordable footholds in the city (Benjamin 2004), these areas – often located on floodplains, on steep mountain slopes, or near garbage dumps – marginalize the poor and inflict on them heavy health burdens and exceptional environmental risks. The dilemma is to achieve better environments without destroying the flexibility, affordability, and dynamism of such poor areas of cities.

The failure of contemporary patterns of urbanization is not restricted to poor countries. Even in developed countries, economic restructuring, the weakening of social welfare systems, the abandonment of social housing programs, the downloading of responsibilities to municipal governments, and increased competition for inward investment have led to social polarization, poverty, and social pathologies such as homelessness. In some developed countries, planning has contributed to the production of sterile, monofunctional city areas that require long-distance commuting and prevent the creative adaptive re-use of older urban areas. The increased global mobility of capital and a shift from investment in productive capacity to investment in a securitized real estate industry has seen the emergence of an increasingly international development industry that has contributed greatly to the destabilization of urban livability and reduced access to housing for the poor and middle classes, as well as being a primary cause of the global economic and financial collapse since 2008.

Further, the failure to adequately manage urban fringe land development has led to wasteful urban sprawl, political fragmentation, and the rapid

decline of many central cities, especially in the United States. Sprawl causes increased air pollution, long-distance commuting, heavy energy use, and wasted land. Worse, in poor countries the informalization of peri-urban land development is not just a matter of planning or governance failure, but as Roy (2005) argues, implicates the state in creating spaces of exception that facilitate social segregation and land development profits.

In both developed and developing countries, rapid urban growth during the last 30 years without adequate governance and planning regimes has facilitated an accelerating process of socio-spatial polarization, in which the wealthy are increasingly self-segregating in gated communities and fortified enclaves, and in many cities have successfully withdrawn from contributing their share of resources to provide public goods. In many megacities, elites are able to ensure that municipal investment in infrastructure and facilities benefits themselves disproportionately, producing a self-reinforcing process of segregated high-amenity communities for the wealthy, isolated from the environmental and social problems of poorer areas.

Although this contemporary urban crisis is far graver and on a vaster scale than that of the mid-nineteenth century that prompted the great urban reform movements of the end of that century, it is still largely ignored by those who are not directly affected. The magnitude of the problems, and the fact that trends in most relevant indicators are moving in the wrong direction render contemporary patterns of urbanization discouraging for those concerned about sustainability, social equity, and ecological integrity at the local and global scales. In this context, linking the concepts of "sustainability" and "megacities" may appear absurd, but we argue that the role of megacities in this urban crisis does, in fact, present significant insights about the meanings of sustainability and unsustainability.

1.2 Sustainable Megacities?

A review of the enormous literature on sustainable cities is neither possible nor necessary here (see Owens 1986; Stren et al. 1992; Haughton and Hunter 1994; Campbell 1996; Sorensen et al. 2004). The concept of sustainability has been so influential, however, and used in such a wide range of contexts that its meaning has become somewhat diffuse, so it is necessary to make explicit our approach. The seminal Brundtland Report (World Congress on Environment and Development 1987: 43), defined sustainability as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs." The key insight of that

work was that both the overexploitation of global natural resources by the North, and the failure to meet basic needs in the South are generators of unsustainable outcomes. Intergenerational equity and transfrontier equity have since become central concepts of sustainable development.

Campbell (1996: 298) developed this perspective concisely in his "planners' triangle" diagram, in which the three corners of the triangle represent the three fundamental priorities of economic development, environmental protection, and social equity, with the three sides of the triangle representing the "resource conflict" between economy and environment, the "property conflict" between economic growth and social justice, and the "development conflict" between social justice and environmental protection, with sustainable development located in the middle. Campbell argues convincingly that the idea of sustainable development will be particularly effective if "it acts as a lightning rod to focus conflicting economic, environmental, and social interests. The more it stirs up conflict and sharpens the debate, the more effective the idea of sustainability will be in the long run" (1996: 297). Therefore, pretending that there is some singular solution to these conflicts is not helpful. Instead it is necessary to continue to negotiate strategies to manage these enduring conflicts between the usually divergent priorities of environment, economy, and social equity, at all different scales.

So, the point is not to imagine a perfectly sustainable megacity. In a profound sense, megacities are inherently unsustainable, with their vast consumption of resources drawn from distant elsewheres, and equally vast production of wastes that are routinely exported elsewhere. The challenge is instead to keep looking for ways of reducing the ecological impacts of cities, achieving greater social equity, and strengthening economic functions to accomplish the first two priorities. The goal, in other words, is not sustainable cities per se, but cities that contribute to sustainable development (Satterthwaite 1997).

Urban growth has always involved overcoming existing limits and thresholds of risk and dysfunction, either through market processes, education, planning, technology, infrastructure provision, or a combination of those. A new understanding introduced by the sustainability debate, especially with the recognition of global climate change as a pressing environmental issue, is that limits are a permanent reality, not to be overcome, but to be embraced as a way of accelerating technological and governance change that reduces megacities' environmental footprints. The development and elaboration of an imaginary of unsustainability, risk, and disaster is part of the process of framing different future pathways and priorities of planning and governance in each megacity.

Each megacity has a legacy of built form, patterns and understandings of property rights, and planning and governance cultures that structure the ways in which issues of sustainability are framed, the kinds of solutions that can be imagined and proposed, and the policy approaches that are actually implemented. Different actors understand and prioritize sustainability issues in diverse ways, from the intimate and hyperlocal to the regional and ecosystemic. Developing a political and planning framework that addresses megacity sustainability in meaningful ways must engage a range of different actors at different scales and in different sectors. The structure, capacity, and nature of that engagement have a profound influence on the equity, environmental, and economic impacts of those processes.

In all of the cities examined here, concepts of sustainable development and fears of unsustainable development have been influential and in some cases have produced innovative and even transformative changes. The goal is not to cherry-pick success stories, but to examine how issues of megacity development, urban form, sustainability, and unsustainability are conceived and reconceived, how governance processes are influenced by these ideas and either block or facilitate their implementation, and how these processes in turn influence outcomes on the ground.

1.2.1 Defining Megacities

Definitions of "megacity" vary, from a population threshold as low as four million (Dogan and Kasarda 1988), to eight million (Richardson 1993; Gilbert 1996) or ten million (Ward 1990; UNDESA 2008). But as Gilbert (1996) notes, this threshold is arbitrary, and there is no theoretical basis for believing that the issues facing a city of eight million are qualitatively different from those of a city of ten million. There are also great difficulties in deciding where to draw the line when counting megacity populations, as population data is usually collected for specific political jurisdictions, and megacities are continually growing beyond those political lines. So the precise threshold is not as important as the fact that cities of eight or ten million face significantly different challenges from those of cities of a hundred thousand or one million, and that the number of such giant cities is rapidly increasing.

As yet there is little systematic research or reliable comparable data on the precise ways in which urban issues vary with city size, and the goal here is not to attempt a contribution to the long and inconclusive optimal city size debate (see Richardson 1973; Begovic 1991). Most variables do not vary consistently with city size (Richardson 1973; Gilbert 1996: 4), and

as the studies collected here show, the most pressing issues can be quite different in two cities even of similar size. Nor is there a singular urban problematic or agenda common to all megacities. Several major issues do seem characteristic of megacities, however, and come up repeatedly in the studies here. These include air pollution, water supply, waste management, transportation, housing, growth management, and governance, although these manifest themselves variously in different places. Our suggestion is not, therefore, that these cities face identical problems, but simply that they share a number of issues and that a close examination of the challenges and responses to these issues in different contexts will be valuable.

1.2.2 Giant Cities in Developed and Developing Countries

We argue in the conclusions that it is increasingly necessary to move beyond a simple divide between megacities in developed and developing countries, but first it is important to acknowledge profound differences between cities in developed and developing countries. As White and Whitney (1992: 16) showed, cities in rich and poor countries differ not only in the kinds of sustainability issues that are most critical, but also in their capacity to manage them. They argued that in developing countries, job opportunities, water supply, transportation, and air pollution are likely to be much bigger problems in large cities than in small and medium-sized cities, while in developed countries, pollution, crime, and housing tend to pose greater problems in large cities than in smaller ones.

More recent research suggests that the fundamental difference is not just wealth, although that is important, but the speed and timing of growth. As has often been noted, the pace of urbanization has accelerated during the last two centuries. While a city like London took over a century to grow from one to seven million people, Tokyo took half that time, and cities like Delhi are making the same transition in a few decades. Cities in developing countries are also growing faster than early industrializing cities in Europe, which had the "pressure release" of massive exports of population to colonies in the new world; such emigration is proportionately much less today. Most of the huge migrations of poor people from rural hinterlands are towards cities like Delhi, Istanbul, and Sao Paulo, rather than to other countries.

The increasing speed of urbanization has had major consequences: building infrastructure takes time as well as money, and rapid growth often means that there is not enough of either to keep up with needs. Perhaps more fundamentally, political processes and governance institutions take time to evolve and generate the effective frameworks to manage the

complex systems that make giant cities more livable – such as public utilities commissions to finance, build, and maintain infrastructure, intermunicipal councils and agreements to share responsibilities, or coroners' juries to determine liability and propose remedies for institutional failure, among hundreds of others.

An important analysis of how the speed and timing of urbanization create different experiences in different countries is the "urban environmental transition" hypothesis, which suggests that cities go through a sequence of environmental challenges as they get wealthier (see McGranahan et al. 1999; Marcotullio 2007). In the first stage, they must deal primarily with "brown" environmental issues – clean water supply and waste management. As they increase in wealth and industrial development, "grey" issues of air and water pollution become increasingly important. In the third stage, the "green" environmental agenda of sustainable ecosystems and life-support systems comes to the fore.

There are also important temporal and scale components of this analysis, in that as cities develop, neighborhood-scale brown issues that have immediate health impacts are overcome, and the focus shifts to larger city-region-scale issues of industrial air and water pollution. Wealthier cities struggle with ecosystemic challenges that are regional or global in scale, such as acid rain, ozone depletion, and global warming.

Intrinsic to this analysis is the suggestion that environmental burdens are increasingly displaced to ever-greater scales. Brown issues affect primarily those creating the waste and others nearby, but grey issues tend to be dispersed – for example by tall smokestacks – over much wider areas. Finally, the wealthiest cites are able to export the "green" environmental burdens of their consumption throughout the globe not only by shipping toxic waste to unregulated dumps and materials recyclers in distant locations, but also by consuming natural resources and manufactured products whose primary environmental impacts are in other (usually poorer) places. And of course, the consumption of carbon-based fuels is much higher per capita in rich cities and countries, yet the wastes that contribute to global warming are dumped into a global waste-sink.

To this analysis Marcotullio (2007) adds an important further insight: this series of environmental challenges has been radically "telescoped" into an ever-shorter period, so that whereas cities in early industrializing countries had centuries to deal with brown issues and then grey and green issues sequentially, building gradually to their governance capacity and norms, developing countries today are dealing with all three simultaneously. As he concisely puts it, "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" (Marcotullio 2007: 46, italics in original). The challenges of livability are thus much greater, and in many ways qualitatively different for cities in developing countries today than they were in cities at a similar stage of development in developed countries decades ago.

Another major difference between megacities has to do with the timing of major urban growth relative to prevailing ideologies of development and governance. The shifts in political and economic ideology that have occurred during the last 30 years have had profound impacts on planning and governance institutions. During the 1950s and 1960s the dominant economic model for developing countries was import-substitution, the promotion of national industrial champions, and the creation of the bureaucratic, infrastructural, and technological support structure to enable their growth. Since the 1970s, however, the hegemonic idea of best practices for development has shifted towards neo-liberal formulas of open markets, reduced government, and lower taxes. At the same time, accelerating globalization means that cities are more thoroughly integrated into global financial, technological, and production systems than before, with cities in the global South systemically at a disadvantage, gaining primarily low-value-added production functions and heavy environmental burdens, while (some) cities in the developed countries gain an increasing share of high-value-added command and control functions (Sassen 1991; Dicken 1998).

One profound consequence of this shift has been a transformation of the way urban infrastructure is understood, built, and managed. The institutional frameworks of urban infrastructure provision – for example for water supply or public transit – established during the former period are in almost all cases very different from those established during the latter period. As Graham and Marvin (2001) and a growing literature on "splintering urbanism" show, in the earlier era a "modern infrastructural ideal" assumed that the right way to build infrastructure was as public monopolies delivering integrated and standardized networks throughout urban areas. Now it is more likely that service delivery is fragmented, delivered by both public- and private-sector actors, with huge and growing disparities in provision between well-served and un-served areas.

These new patterns are in part a product of new technologies that allow efficiency in much smaller networks, and a shift in which new kinds of networks are being provided (cellphones vs. sewerage). But it is also fundamentally a shift in ideology, towards a withdrawal of the state,

increased urban competition, and a neoliberal emphasis on privatization, full-cost pricing, and the elimination of cross-subsidies. There is also heavy pressure from international organizations such as the World Bank and International Monetary Fund, for example, which promote the privatization of water supply systems. Furthermore, the "unbundling" of infrastructure allows increasing segmentation of urban space into highly networked areas for those who can afford to pay, and unserviced areas for the less powerful and less able to pay, thereby promoting enclave developments for the rich (Graham and Marvin 2001: 383).

Graham and Marvin (2001) describe this as a process of "splintering cities." They argue that the decline of the "modern infrastructure ideal" in the second half of the twentieth century has led in many cities to the abandonment of the goal of public provision of municipal services throughout the urbanized area. This shift is producing an increased differentiation between high-value locations served by modern infrastructure and deprived locations that are bypassed by it. This trend is having profound impacts on cities in developing countries that did not have infrastructure networks in place before the onset of the current period and the decline of the modern infrastructure ideal. At the same time, these impacts are seen in many more developed cities where processes of social polarization are often exacerbated by highly uneven service provision.

As discussed in the conclusions chapter, the challenges of sustainability, urban form, infrastructure provision, and governance are closely linked. Although megacities in developing countries experience these challenges in acute forms, cities in more developed countries face many of these fundamental issues too. This book does not attempt to highlight solutions achieved in rich cities for transfer to poorer cities, since learning and innovation is taking place in all the cities examined here. Without minimizing the challenges faced by rapidly growing megacities in developing countries, we are also seeing shared challenges, dilemmas, and policy approaches among the megacities in all countries.

The detailed case studies of 15 megacities around the world are organized around a shared set of concerns and questions about issues of sustainability, land development, urban governance, and urban form. The main questions that framed our investigations are: What are the most pressing issues of sustainability and urban form in each megacity? How are major issues of sustainability understood and framed by policymakers? Is urban form considered a significant component of sustainability issues in public debates and public policy? Who are the key actors in framing urban sustainability challenges and in shaping urban change? How is unsustainability, risk, or disaster imagined?

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