8

Exploring a New Vision for Cities

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"It was a town of unnatural red and black like the painted face of a savage," wrote Charles Dickens in his 1854 novel *Hard Times*. "It was a town of machines and tall chimneys, out of which interminable serpents of smoke trailed themselves for ever and ever, and never got uncoiled." Although Dickens showed a brighter side to urban life in some of his earlier work, from the 1850s onward his characters were increasingly worn down by the industrial city's untamed filth.[1]

This shift in Dickens's stories coincided with a turning point in the history of cities. In 1850, the United Kingdom became the first nation to have a mainly urban population, and it was followed by a score of industrial countries in Europe, then North America, and later Japan. Booming industrial cities required tremendous quantities of water, food, fuels, and building materials. Pollution and waste were evident everywhere, as Dickens so vividly described.[2]

As the nineteenth century came to a close, the ills of the industrial city prompted visions of a new urban form. Engineers were already building bigger water and waste systems. And innovations such as the telephone, automobile, and skyscraper inspired futuristic thinking. Among the most influential visionaries was Ebenezer Howard, a British stenographer-turned-reformer. "Ill-ventilated, unplanned, unwieldy, and unhealthy" cities, Howard declared in 1902, had no place in a more humane future. Instead, a network of clean, self-sufficient "garden cities" would marry the best social aspects of city life to the beauty of nature. French architect Le Corbusier, a generation after Howard, was also offended by the industrial cities of his time: "They are ineffectual, they use up our bodies, they thwart our souls." Le Corbusier envisioned gleaming skyscrapers surrounded by parks and wide motorways that would shape a "radiant city" worthy of the new century.[3]

Today, cities around the world have some of the forms prescribed by Howard and Le Corbusier but not the function they intended: sustaining a more equi-

table society in harmony with nature. Chaotic suburban development in the United States, for instance, is a caricature of Howard's garden city ideal. Gated enclaves and congested roads have degraded rather than enhanced public space. Towering office blocks, Le Corbusier's "islands in the sky," were supposed to allow more room for nature below. But most skyscrapers tend to be built without regard to the local environment—heating or air conditioning must make up for shortfalls in design—and so take a heavy toll on natural resources.[4]

Twentieth-century cities fail to meet the needs of the present while at the same time compromising the ability of future generations to meet their own needs—the exact opposite of "sustainable development" as defined by the Brundtland Commission's 1987 landmark report, *Our Common Future*. Plato's observation in 400 B.C. that "any city, however small, is in fact divided into two, one the city of the poor, the other of the rich" holds true today. And the most basic requirements of the urban poor, particularly in the developing world, go unfulfilled. At least 1.1 billion choke on unhealthy levels of air pollution, 220 million lack clean drinking water, 420 million do not have access to the simplest latrines, and 600 million do not have adequate shelter.[5]

At the same time, resource use by the rich threatens the security of future generations. Although cities have always relied on their hinterlands, wealthy urbanites today draw more heavily on far-flung resources—quickening the pace of climate change, deforestation, soil erosion, and loss of biological diversity worldwide. London, for example, now requires roughly 58 times its land area just to supply its residents with food and timber. Meeting the needs of everyone in the world in the same way that the needs of Londoners are met would require at least three more Earths.[6]

The search for a new vision for cities has even more urgency now. In 1900, only 160 million people, one tenth of the world's population, were city dwellers. By shortly after 2000, in contrast, half the world (3.2 billion people) will live in urban areas—a 20-fold increase in numbers. The challenge for the next century will be to improve the environmental conditions of cities themselves while reducing the demands that they make on Earth's finite resources.[7]

An Urbanizing World

Although urban areas have existed for millennia, we still do not have a good definition of "the city" because its shape and role keeps changing from place to place and over time. Around 4000 B.C., farming villages in Mesopotamian river valleys grew into the world's first cities. These settlements culminated in the Sumerian city-state—with its elaborate temples, stratified social classes, advanced technology, extended trade, and military fortifications. Many of these early cities had walls that formally set the town off from the countryside. Over the years, these walls were often rebuilt to accommodate larger populations, as rural dwellers sought a better life in the city and as births within the city began to outnumber deaths.[8]

The Industrial Revolution brought the next major urban transformation. By the eighteenth century, industrializing cities in Europe were spilling over their confines. In the late nineteenth and early twentieth centuries, western urban populations surged beyond administrative limits as well. In many cities in Europe and North America, the number of people living within the political boundaries of major city centers declined, particularly after 1950, but roads and buildings continued to pave over surrounding forest and farmland. New technologies and government policies helped create this

sprawl. The most extreme examples of widely dispersed suburban "edge cities" are found in the United States. Between 1950 and 1990, for instance, greater Chicago's population grew by 38 percent but spread over 124 percent more land; metro Cleveland's population increased by 21 percent during these years, but the city ate up 112 percent more land.[9]

As the shape of cities has changed, so have notions about what constitutes an "urban area." Today, cities swell not only from an influx of newcomers and births within the city but also from reclassification of rural areas. Urban population statistics may correspond to the political boundaries of an old city center or extend to some part of the greater metropolitan region, which may have numerous centers of employment. Thus, depending on where the lines are drawn, Tokyo's population ranges from 8 million to 39 million and Mexico City's from 2 million to 18 million. This chapter uses the U.N. definition for "urban agglomerations," which incorporates the population in a city or town plus the adjacent suburban fringe.[10]

Economic forces underlie the ongoing changes in the role of cities. In the past half-century, many cities in the developing world have grown as industrialization has brought both the prospect of urban jobs and the degradation of rural areas. In the 1950s, most of the world's jobs were in agriculture; by 1990, most were in services—an outgrowth of industrialization. Cities still provide a marketplace for food and other items produced in the surrounding region, but a growing number also serve as global bazaars. Telephones, satellites, and computer links are among the technologies that allow today's network of "global" cities to reach beyond their immediate hinterlands. Elites in Seoul and Stockholm may have more in common with each other than with their rural compatriots.[11]

Much modern urban infrastructure was built in response to nineteenth-century problems in the western industrial city, which dominated history for a brief moment. In 1800, just 3 of the 10 largest cities were in Europe (see Table 8–1); by 1900, 9 were in Europe or North America; but by 2000, there will only be 2. Asia, which led world urbanization between 800 and 1800, again today has half of the 10 largest cities. India's urban population alone—256 million—could constitute the world's fourth most populous nation.[12]

Table 8–1. Population of World's 10 Largest Metropolitan Areas in 1000, 1800, and 1900, With Projections for 2000

1000		1800		1900		2000	
			(million)				
Cordova	0.45	Peking	1.10	London	6.5	Tokyo	28.0
Kaifeng	0.40	London	0.86	New York	4.2	Mexico City	18.1
Constantinople	0.30	Canton	0.80	Paris	3.3	Bombay	18.0
Angkor	0.20	Edo (Tokyo)	0.69	Berlin	2.7	São Paulo	17.7
Kyoto	0.18	Constantinople	0.57	Chicago	1.7	New York	16.6
Cairo	0.14	Paris	0.55	Vienna	1.7	Shanghai	14.2
Bagdad	0.13	Naples	0.43	Tokyo	1.5	Lagos	13.5
Nishapur	0.13	Hangchow	0.39	St. Petersburg	1.4	Los Angeles	13.1
Hasa	0.11	Osaka	0.38	Manchester	1.4	Seoul	12.9
Anhilvada	0.10	Kyoto	0.38	Philadelphia	1.4	Beijing	12.4

SOURCE: 1000–1900 from Tertius Chandler, *Four Thousand Years of Urban Growth: An Historical Census* (Lewiston, NY: Edwin Mellen Press, 1987); 2000 from United Nations, *World Urbanization Prospects: The 1996 Revision* (New York: 1998).

With North America, Europe, and Japan already highly urbanized, most city growth will continue to occur in developing countries. The pace of urbanization today in places such as Lagos and Bombay echoes that of Chicago and New York a century ago. The big difference lies in the absolute population increase, however, which is much higher. (See Table 8–2.) Between 1990 and 1995, 263 million people were added to the cities of the developing world—the equivalent of another Los Angeles or Shanghai forming every three months. Indeed, population increase in developing-country cities will be the distinguishing demographic trend of the next century, accounting for nearly 90 percent of the 2.7 billion people due to be added to world population between 1995 and 2030.[13]

Regional variations within the Third World are striking. Some 73 percent of Latin Americans now live in cities, making the region roughly as urbanized as Europe and North America. Thus, the most explosive growth in the future is expected in Africa and Asia, which are still only 30–35 percent urbanized. (See Table 8–3.) In many parts of the developing world, particularly Southeast Asia and West Africa, urban numbers are hard to gauge as "circular" migrants—people who move to the city temporarily—elude census takers. In general, cities with more than 1 million people are often called large, while membership in the "megacity" club generally requires a population of 10 million. By this definition, Africa has just one megacity, Lagos. But burgeoning African cities of several hundred thousand are "mega-villages" that are growing too fast for local authorities to manage.[14]

As urban numbers swell, cities present not only problems but also opportunities. For millennia, cities have been the cultural centers and engines of creativity that advance civilization. They remain magnets that draw people and ideas. Urban environmental stewardship can improve local conditions, resulting in clean public spaces, services, and access to places of employment—all of which help ease inequities between rich and poor. The sheer size and reach of cities means that

Table 8–2. Rate and Scale of Population Growth in Selected Industrial Cities, 1875–1900, and Developing Cities, 1975–2000

City	Annual Population Growth (percent)	Population Added (million)
Industrial Cities (1875–1900)		
Chicago	6.0	1.3
New York	3.3	2.3
Tokyo	2.6	0.7
London	1.7	2.2
Paris	1.6	1.1
Developing Cities (1975–2000)		
Lagos	5.8	10.2
Bombay	4.0	11.2
São Paolo	2.3	7.7
Mexico City	1.9	6.9
Shanghai	0.9	2.7

SOURCE: Industrial cities from Tertius Chandler, *Four Thousand Years of Urban Growth: An Historical Census* (Lewiston, NY: Edwin Mellen Press, 1987); developing cities from United Nations, *World Urbanization Prospects: The 1996 Revision* (New York: 1998).

Table 8–3. Percentage of Population Living in Urban Areas, by Region, 1950–95, With Projections for 2015

Region	1950	1975	1995	2015
Africa	14.6	25.2	34.9	46.4
Asia[1]	15.3	22.2	33.0	45.6
Latin America	41.4	61.2	73.4	79.9
Industrial Countries[2]	54.9	69.9	74.9	80.0
World	29.7	37.8	45.3	54.4

[1]Excluding Japan. [2]Europe, Japan, Australia, New Zealand, and North America excluding Mexico.

SOURCE: United Nations, *World Urbanization Prospects: The 1996 Revision* (New York: 1998).

they will have a profound effect on the global environment—for better or worse. Today's cities take up 2 percent of the world's surface but consume 75 percent of its resources. Thus, increased efficiency in a relatively small part of the world would yield big results. The remainder of this chapter provides examples of changes in urban water, waste, transportation, and buildings that can benefit both people and the planet.[15]

Improving Water Supply and Quality

Most human settlements have been sited to take advantage of water for agriculture and transportation. The world's earliest cities arose in the valleys of great rivers: the Nile, the Tigris-Euphrates, the Indus, and the Yellow. But the rivers and streams that provide drinking water also receive household and industrial wastes, so the flow of water into a city and the flow of wastes out are intimately linked.[16]

Nineteenth-century engineers constructed vast water and sewer systems in industrial countries. The goal was twofold: to meet growing water demand by boosting supplies, and to channel wastewater and rainwater away from people as quickly as possible. These systems were an unquestionable boon to health. With better water and sanitation, life expectancy in French cities, for instance, shot up from 32 years in 1850 to 45 years by 1900.[17]

But large, costly projects have failed to reach many rural areas and poor urban districts. Despite gains during the 1980s, which was designated by the United Nations as the International Water Supply and Sanitation Decade, 25 percent of the developing world remains without clean water and 66 percent lacks sanitation. Waterborne diarrheal diseases, which arise from poor water and waste management, are the world's leading cause of illness. Each year, 5 million children die from diarrheal ailments; most come from poor urban families.[18]

Moreover, technologies designed to promote health now contribute to broader environmental ills. The first class of problems occurs in bringing water into cities. The architect Vitruvius wrote in the first century B.C. that finding water was the first step in planning a new city. But his contemporary colleagues today assume water is a secondary consideration, relying instead on engineers to divert rivers or pump water over great distances. Thus, cities have extended their reach for water, destroying fragile ecosystems and reducing the water available for crops. Prime examples include the western United States, where water battles are being waged, and northern China, where 108 cities report shortages. Since the turn of the century, municipal use of water worldwide has grown 19 times and industrial use has grown 26 times while agricultural use has increased only 5 times.[19]

Another set of damaging effects occurs as water is hurried away from cities. When rainwater is channeled through pipes and gutters, less water infiltrates the soil to recharge underground supplies. Roads also prevent water from seeping into the ground. Thus rain runs off pavement straight into channels, where it speeds into rivers and streams, causing more severe floods than would occur if plants or soil soaked up some of the deluge. Moreover, without enough water to recharge underground supplies, the land may subside, causing rail tracks to buckle, water pipes to burst, and building foundations to crack. And in coastal areas, salt water may leak into wells, ruining drinking supplies.[20]

A dramatic image of subsidence appears in a 1995 report on Mexico City's water supply. At first, the photo of a small boy apparently leaning against a tele-

phone pole looks out of place in a book about water. But the pole is actually a well casing that was once underground. Excessive withdrawal of groundwater has caused parts of Mexico City to sink more than 9 meters in the last century, so now the pipe towers some 7 meters above ground. Local children reportedly mark their height on it to see if they grow faster than the ground sinks.[21]

Water-short cities in the next century will be pressed to slake their thirst in ways that cause less ecological destruction and require less money. Conservation may be a large part of the solution. Unlike energy, water has yet to become a major target for efficiency gains. Complementary approaches include restricting development near drinking water sources and using low-cost methods of wastewater treatment.[22]

Metropolitan Boston provides an example of successful water conservation. Since 1987, the Massachusetts Water Resources Authority has managed to avoid diverting two large rivers to augment supply, as engineers had initially prescribed. For a third to half the cost of the diversions, the government has reduced total water demand by 24 percent by repairing leaky pipes, installing water-saving fixtures, and educating everyone from schoolchildren to plant managers on water-saving measures.[23]

Conservation is not only for the rich; developing countries also stand to save money. In the Third World, as much as 60 percent of water is lost through leaky pipes and theft. In Manila, for example, 58 percent of the drinking water is forfeited to leaks or illegal tapping, whereas Singapore, where pipes are better maintained, loses only 8 percent.[24]

A key to water conservation is removing incentives for profligate use. Lack of meters, inordinately low prices, and prices that decline as use increases all encourage wastefulness. As underpricing causes excessive use, the problem feeds on itself. With the cash-strapped water agency unable to maintain its pipes, more water is lost to leaks. This causes the agency to lay claim to additional water supplies, diverting them from agriculture. And as farms fail without irrigation, more people migrate to cities, raising the demand for water. Bogor, Indonesia, took its first steps to break this cycle in 1988, when it installed meters and hiked prices to encourage households to conserve. Demand initially fell by one third, allowing the utility to connect more families to the system.[25]

Although pricing the poor out of water is a concern, artificially low prices may hurt this group even more. Prices that do not reflect the true cost of water discourage utilities from extending service. It would be a losing proposition. Thus many of the poor in developing countries end up paying much more for water from private vendors, who charge anywhere from 4 to 100 times the public rate that wealthy citizens pay. In Istanbul, water from vendors is 10 times the public rate; in Bombay, it is 20 times higher.[26]

Making better use of rainwater is another conservation technique that doubles as a flood-control strategy. Metropolitan Tokyo, with 82 percent of its land surface covered by asphalt or concrete, suffers from torrential runoff that causes floods and depletes underground water supplies. The city has thus turned to rainwater as a supplemental source. Tanks atop 579 city buildings capture this free resource for use in washrooms, gardens, air-conditioning systems, and fire hoses. Now rain that falls on the giant Kokugikan sumo wrestling stadium supplies 70 percent of the water in the building that is not used for drinking.[27]

Other forms of water recycling also hold potential to enhance city water supplies. Municipal wastewater can be used instead of high-quality drinking water to flush toilets or to water lawns. If treated, it may be used to irrigate some types of crops

or to raise fish. Some 70 percent of Israeli wastewater is recycled in this way. Treatment is made easier if wastewater from industry is kept separate from the residential flow. In most countries, the flows are combined, however. Thus as cities in developing countries build sewage infrastructure, they will save money and water if they keep flows separate.[28]

Just as conservation of water can boost water supplies, conservation of land can protect water quality. A number of cities are finding that cooperating with neighboring regions, industries, and agriculture to protect watersheds is ultimately less costly than trying to make polluted water safe for drinking. New York City, for instance, plans to buy $300 million worth of land upstate to protect the watersheds that deliver the city's drinking water. The tactic is part of a comprehensive watershed protection strategy that, while costly at $1.4 billion, will save the city from having to pay $3–8 billion for a new filtration system.[29]

Limiting development near important water sources not only preserves water quality, it also prevents floods and provides a connection to nature. In the 1880s, landscape architect Frederick Law Olmsted persuaded Boston that keeping buildings away from floodplains by establishing riverfront parks would ultimately prove cheaper than keeping floods away from buildings through huge public works projects. The result was the verdant Back Bay Fens, a park that protected the neighborhood from flooding. In contrast, Los Angeles has paid for failing to heed similar warnings made by Olmsted's son in the 1930s—the city has little parkland and faced $500 million in damages from three major floods in the early 1990s alone.[30]

In addition to improving water supply and quality, cities can also treat wastewater at lower economic and environmental cost. One time-honored biological approach—wetlands treatment—uses more land but is also much less expensive and does not produce toxic sludge. Vegetation in stabilization ponds or modified wetlands extracts contaminants such as nitrates and mercury, while bacteria and other organisms break down toxic compounds. Phoenix, Arizona, is creating wetlands to clean a portion of its sewage because the option is much cheaper than a $625-million upgrade of its wastewater treatment plant.[31]

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Where cities have been unable or unwilling to extend sewers to the poorest people, some communities have stepped into the breach with low-cost solutions. The most famous example is in the Orangi district of Karachi, Pakistan, home to nearly 1 million "squatters." In the early 1980s, Akhter Hameed Khan, a dynamic community organizer, formed a nongovernmental research institute called the Orangi Pilot Project. Between 1981 and 1996, this group helped neighborhoods to organize, collect money, and manage construction of sewers that serve some 90 percent of Orangi's residents.[32]

Increasingly, cities are looking to tap the resources of the private sector, as governments alone will be unable to come up with the billions of dollars needed over the next decade for reliable water systems. Water privatization is most extensive in the United Kingdom and France, and companies from these countries are beginning to ply their trade abroad. Only 5 percent of the financing for water worldwide comes from private sources, but privatization, in various degrees, is a growing trend. Between 1990 and 1997, the number of private water projects in developing countries increased more

than 10-fold, mainly in Latin America and East Asia. In Buenos Aires, for instance, an international consortium led by the French firm Lyonnaise des Eaux-Dumez renovated thousands of kilometers of pipes in the water system, expanding coverage and lowering rates.[33]

Still, privatization is not a panacea. Water supply and sanitation are important public services, so some form of public control or regulation will always be needed to make sure that quality and prices are reasonable. Unfortunately, few cities have regulations in place yet to make privatization work fairly.

Mining Urban Waste

Remains from some of the earliest cities suggest that residents there at first took a *laissez-faire* approach to waste disposal, simply raising the roofs of their houses as mounting garbage caused street levels to rise. In eighteenth-century Boston, when refuse threatened to impede industrial progress, the city's first "paved" roads were built: wooden planks placed on top of the garbage. A century later, Charles Dickens spoke to both the water and waste problems of nineteenth-century New York when he referred to it as "a city without baths or plumbing, lighted by gas and scavenged by pigs."[34]

Today, garbage is most voluminous in rich countries but most visible in cities of developing countries. In the 1950s, Manila began to dump much of its garbage in a poor neighborhood, laying the foundation for what would become the city's most striking topographical feature—"Mount Smoky." Methane from the rotting refuse burned in an acrid haze, lending the summit its name. Until a newly elected Philippine president razed the garbage mountain in the early 1990s, it towered 40 meters above sea level in Manila Bay and was home to some 20,000 people who made a living from scavenging the refuse.[35]

Like water, waste profoundly affects human health. Hazards are most pronounced in the developing world, where between one third and half of city trash goes uncollected. Open piles of garbage attract disease-carrying rats and flies, and often wash into drainage channels, where they contribute to floods and waterborne disease. And even the most expensive methods of waste disposal—high-tech "sanitary" landfills and incinerators—are not completely free of health risks. Toxins from landfills can leach into groundwater, and heavy metals, chlorine compounds, and dioxin are among the hazards in incinerator ash.[36]

City waste has many broader environmental implications. Just as storm drains short-circuit the water cycle, urban waste disposal systems designed to speed wastes away from people actually interrupt the nutrient cycle. Trucks, planes, and trains haul food into cities from great distances, but the nutrients rarely make it back to farmland. Roughly half of the 20,000 tons of food that New York City receives each day is transformed into human energy; the other half is shunted to sewers or trucked to increasingly remote landfills. Not only does this add to the waste disposal burden, it also heightens the demand for manufactured fertilizer, a major source of nitrogen pollution, which is a growing global threat.[37]

Moreover, throwing items away instead of reusing or recycling them increases the demand for new resources obtained by environmentally destructive mining and logging. (See also Chapter 3.) In 1895, George Waring, New York City's commissioner of street cleaning, recognized that the "out of sight, out of mind" approach to trash "is an easy one to follow, but it is not an economical one, nor a decent one, nor a safe one." His prescient warning went unheeded. In the industrial world, waste collection has improved public

health, but the problem of waste generation has only worsened. Urbanites in industrial countries generate up to 100 times more refuse per person than their counterparts in developing countries.[38]

But cities have the potential to shift from being repositories of waste to great sources of raw materials. The farms, forests, and mines of the twenty-first century may well be found in our urban centers—in the form of city gardens and recycling plants. Local authorities can spur the transition by providing incentives for composting, recycling, and waste-based industries.

Organic waste—paper, food scraps, lawn clippings, and even human waste—is a valuable resource. In industrial countries, food and yard waste alone account for some 36 percent of the municipal waste stream. European cities are leading a trend toward composting, which transforms this organic waste into a product that invigorates agricultural soils. Cities in seven countries—Austria, Belgium, Denmark, Germany, Luxembourg, the Netherlands, and Switzerland—collect these wastes separately, recovering more than 85 percent of them.[39]

Composting can also boost urban food security by enriching city gardens. The U.N. Development Programme (UNDP) estimates that 800 million urban farmers harvest 15 percent of the world's food supply. In parts of Africa, urban agriculture is a survival strategy. Some 68 percent of families in Dar es Salaam, Tanzania grow vegetables or raise livestock. City farmers also tend 80,000 gardens in Berlin as well as crops in Buenos Aires that meet one fifth of that city's nutritional needs.[40]

To keep paper and inorganic materials such as metals, glass, and plastics from landfills, a number of cities have found ways to promote recycling and waste-based industries. They can charge a fee for the collection of unsorted garbage, for example, while picking up for free refuse that has been separated for recycling. By adopting "pay-as-you-throw" systems, at least 11 U.S. cities have boosted recycling rates to the 45–60 percent range, well above the national average of 27 percent.[41]

Some cities have gone a step further, to engage the industries that create disposable goods or generate waste. In 1997, Tokyo municipal officials—looking for new waste disposal options in land-short Japan—announced that they would require makers and distributors of plastic bottles to recover and recycle their products. And Graz, Austria, has created a labeling program to spur small- and medium-sized industries to reduce waste: companies receive the city's Ecoprofit label if they reduce solid waste by 30 percent and hazardous waste by 50 percent.[42]

While the private sector is a newcomer to water supply and sanitation, it has a long history in waste collection and disposal. In some developing-country cities, local authorities have struck recycling deals with private companies and even self-employed wastepickers. (See Table 8–4.) City officials in Bandung, Indonesia, are working with a local nongovernmental organization (NGO) to employ a group of scavenger families. The families receive financial and technical support to separate recyclables more safely and efficiently, compost organic wastes, and create businesses that use the wastes they collect as raw materials. They make money—and the city reduces the cost of waste management.[43]

A handful of cities are moving beyond recycling to "industrial symbiosis," where one company's waste becomes another's input. (See Chapter 3.) The first eco-industrial park began to evolve more than 20 years ago in Kalundborg, Denmark. Today, waste gases from an oil refinery there are burned by a power plant, waste heat from the plant warms commercial fish ponds, and other companies use byproducts of combustion to make wallboard and concrete. According to one calculation, Kalundborg's waste-saving

Table 8–4. Community Waste-Based Industries

Location	Description
Santos, Brazil	Calculating that scavengers were collecting about 1,200 tons of recyclable materials per month, compared with the city's 200, Santos authorities began to pay scavengers to collect recyclables; the scavengers also share in the profits from sale of the materials.
Dakar, Senegal	Dakar officials divided the city into collection zones with subsectors and invited companies to bid for contracts to collect waste from a maximum of three zones. Companies must subcontract in each sector with community groups that collect garbage from inaccessible areas and educate their neighbors. The new system costs less, covers 80 percent of the city (15 percent more than before), and provides 1,000 new jobs.
Cairo, Egypt	The Zabbaleen have been garbage pickers since they began coming to Cairo in mid-century. With the help of aid agencies, the city and the community launched a program in 1981 to improve city collection service and boost the Zabbaleen's income and standard of living. Today, the Zabbaleen sew rags into quilts and compost animal waste to sell to farmers.

SOURCE: International Council for Local Environmental Initiatives (ICLEI), "Santos, Brazil: Recycling, Dignity, and Citizenhood," *Members in Action, 1996–1997* (Toronto: 1997); ICLEI, *Urban Community of Dakar, Senegal: Participatory Solid Waste Management*, Case Study 45 (Toronto: January 1997); Richard Gilbert et al., *Making Cities Work: The Role of Local Authorities in the Urban Environment* (London: Earthscan, 1996); Akhtar Badshah, *Our Urban Future* (London: Zed Books, 1996).

approach translates into $120 million in savings and revenues on a $60-million investment over a five-year period. Since 1993, more than 20 U.S. cities hoping to revive stagnant economies have announced plans for similar parks.[44]

Moving People and Goods

Transportation shapes cities. While walking distances constrained life in the earliest cities, by the end of the nineteenth century electric trolley and rail tracks stretched growing industrial cities into radial spokes. Early twentieth-century "streetcar suburbs" in North America and Europe were initially compact, with houses a short walk from the stations.[45]

The automobile allowed the city to spread out in a more random fashion than ever before—a trend the United States was quickest to adopt. By the 1930s, developers were building houses and roads between the rail spokes for people with cars. Bangkok has experienced a speeded-up version of this phenomenon. As recently as 1959, a group of U.S. consultants noted: "To a person accustomed to Western standards, [Bangkok] is remarkable for its compactness. A vigorous walker can traverse it from north to south in three hours or less." But as population soared and a city built for canal traffic became a city dominated by motorized vehicles, Bangkok's built-up area mushroomed from 67 square kilometers in 1953 to 426 square kilometers in 1990. Today even the most vigorous walker would probably not contemplate a cross-city voyage on foot; in fact, it can take three hours to cross Bangkok by car.[46]

The shape of a city, in turn, influences livability and demands on natural

resources. Sprawling conurbations threaten both human and environmental health. By the mid-1920s, Le Corbusier was lamenting the destruction wrought by car fumes: "On the Champs Elysees, half the chestnuts lining the avenue have their leaves withered….Our lungs absorb these dangerous gases. But the martyred trees cry out, 'Beware!'" Today, vehicle exhaust is often the dominant ingredient in urban air pollution, which takes at least 3 million lives worldwide each year.[47]

Roads designed to hasten the speed of cars are often dangerous. Traffic accidents kill some 885,000 people each year—equivalent to 10 fatal jumbo jet crashes per day—and injure many times this number. Another health threat is less obvious: by replacing short trips that could be made by bicycle or on foot, cars promote sedentary lifestyles. Even in the United Kingdom's most hostile traffic, the health benefits of cycling—reduction in coronary heart disease, obesity, and hypertension—outweigh the risks of accidents by around 20 to 1, according to the British Medical Association.[48]

Car dependency also breeds social inequities. One third of the U.S. population is too young, too old, or too poor to drive. Some 98 percent of Boston's welfare recipients live within walking distance of public transit, but only 32 percent of potential employers are that close to a transit station. In the developing world, as much as 80 percent of the population can afford a bicycle, but only 5–10 percent earn enough to buy a car.[49]

Some technical fixes, already adopted in most industrial nations, are urgently needed in many developing countries. The reduced health risks and car maintenance costs that follow from removing lead from gasoline and requiring catalytic converters far outweigh the expense. The World Bank estimates that in Manila, basic improvements in vehicles and fuels alone would save more than 2,000 lives and at least $200 million a year in avoided health costs. Even more efficient cars and cleaner fuels are on the horizon—in the form of ultra-efficient cars powered by emissions-free hydrogen fuel cells, for instance. (See Chapter 2.) While promising, these innovations will still only address pollution, leaving accidents, congestion, and social inequities untouched.[50]

Greater reliance on cars in cities cannot be sustained. In the United States, suburban roads and houses supplant more than 1 million hectares of farmland each year. According to government estimates, some 200,000 hectares of arable land in China disappear each year under city streets and developments in China. Today, transportation accounts for 15–20 percent of the annual 6 billion tons of carbon emissions from human activities that are leading to climate change. By 2030, China is expected to have 828 million city dwellers. If they were to drive as much as the average American, the carbon emissions from transportation in urban China alone would exceed 1 billion tons, roughly as much as released from all transportation worldwide today.[51]

Transportation and land-use decisions by city officials can shape an alternative to the car-reliant city: a cleaner, greener, and more equitable urban form. Some of the best examples come from Western Europe and Scandinavia. The Netherlands has 128 cars per square kilometer, one of the highest densities in the world. But nationwide spatial planning gives priority to bike paths, allowing Dutch cities to achieve some of the world's highest rates of bicycle use. Some 30 percent of all urban trips there are made by bike, compared with less than 1 percent in U.S. cities. In Stockholm, the city council has orchestrated "transit villages" around suburban rail stations, allowing homes to sprout only a short walk from offices and stores. The walkability of these neighborhoods prompted car trips to fall by 229 kilometers per person between 1980 and 1990

as transit use rose.[52]

Curitiba, Brazil, is famous for both its busways and its bikeways. In the early 1970s, the city designated several main roadways radiating from the city center as structural axes for busways. Through zoning laws, the city encouraged construction of high-density buildings along these transit corridors. Since then, innovations such as extra-large buses for popular routes and tube-shaped shelters where passengers pay their fares in advance have added to the system's speed and convenience. The bus stations link to a 150-kilometer network of bike paths. Although Curitiba has one car for every three people, two thirds of all trips in the city are made by bus. Car traffic has declined by 30 percent since 1974, even as the population doubled.[53]

In cities where public support for transit and cycling is strong, some interesting private initiatives are beginning to flourish. Car-sharing networks, for example, have grown in popularity in Europe since the late 1980s. Each member pays for a card that opens the lockers that hold keys to cars parked around the city. Members who call the network to reserve a car are directed to the closest one. The European Car Sharing Network now has more than 100,000 participants in 40 organizations in 230 cities in Germany, Austria, Switzerland, and the Netherlands. One of the largest groups is Stattauto, headquartered in Berlin, which estimates that each of their vehicles replaces five private cars; altogether the fleet eliminates 510,000 kilometers of driving each year.[54]

The private sector has been involved in financing city transport for a long time. In the late nineteenth century, private companies would foot the bill for urban rail construction in return for development rights near the stations. Public funds have paid for such construction in recent years. But now a company in Portland is negotiating construction of a light rail track to the airport in exchange for a lease to airport land. At the same time, an elevated rail system through Bangkok will get much of its revenue from property development under the route, and numerous other projects are under way elsewhere. The private sector can help operate public transit as well. In Curitiba, private companies pay for bus operating costs; the city pays for the roads, lighting, bus stops, and staff to monitor the companies.[55]

Copenhagen has even extended the public-private partnership idea to bicycles. The city maintains a fleet of bikes for public use that is financed through advertising on the wheel surfaces and bicycle frames. The system is popular: organizers estimate that the 2,300 bicycles are used on average once every 8 minutes.[56]

Building Better Neighborhoods

The layout of neighborhoods goes hand-in-hand with transportation in shaping cities. By building roads, rail lines, or bike paths, cities decide not only how people will move around, but where the accessible and desirable buildings will be and where new services will be needed. And by mandating where new buildings can be built and what kind of uses—residential, retail, industrial—are allowed, land-use and zoning laws influence how far people must travel to get to work, buy food, and go about their daily business.[57]

Responding to pollution and overcrowding in the early twentieth century, local governments in the United States adopted zoning laws that limited residential density and placed restrictions on land use that separated houses from businesses. The car helped make such land use possible, and ever greater distances between houses, stores, and jobs made the car more essential. That feedback effect has helped to make U.S. cities

among the least compact and most car-dependent in the world. (See Table 8–5.)

Much of the chaotic urban development in developing countries occurs because 30–60 percent of city populations live in squatter settlements and 70–95 percent of new housing is technically outside the law. In Cairo, to cite just one case, informal settlements have grown rapidly, turning a cemetery in the city's eastern section into the "City of the Dead," where poor families squeeze into the small caretakers' rooms in the tombs. At the same time, more than a half-million apartments stand empty because the poor cannot afford the public housing and because the private sector caters to the upper class.[58]

The arrangement of buildings helps determine the livability of a city. Streets come alive with pedestrians when shops, factories, offices, and houses are all within walking distance of each other. And city greenery and parks between buildings cool streets and soothe the spirit. In contrast, public life diminishes when architects design office parks and shopping malls to be enjoyed from the inside, and gaping parking lots to welcome cars but not pedestrians. Crime often plagues fragmented cities, which isolate the poor in distinct pockets. Brazilian scholar Raquel Rolnick has exposed the link between territorial exclusion and violence in cities within the state of São Paulo. On the other hand, urban analyst Jane Jacobs noted an advantage to diverse street life when she wrote about Manhattan in the early 1960s: many "eyes on the street" deter crime.[59]

Table 8–5. Population Density and Car Use in Selected Cities, by Regional Average, 1990

Location of Cities	Population Density	Private Car Use Per Capita
	(persons per hectare)	(kilometers driven per person)
United States	14.7	10,870
Canada	26.2	6,946
Europe	49.9	4,519
Wealthy Asia	163.9	1,487
Developing Asia	162.8	1,611

SOURCE: Peter Newman and Jeffrey Kenworthy, *Sustainability and Cities: Overcoming Automobile Dependence* (Washington, DC: Island Press, in press).

Neighborhood layout also influences the resource demands of a city. Changes in the layout can lower energy demands from transportation by a factor of 10. And trees that block buildings from the sun or wind lower the energy the residents need for heating and cooling. Moreover, when neighborhoods are spread out at low density, they require more water, sewer pipes, power lines, and roads. Sprawling cities also use more building materials. Buildings, which consume roughly 40 percent of materials in the global economy, represent one fourth of the demand for wood worldwide.[60]

Economic concerns are forcing a number of local authorities in the United States to face up to these realities. A Rutgers University study found that compact growth instead of sprawl-as-usual would save New Jersey taxpayers $1.3 billion in infrastructure costs over 20 years. Similarly, another study predicted that if rapid suburban development continued apace in Maryland between 1995 and 2020, the new sewers, water pipes, schools, and roads to support it would cost about $10 billion more than if population growth were accommodated by more condensed development. And the U.S. Forest Service estimated that planting 95,000 trees in metropolitan Chicago would yield a net benefit of $38 million in energy savings over 30 years.[61]

A few cities are beginning to rein in rapacious development, boost parkland, and even improve the quality of buildings that do get constructed. Their tools include regulations or incentives that push developers to build on vacant land within the city rather than outlying green areas, setting aside land for informal settlements,

and changing city building codes.

The U.S. city with the most success at stemming sprawl is Portland, Oregon. A 1973 state law requires the metropolitan area to demarcate an urban growth boundary to allow for future growth without encroaching too far into agricultural or forestland. Planners are now trying to reduce the need for cars within the boundary. New rules require 85 percent of new building to be within a five-minute walk of a transit stop. Revised codes allow for mixed-use development of apartments above stores and forbid "snob zoning" that prohibits the denser type of housing—townhouses and apartment buildings—that can support transit.[62]

In Kimberly, South Africa, a private developer teamed up with local residents to replace shacks with a low-cost "solar neighborhood" for 200 families.

Compact cities need not be forbidding concrete jungles. Portland has fortified its ties to nature by removing freeways that blocked access to the Willamette River and requiring buildings to step down as they approach the city's eastern edge, in order to protect "view corridors" of Mount Hood. And because suburban development is confined, Portlanders do not have to travel far to enjoy the wilderness. Peter Newman and Jeff Kenworthy, Australian researchers who have analyzed transportation in cities extensively, point out that some of the most population-dense and least car-reliant European hubs, such as Paris and Vienna, are among the most aesthetically pleasing cities in the world.[63]

To reduce fringe development, a number of older industrial cities are offering incentives to redevelop vacant or abandoned parcels of land within the metropolitan area. Some of the most sought-after new housing in southern England, for instance, is on such "infill" sites. One concern, however, is that a former occupant may have been an industrial polluter who left the land contaminated. By offering tax credits and funds for environmental cleanup, cities and higher forms of government can entice buyers to take the risk—a strategy that benefits the region in the long term. Following the U.S. Environmental Protection Agency's announcement of a federal "brownfields" initiative, some 228 pilot redevelopment efforts have been proposed in U.S. cities.[64]

Increasingly, local authorities in developing countries recognize the truth of a point made a decade ago by researchers Jorge Hardoy and David Satterthwaite: "the unnamed millions who build, organize and plan illegally are the most important organizers, builders and planners of Third World cities." Those who cannot afford a house on the formal market seek out the most precarious slopes and river valleys. Squatters are unlikely to receive an eviction notice—but they probably will never see water pipes and electricity lines either. However, most cities contain places where low-income sites could be developed, at lower cost, because they are already close to transportation and services. In Curitiba, the city set aside such tracts for informal settlements.[65]

Not only can neighborhoods be laid out better, buildings themselves can be constructed better. Buildings—which have their own water, waste, and energy flows—are actually microcosms of the city. They are particularly well suited to use the new decentralized energy technologies such as solar panels that generate electricity and natural gas turbines that generate both heat and electricity. (See Chapter 2.) Cities can support green construction by setting codes that require buildings to be

energy-efficient, and by requiring green design for public construction. The Danish Planning Institute has published a guide to urban ecology in Copenhagen that highlights 45 projects in the city that use much less water and energy than conventional buildings and that contain facilities to compost organic waste.[66]

In the much less affluent city of Kimberly, South Africa, a private developer teamed up with local residents to replace tin and mud shacks with a low-cost "solar neighborhood" for 200 families. Based on that success, the developer is planning a similar project for the smaller town of Ugie, where homes using passive solar design and solar ovens will be clustered in groups of six to share gardens. Household organic waste, composted on-site, will be used in the gardens, as will filtered wastewater. The basic home costs no more than the $3,200-government subsidy for first-time home buyers—a state-assisted "self-help" program designed to address the legacy of apartheid. Costs stay low because residents do the construction themselves.[67]

Realizing the Vision

At the end of her classic 1984 book on the urban environment, *The Granite Garden*, Anne Whiston Spirn reminds us that "in the present lies not only the nightmare of what the city will become if current trends continue, but also the dream of what the city could be." Taking today's urban problems to an apocalyptic conclusion, Spirn envisions an "infernal city" that has disintegrated following uprisings by city dwellers denied adequate food, water, and work. Social and environmental ills have followed those fleeing cities into a countryside ravaged by suburban development.[68]

The innovations in water, waste, transportation, and neighborhoods described in this chapter help shape an alternative "sustainable city" vision. It is a city with a unique sense of place. Architects and engineers design buildings and transportation systems in response to citizens' requests and local climate. Rich and poor alike share clean air and water and vibrant public spaces. John Eberhard of the Massachusetts Institute of Technology suggests that just as the industrial city supplanted the preindustrial, a "third generation" of urban systems will arise. In the sustainable city, these new systems mimic the metabolism of nature. Rather than devouring water, food, energy, and processed goods and belching out the remains as noxious pollutants, the city controls its appetites and puts its waste to use. Rainwater and filtered wastewater are used to water gardens. Food scraps become compost that sustains the city's vegetable crops. Roofs are adorned with water tanks, vegetation, and solar panels.[69]

In June 1996, representatives from 171 nations and 579 cities met in Istanbul for the second U.N. Conference on Human Settlements (Habitat II) to endorse the broad outlines of the sustainable city vision: "the universal goals of ensuring adequate shelter for all and making human settlements safer, healthier and more livable, equitable, sustainable and productive." Delegates signed on to a Habitat Agenda that complemented the call for sustainable development made four years earlier in Rio, at the U.N. Conference on Environment and Development. Some 127 governments arrived in Istanbul with five-year national action plans; they agreed that a key to implementing their proposals would be support of the city-level Local Agenda 21 plans called for in Rio. These conferences—which included record numbers of NGOs—shone a spotlight on problems of environment and development, from the global to the local level. And in doing so, they helped reveal two key obstacles to progress in sustainable urban planning:

lack of political will and lack of money.[70]

Lack of political will may relate to insufficient understanding of local problems. Cities highlighted in this chapter for their "eco-innovations" succeeded because they identified problems and the links between them. A charismatic mayor in Curitiba, for instance, saw that chaotic development and poor public transportation conspired to worsen air pollution: car use increased as buildings sprouted far from bus stops. When citizens understand such connections, they often support or even demand change. Yet most poor cities lack the basic demographic and environmental data necessary to unveil the links between problems. The Habitat Agenda charges the U.N. Centre on Human Settlements (Habitat) with helping in such data gathering, in order to review post-conference progress. Since 1995, Habitat has been compiling data, which now includes indicators on population, income, water, waste, housing, and transportation for 237 cities in 110 countries. To expand the effort, Habitat has been assembling government experts, university scholars, and independent researchers in a Global Urban Observatory Network.[71]

Yet even when data on local problems are adequate, cities may face a dearth of ideas for solutions. Inspiration from other cities may help bolster political will. Nineteenth-century sanitary reforms gained momentum as scientists and local authorities from different cities compared notes. Such exchange is just as essential today. In 1990, the Toronto-based International Council on Local Environmental Initiatives (ICLEI) was formed to serve as the environmental arm of the world's oldest association of municipalities, the International Union of Local Authorities. As a clearinghouse, ICLEI disseminates information about the 2,000-plus cities in 64 countries that are now working on Local Agenda 21 initiatives. In a similar vein, one of the most immediate outcomes of the Istanbul meeting was a database of "Best Practices," which now contains more than 650 urban success stories. Each city is unique, so an innovation from one might be adapted, rather than precisely replicated, in another.[72]

Direct contact between local authorities from different cities can speed such information exchange. In recent years, networks for sustainable cities have proliferated, organized by existing municipal associations, NGOs, national governments, or international agencies. The New York-based Mega-Cities Project, one of the most prominent NGOs, was founded in 1987 to promote exchange between officials from the world's largest cities. Europe has some of the strongest city exchange programs. More than 100 European city leaders convened in Aalborg, Denmark, in 1994 to inaugurate the European Sustainable Cities and Towns Campaign, which is supported by several municipal associations in Europe, as well as ICLEI and the World Health Organization. Networks linked to governments or international agencies may have a funding component. For instance, the World Bank and the European Investment Bank brought mayors of cities bordering the Mediterranean together in Barcelona in 1991 to launch the Mediterranean Coastal Cities Network. The lending institutions, along with UNDP, help the cities gather data on environmental problems and devise solutions, as well as exchange information.[73]

Even when political will exists in one part of a city, fragmented governance often inhibits political action. Rarely does one government structure correspond to an entire metropolitan region. As districts within a metropolis compete with each other for development that will boost tax revenue, they push built-up areas over forests and farmland, pave over watersheds, and invite air pollution from increased car use. In the United States,

the city that has made the most notable progress toward sustainability, Portland, is also the only one with an elected metropolitan government. David Rusk, former mayor of Albuquerque, New Mexico, has shown that regions with strong metropolitan cooperation are also less segregated along lines of race and class and are economically healthier. And Myron Orfield, a legislator from Minnesota, has helped galvanize "metropolitanism" in the United States—a movement that includes inner-city boosters and residents of decaying older suburbs seeking to direct investment toward existing infrastructure, as well as environmentalists trying to protect fringe areas from development.[74]

National and subnational policies can make or break a city's efforts to develop sustainably. Only higher levels of government can subdue the rivalry that spawns urban sprawl. State law requires Portland, for instance, to constrain its metropolitan boundary. Similarly, national policies that integrate environmental and spatial planning in Denmark and the Netherlands restrict new urban development in cities such as Copenhagen and Amsterdam to preserve green space. A city council can enact building codes to improve water and energy efficiency, but its conservation efforts will be undermined if the national government continues subsidizing the use of these resources. Cities with Local Agenda 21s are generally those that have strong support from the national level. A 1997 survey showed that 82 percent of known Local Agenda 21 initiatives were concentrated in 11 countries with national campaigns sponsored by government or country-wide municipal associations.[75]

The second main obstacle, lack of money, is often exacerbated by such disconnections between different levels of government. National governments in both industrial and developing countries have continued to shift functions to subnational and city governments in recent years, relying on local authorities to find the money to do the job. Yet city governments are generally not allowed to levy taxes high enough to yield the needed revenue. The challenge for cities is to mobilize existing revenue and local resources to provide needed services.[76]

National policies that integrate environmental and spatial planning restrict new urban development in Copenhagen and Amsterdam to preserve green space.

If cities have control over services that draw on natural resources, they may be able to raise fees to meet both economic and environmental goals. Fees for unsorted household garbage have bolstered urban recycling efforts in a number of industrial countries. The success of water conservation programs from Bogor to Boston has hinged on higher prices—a standby of energy efficiency as well. Rather than maintain artificially low prices for all, water authorities or electric utilities can provide targeted subsidies, such as a loan or grant for the poorest families to pay for the initial hook-up, which is often the most prohibitive cost. Another tactic is to raise fees on parking to discourage driving and help fund public transportation.

In seeking to fund a sustainable city, local authorities have increasingly relied on the resourcefulness of local communities and NGOs, as well as the profit-making ability of the private sector. Both types of alliances work best if they are actual partnerships, in which local authorities acknowledge their responsibility for safeguarding public welfare. When the resources of the private sector far outweigh those of the city, local authorities may be unable to oversee the companies' activities and to insist on service provision

to all. These concerns are not new: in the industrial cities of the nineteenth century, people complained that rail companies neglected projects that would benefit the public. UNDP's recently established Public Private Partnerships for the Urban Environment program emphasizes the importance of public oversight. It aims to help cities in developing countries turn environmental problems into viable business opportunities in water, waste, and energy services.[77]

Some cities have found a novel way to use one of the most widespread forms of local revenue, the property tax, to promote development of vacant lots within urban areas. Taxes on buildings tend to raise rents and discourage urban redevelopment, so shifting property taxes from buildings to land can stimulate construction on central sites, and can encourage speculators to develop empty city lots to help pay their taxes. But such a shift will only work if complementary policies protect surrounding forests and farmland from development. Thus, metropolitan areas subject to spatial restrictions on growth may be best equipped to make use of this tactic.[78]

Higher service fees and targeted tax policies will not achieve their desired effect if people cannot pay bills or taxes. Pervasive unemployment and poverty often keep cash-strapped cities in the red. Most mayors, according to a recent survey by UNDP, cite job creation as their most pressing concern. The need for environmental services can match up with the demand for jobs, as the experience with community waste-based industries in cities such as Cairo demonstrates. Small-scale lending programs—"microcredit"—can also help alleviate the poverty that blights cities. Small loans give a chance to poor entrepreneurs who lack the collateral a traditional bank would require. In the United States, there were 250 microcredit programs in 1996, twice as many as in 1992. According to the World Bank, 30–80 percent of workers in the developing world work in the microenterprise sector.[79]

Rectifying local finances and improving the ability of citizens to pay local taxes frees up money for environmental protection. In Ahmedabad, India, a talented municipal commissioner began a campaign in the early 1990s to balance the city's budget by eliminating costly corruption, raising utility rates, and collecting taxes. By 1996, the city boasted a substantial surplus, as revenues shot past expenditures. With the new funds, the city initiated a host of projects to improve the local environment and public health. As environmental health rebounded, so too did the climate for private investment, which may ultimately attract even more money to solving Ahmedabad's problems. With advice from the U.S. Agency for International Development, the city has floated India's first municipal bond, which will finance improvements in water and sewer infrastructure.[80]

In the late nineteenth and early twentieth centuries, those who reflected on life-threatening urban pollution—Dickens, Howard, and Le Corbusier among them—feared that cities might eventually self-destruct. Today, it is not only inhumane living conditions but also unsustainable resource use that pose a threat. Efforts to overcome the political and financial barriers to sustainable city planning have one thing in common: the dynamism of committed people trading ideas and working together. It is this concentration of human energy that allowed cities to give birth to human civilization—and that may ultimately save it.

Notes

Chapter 8. Exploring a New Vision for Cities

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