CHAPTER

02

Urbanization as a Transformative Force

QUICK FACTS

① Over the last two decades, cities have emerged as the world's economic platforms for production, innovation and trade.

② Urban areas offer significant opportunities for both formal and informal employment, generating a sizeable share of new private sector jobs.

③ Urbanization has helped millions escape poverty through increased productivity, employment opportunities, improved quality of life and large-scale investment in infrastructure and services.

④ The transformative power of urbanization has in part, been facilitated by the rapid deployment of Information and Communications Technology.

POLICY POINTS

① Cities have become a positive and potent force for addressing sustainable economic growth, development and prosperity and for driving innovation.

② Realizing the gains of urbanization will depend on how urban growth is planned and managed, and the extent to which the benefits accruing from urbanization are equitably distributed.

③ The need to move from sectoral interventions to strategic urban planning and more comprehensive urban policy platforms is crucial in transforming city form.

④ When ICT is deployed unevenly, it can create a digital divide, which can exacerbate inequality, characterized by well-connected affluent neighbourhoods coexisting with under-serviced residents in low-income neighbourhoods.

of global GDP is accounted by cities

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Contribution of cities to national income is greater than their share of national population

Paris: is 16% of the population of France, but accounts for 27% of GDP

Kinshasa: is 13% of the population of DRC but accounts for 85% of GDP

Metro Manila: is 12% of the population of Philippines but contributes 47% of the GDP

……

WELL PLANNED AND MANAGED URBANIZATION BENEFITS

- Economic prospects and quality of life for the majority
- Drives innovation and productivity
- Contribute to national and regional development
- Alleviation of poverty
- Work towards social inclusion

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Transformative Power of Connected Cities:

The deployment of **information and communications technologies in cities supports innovation and promotes efficiencies in urban infrastructure leading to lower cost city services.**

In some cases, urban economies are able to leapfrog stages of development by deploying new technologies in the initial construction of infrastructure.

Key issues that position cities at the fore towards enabling transformative and sustainable development

01 The dynamic economic transition of cities in national and global contexts

02 The evolving spatial form of cities

03 Capacity of cities to address environmental risks;

04 The emergence of smart and connected cities, driven by information and communication technologies (ICT), city data movements and the field of big data

ROLE OF CITIES IN SUSTAINABLE DEVELOPMENT

Cities

play a central role in moving the sustainable energy agenda forward.

Current global share of renewable energy supply is **11%**

The diversity of renewable energy resources is vast and research indicates a potential contribution of renewable energy reaching **60%** of total world energy supply.

Sustainable **urban mobility**

provides efficient access to goods, services, job markets, social connections and activities while limiting both short- and long-term adverse consequences on social, economic, and environmental services and systems. An evolving transformative trend is the shift away from auto-dependency.

Good governance

is crucial for developing, maintaining, and restoring sustainable and resilient services and social, institutional, and economic activity in cities. Many city governments are weakened due to limited power and responsibility over key public services, including planning, housing, roads and transit, water, land-use, drainage, waste management and building standards.

Tracking the last twenty years of development reveals a global transformation that positions cities at the core of the development agenda. Urbanization is indeed one of the most significant trends of the past and present century, providing the foundation and momentum for global change. The shift towards an increasingly urbanized world constitutes a transformative force which can be harnessed for a more sustainable development trajectory, with cities taking the lead to address many of the global challenges of the 21st century, including poverty, inequality, unemployment, environmental degradation, and climate change. Cities have become a positive and potent force for addressing sustainable economic growth, development and prosperity, and for driving innovation, consumption and investment in both developed and developing countries. This dramatic shift towards urban life has profound implications for energy consumption, politics, food security and human progress.[1] Although some of this change is positive, poorly planned urbanization can potentially generate economic disorder, congestion, pollution and civil unrest.[2]

Urbanization is indeed one of the most significant trends of the past and present century, providing the foundation and momentum for global change

Cities have become a positive and potent force for addressing sustainable economic growth, development and prosperity, and for driving innovation, consumption and investment in both developed and developing countries

As the mindsets resisting urbanization have changed, so have city dwellers' living and working environments. Globally, urban centres are expanding due to their capacity to generate income, contribute to national wealth, attract investments and create jobs.[3] Cities are places of mass production, consumption and service provision, with their scale, density and diversity of social, cultural and ethnic groups, setting them apart from rural contexts.[4] This draws sharp focus to the galvanizing power of proximity for innovation, including the economies of urbanization and agglomeration—which together establish the foundation of the transformative power of urbanization.

From New York to São Paulo, the upside potential of globalization has facilitated the re-emergence of cities as strategic global centres for specialized functions.[5] Cities have become the locus for change and the venue where policies and actions are mobilized. Yet, as shown in Chapters 1 and 4, cities have turned into nodal points of mounting human, socioeconomic

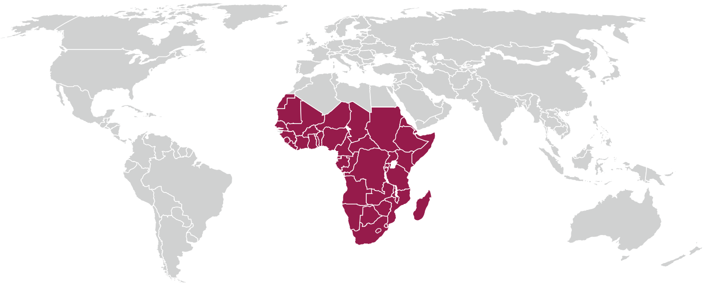
KHAHOMEX building

Workers take a break at a construction site. Rapid urbanization in Vietnam has brought both opportunities and challenges to the country. Ho Chi Minh City, Vietnam.

Source: Tran Viet Duc/World Bank, CC BY 2.0, https://creativecommons.org/licenses/by/2.0/legalcode

and environmental vulnerabilities, of which inequality, sprawl and air pollution have become the most visible manifestations. It therefore follows that a business-as-usual approach will not be enough to keep up with the pace of urban growth in the next coming decades.

This chapter presents key issues that position cities in a transformative role towards sustainable development. These transformative issues relate to the dynamic economic transition of cities in national and global contexts; the evolving spatial form of cities; capacity of cities to address environmental risks; and the emergence of smart and connected cities, driven by ICTs, city data movements and big data.



Increase in people living in extreme poverty in Sub-Saharan Africa

1981	**205 million**
2010	**414 million**

Cities have become the locus for change and the venue where policies and actions are mobilized

In virtually all cases, the contribution of urban areas to national income is greater than their share of national population

2.1

The Dynamic Economic Transition of Cities

No country has achieved its level of development without urbanizing

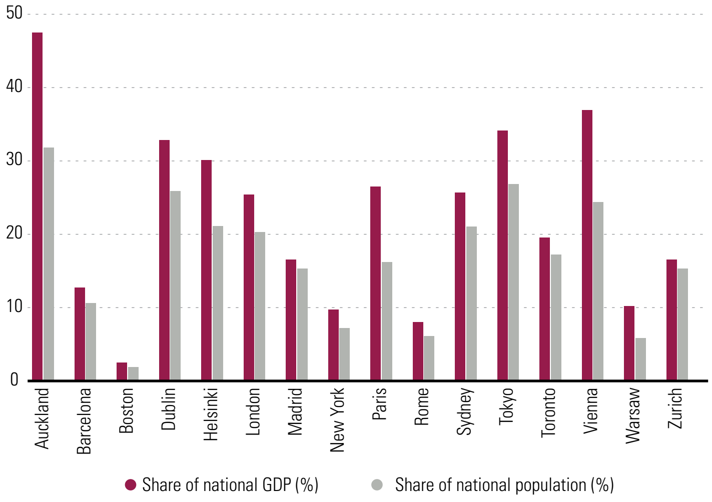
As shown in Chapter 8, cities have emerged as economic powerhouses driving the global economy. Cities are engines of economic growth and development. No country has achieved its level of development without urbanizing. Increased productivity due to urbanization has strengthened the weight of urban areas and reduced poverty, thus making cities more important to national and global economies. Indeed, the prosperity of nations and regions is increasingly dependent on the economic performance of cities.

In virtually all cases, the contribution of urban areas to national income is greater than their share of national population

Large cities are associated with higher levels of productivity and income, given their central role in innovation and job creation, amidst rapidly increasing economic and technological complexity (Chapter 8). Sustainable economic growth is virtually impossible without the growth of cities. As cities become more concentrated, the economic potential of urban growth is driven by higher levels of productivity.

Figure 2.1: **Share of GDP and national population in selected cities (developed countries)**

Source: UN-Habitat, 2011f.



As the world recovers from the global recession, cities in emerging economies such as China, India and Brazil have become major sites for business investment, presenting global companies with unprecedented opportunities for research and development. By 2030, the middle class in China – the majority of which will be concentrated in urban areas could reach one billion, corresponding to 70 per cent of China's projected population.[6] Undoubtedly, urbanization will be one of the biggest drivers of global economic growth in this era, but countries and cities may not equally seize the advantages and opportunities.

Productivity in cities

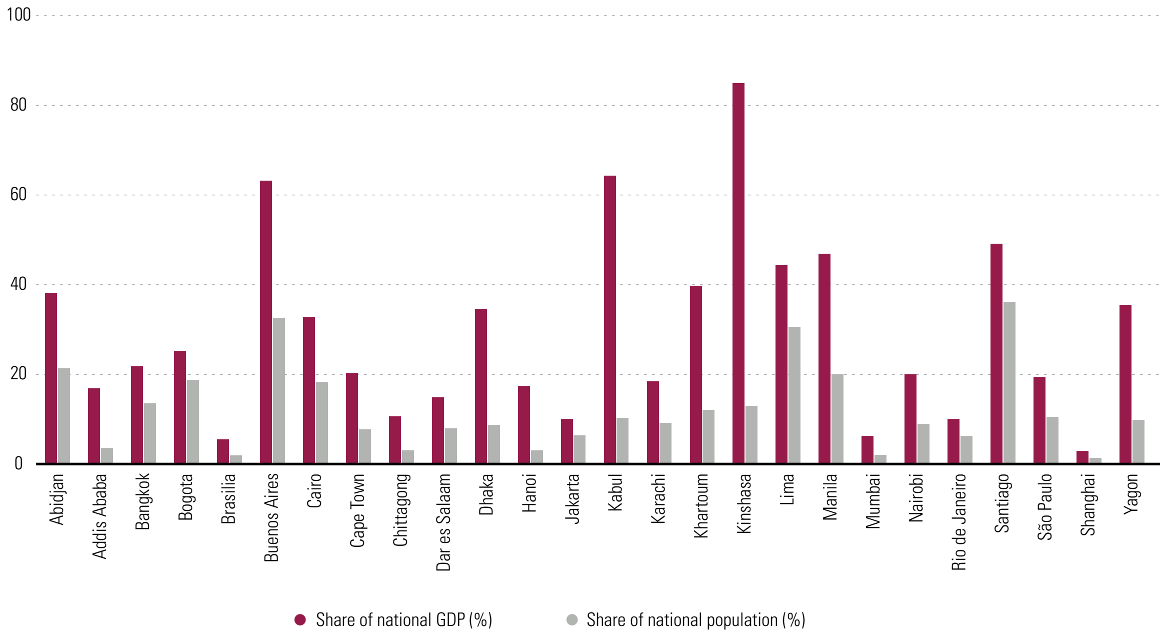
The evidence of the positive link between urban areas and economic development is overwhelming. With just 54 per cent of the world's population, cities account for more than 80 per cent of global GDP.[7] Figure 2.1 and Figure 2.2 respectively show the contribution of cities in developed and developing countries to national income. In virtually all cases, the contribution of urban areas to national income is greater than their share of national population. For instance, Paris accounts for 16 per cent of the population of France, but generates 27 per cent of GDP. Similarly, Kinshasa and Metro Manila account for 13 per cent and 12 per cent of the population of their respective countries, but generate 85 per cent and 47 per cent of the income of the Democratic Republic of Congo and Philippines respectively. The ratio of the share of urban areas' income to share of population is greater for cities in developing countries vis-à-vis those of developed countries. This is an indication that the transformative force of urbanization is likely to be greater in developing countries, with possible implications for harnessing the positive nature of urbanization.

The higher productivity of urban areas stems from agglomeration economies, which are the benefits firms and businesses derive from locating near to their customers and suppliers in order to reduce transport and communication costs.[8] They also include proximity to a large labour pool, competitors within the same industry and firms in other industries.

These economic gains from agglomeration can be summarized as three essential functions: matching, sharing, and learning[9]. First, cities enable businesses to *match* their distinctive requirements for labour, premises and suppliers better than smaller towns because a wider choice is available. Better matching means greater flex-

Figure 2.2: **Share of national population and GDP in selected cities (developing countries)**

Source: UN-Habitat, 2011f.



ibility, higher productivity and stronger growth. Second, cities give firms access to a bigger and improved range of *shared services*, infrastructure and external connectivity to national and global customers because of the scale economies for providers. Third, firms benefit from the superior flows of information and ideas in cities, promoting more *learning* and innovation.[10] Proximity facilitates the communication of complex ideas between firms, research centres and investors.[11] Close proximity also enables formal and informal networks of experts to emerge, which promotes comparison, competition and collaboration.[12] It is not surprising therefore that large cities are the most likely places to spur the creation of young high growth firms, sometimes described as "gazelles."[13] It is cheaper and easier to provide infrastructure and public services in cities. The cost of delivering services such as water, housing and education is 30-50 per cent cheaper in concentrated population centres than in sparsely populated areas.[14]

The benefits of agglomeration can be offset by rising congestion, pollution, pressure on natural resources, higher labour and property costs, greater policing costs occasioned higher levels of crime and insecurity often in the form of negative externalities or *agglomeration diseconomies*.[15] These inefficiencies grow with city size, especially if urbanization is not properly managed, and if cities are deprived of essential public infrastructure. The immediate effect of dysfunctional systems, gridlock and physical deterioration may be to deter private investment, reduce urban productivity and hold back growth. Cities can become victims of their own success and the transformative force of urbanization can attenuated.

Cities in the global economy

Over the last two decades, cities and metropolitan areas have emerged as the world's economic platforms for production, innovation and trade. However, this global connectivity also carries with it concurrent risks, since the wellbeing of cities is greatly influenced by regional and global dynamics. Urbanization is currently taking place within the context of a relatively weakened global economy. During the 2008 global financial crisis, the world suffered the most significant economic downturn since the Great Depression. By October 2008, the crisis had erased around US$25 trillion from the value of stock markets globally.[16] The pace of world economic growth slowed down to 3.1 per cent in 2015, as against 3.4 per cent in 2014,[17] which was significantly less than before the economic crisis.

Urbanization is currently taking place within the context of a relatively weakened global economy

The economic crisis may well have resulted in a reduction of the contribution that urban areas make to the national GDP.[18] A 2009 UCLG study of the impact

Employment is the gateway out of poverty for many and an important cornerstone of economic and social development

of the crisis considered the deterioration of the fiscal position of local governments as its most important consequence.[19] Several other factors combined exacerbated this crisis and its impact on cities: collapsed tax revenues, unemployment, higher operational costs for addressing social needs, difficulty gaining access to borrowing, disinvestment and collapsed public-private partnership activity.

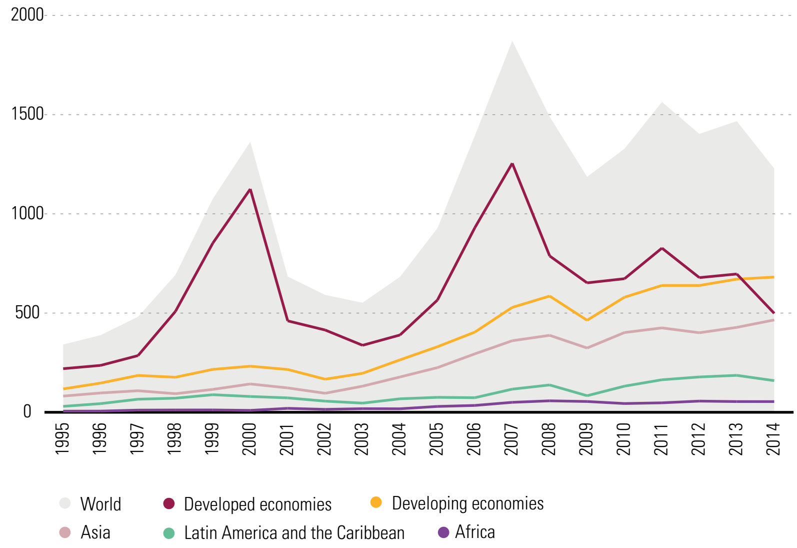
While the effects from the financial crisis varied across the world, one universal impact was the decrease in foreign direct investment (FDI), which is an important contributor to economic growth. During the recession, the world experienced a decline in FDI inflows by more than 20 per cent, with developed countries being the most affected. Developing countries, on the other hand, have been experiencing steady growth in FDI inflows since early 2000s, thereby exhibiting resilience in the face of the economic downturn as shown in Figure 2.3. This is in line with a World Bank study,[20] which shows that between 2003 and 2012, two-thirds of the top FDI destination cities were in Sub-Saharan Africa, South Asia, and East Asia and Pacific (excluding China). The study also notes that FDI remains highly concentrated in a small number of elite cities.

unemployment can be particularly challenging in urban areas, as cities are often associated with a high concentration of unemployed people

The rapid-pace urbanization is regarded as a bright spot in the midst of the multiple global crises confronting countries.[21] As engines of growth, cities have a key role to play in the economic recovery of countries. In coordination with—or financed by—their national governments, many cities worldwide have adopted new policies and stimulus programmes to recover from the global financial crisis. In the UK, cities have been instruments to revive the economy by driving growth, providing jobs, supporting investment in critical infrastructure, and granting greater financial autonomy.[22]

Figure 2.3: **FDI inflows, 1995-2014 (billions of US$)**

Source: Based on UNCTAD, FDI/TNC database (www.unctad.org/fdistatistics), last accessed 17 March 2016.



Cities and employment creation

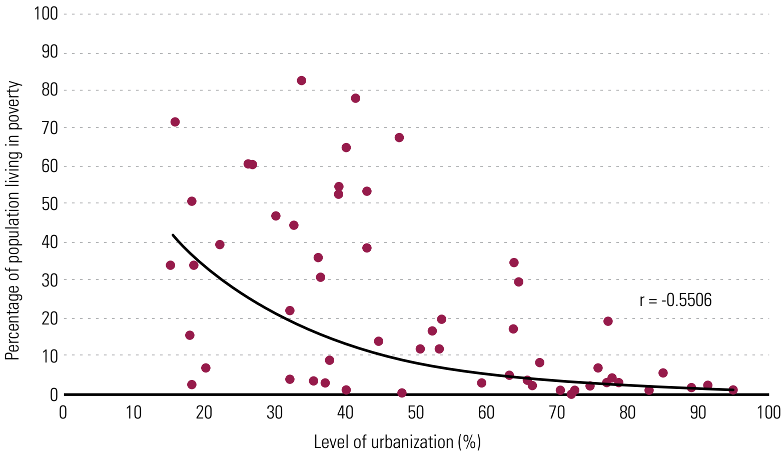
A further indication of the transformative nature of urban areas relates to the significant opportunities they offer for both formal and informal employment. Cities generate a sizeable share of new private sector jobs. Between the year 2006 and 2012, the 750 largest cities in the world created 87.7 million private sector jobs, or 58 per cent of all new private sector jobs in their respect 129 countries.[23] In the UK, cities account for 78 per cent of all jobs.[24] In the US, metropolitan areas account for 84 per cent of total employment and 88 per cent of labour income.[25] Among African countries, urban employment grew by an average of 6.8 per cent over the last decade—twice more than the national rate of 3.3 per cent.[26] In India, between 2000 and 2005, urban employment grew at a rate of 3.22 per cent compared to rural employment, which grew by 1.97 per cent.[27]

Employment is the gateway out of poverty for many and an important cornerstone of economic and social development.[28] Employment is also a key determinant of peoples' satisfaction. The integration of rapidly urbanizing countries endowed with an abundance of unskilled labour into the world economy can generate extensive employment opportunities especially in light manufacturing. This has been the case of East Asia over the last five decades, and mirrors the recent situation in Bangladesh with respect to the garment industry in large cities such as Chittagong and Dhaka.[29] In Bangladesh, the industrial sector currently accounts for 30 per cent of value-added as against 20 per cent in 1990, with the level of urbanization at about 35 per cent.

Notwithstanding the foregoing, unemployment can be particularly challenging in urban areas, as cities are often associated with a high concentration of unemployed people— a phenomenon often referred to as the *urban paradox*.[30] About 60 per cent of unemployment in UK, Japan, Korea, Netherlands and US is concentrated in urban areas.[31] This is likely to be the case in developing countries. The global unemployment rate for 2015 was 5.8 per cent— 197.1 million people, which is one million more than in 2014 and over 27 million higher than the pre-crisis period.[32] Particularly problematic is youth unemployment, which is two-three times higher than adult unemployment. In South Africa and Spain, youth unemployment currently stands at 51 per cent and 42 per cent respectively.[33] Global unemployment cuts across various sectors, but is particularly severe in finance, construction, automotive, manufacturing, tourism, services and real estate— all of which are strongly associated with urban areas. A key issue confronting cities, especially those in developing countries, is to ensure that urbanization generates sufficient economic growth to provide decent, productive and remunerative jobs for the rapidly growing labour force.

Figure 2.4: Urbanization and poverty

Source: Based on United Nations, 2014b; data.worldbank.org, last accessed 20 January 2016.



Cities and inclusive prosperity

A prosperous city supports productivity, infrastructure development, quality of life, equity and social inclusion, and environmental sustainability.[34] The foundations for competitiveness translate to cities that retain and grow their skilled labour, enhance their business attractiveness, and expand their economic base. As cities become more dominant and interconnected in the global economy, competitiveness at the local level becomes imperative for economic growth. In order to sustain inclusive economic growth, local governments are considering their capacity to foster important determinants of productivity, such as higher education, innovation, quality of life, and infrastructure for all.

In light of the current dispensation, cities and city regions compete intensely for investment, for the location of headquarters of transnational corporations, for hosting international agencies, for tourist streams, for large conventions, for major events such as the Olympics or the World Cup, or for major political meetings. A study of the competitiveness of 48 Latin American cities in terms of their attractiveness for external investment identifies five leading cities— São Paulo, Mexico City, Santiago, Rio de Janeiro, and Buenos Aires. [35] The key elements determining the attractiveness to investment of these cities include: the size and wealth of the city; the number of global firms with offices in the city; the depth and specialization of the financial market; and quality of life and security. It is worth noting that the most desirable cities are among the very largest in the region.

While economic growth and prosperity bring many benefits to local economies, inequality and social exclusion may actually be on the rise,[36] especially if the benefits of growth are not equitably distributed. The World Bank promotes shared prosperity or inclusive economic growth, which is at the core of sustainable development. Similarly, UN-Habitat has initiated a global city prosperity initiative in which equity and social inclusion are key dimensions of urban prosperity. The other dimensions are productivity, infrastructure, quality of life, environmental sustainability and governance.

As cities become more dominant and interconnected in the global economy, competitiveness at the local level becomes imperative for economic growth

Poverty and urban-rural linkages

When properly planned and managed, urbanization can play a key role in eradicating poverty. This is how and why cities have been described as *real poverty fighters*.[37] As illustrated in Figure 2.4, highly urbanized countries are associated with low levels of poverty. Urbanization has helped millions escape poverty through higher levels of productivity, employment opportunities, improved quality of life via better education and health, large-scale public investment, and access to improved infrastructure and services. Nowhere is this more evident than in East Asia, where increase in urbanization over the last three and half decades has been accompanied by a remarkable decrease in poverty. In the early 1980s, East Asia was the region with the highest incidence of poverty in the world, with 77 per cent of its

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Urbanization has helped millions escape poverty through higher levels of productivity, employment opportunities; improved quality of life via better education and health; large-scale public investment and access to improved infrastructure and services

Fruit sellers close to the new Hanoi - Lao Cai Expressway, Viet Nam

Source: Asian Development Bank, CC BY 2.0, https://creativecommons.org/licenses/by/2.0/legalcode

population living below the poverty line; by 2008, this has fallen to 14 per cent.[38] In China, urbanization occasioned by massive economic growth helped pull 680 million people out of extreme poverty between 1981 and 2010, and reduce the rate of extreme poverty from 84 per cent in 1980 to 10 per cent in 2013.[39] China alone accounts for three-quarters of the global reduction in poverty.

However, the reduction in poverty associated with urbanization is not automatic.[40] Realizing the potential gains of urbanization will however depend on how well urban growth and its evolving challenges are planned and managed, and the extent to which the benefits accruing from urbanization are equitably distributed. Formulating the necessary policies including effective governance, urban planning and finance is a vital precondition for enhancing the transformative potentials of urbanization. As developing countries rapidly urbanize, it is crucial that the necessary institutions are established. Managing urbanization should therefore be an essential component of nurturing growth. If poorly planned and inadequately managed, urbanization will result in the proliferation of slums, poverty, more unequal, less productive and less habitable cities. Neglecting cities even in countries with low levels of urbanization can impose significant costs.[41]

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people out of extreme poverty between 1981 and 2010, and reduce the rate of extreme poverty from 84 per cent in 1980 to 10 per cent in 2013

Globally, the conventional distinction between urban and rural is changing, with cities emerging as drivers of change in rural areas. Rural areas benefit from urbanization through increased demand for rural goods, which can have a significant impact on rural poverty.[42] Other benefits from the urban-rural linkages include increased urban-rural remittances, increased rural land/labour ratio, and increased rural nonfarm employment.[43] Achieving sustainable development is more likely if there is a shift from the political, social and geographical dichotomy between urban and rural areas; and recognition and understanding of the continuum of urban and rural development.

The transformative power of urbanization has important implications for rural areas

The transformative power of urbanization has important implications for rural areas. Cities act as magnets for rural migration; in developed countries, migration is driven by better opportunities in urban areas. However, in developing countries, rural-urban migration is more complex, in some cases driven by rural migrants seeking refuge from disasters such as famine or war.[44] Cambodia experienced massive rural to urban migration during the 1975-1979 conflict, which contributed 14 per cent of total migrants in urban areas, leading to pressure on land, infrastructures and services in Phnom Penh. This is when the Urban–Rural Partnership Project was launched with the double function of improved livelihoods for the poor and stronger urban-rural linkages. The overarching, objective was to improve conditions in smaller towns to retain potential migrants.

Another facet of the growing interconnection between urban and rural areas is the physical expansion of metropolitan regions, which has seen cities extend to peri-urban and rural areas. These transitional zones enhance linkages between urban and rural areas. Special mechanisms are needed to strengthen land administration, including planning systems to respond to rapid urban expansion. Management of land use in peri-urban areas is critical to balance city expansion so that it does not compromise food production. In developing countries, rural hinterlands can reduce vital vulnerabilities through City

Region Food Systems.[45] Such systems should encourage domestic capital to expand the processing of local agricultural commodities, both for national consumption and for export.

Urbanization can play a key role in eradicating rural poverty. Research in India found that an increase of 200,000 in the urban population resulted in a decrease of 1.3 to 2.6 per cent in rural poverty.[46] Overall, these urban-rural linkages were behind a reduction of 13 to 25 per cent in rural poverty in India between 1983 and 1999.[47] In Vietnam, a more recent study (2006-2008) found that rural households in highly urbanized provinces featured higher income and income growth than rural households.[48] These urban-rural linkages have transformative implications for global poverty reduction.

The benefits of urbanization should not be limited to large cities, but made available to small and medium towns. The adequate provision of adequate infrastructure and opportunities in small and medium cities can promote rural urbanization and contribute to achieving balanced population distribution.[49] In Korea, migration to small and intermediate towns in mid-1970s contributed to diverse and dynamic redistribution of population, induced by specialized local industrial structures, proximity to metropolitan cities and the appropriate educational standards.[50] This is why urban policies must not overlook small and medium-size towns, which rural migrants increasingly favour over larger cities.[51]

2.2

Evolving Spatial Form of Cities

The dramatic changes in the spatial form of cities brought about by rapid urbanization over the last two decades, present significant challenges and opportunities. Whereas new spatial configurations play key role in creating prosperity, there is an urgent demand for more integrated planning, robust financial planning, service delivery and strategic policy decisions. These interventions are necessary if cities are to be sustainable, inclusive and ensure a high quality of life for all. Urban areas worldwide continue to expand giving rise to an increase in both vertical and horizontal dimensions.

With cities growing beyond their administrative and physical boundaries, conventional governing structures and institutions become outdated. This trend has led to expansion not just in terms of population settlement and spatial sprawl, but has altered the social and economic spheres of influence of urban residents.[52] In other words, the functional areas of cities and the people that live and work within them are transcending physical boundaries.

Cities have extensive labour, real estate, industrial, agricultural, financial and service markets that spread over the jurisdictional territories of several municipalities. In some cases, cities have spread across international boundaries.[53] Plagued with fragmentation, congestion, degradation of environmental resources, and weak regulatory frameworks, city leaders struggle to address demands from citizens who live, work, and move across urban regions irrespective of municipal jurisdictional boundaries. The development of complex interconnected urban areas introduces the possibility of reinventing new mechanisms of governance.

In India, urban-rural economic linkages were responsible for

13-25%

of the overall reduction in rural poverty between 1983 and 1999

Source: Cali, 2013.

A city's physical form, its built environment characteristics, the extent and pattern of open spaces together with the relationship of its density to destinations and transportation corridors, all interact with natural and other urban characteristics to constrain transport options, energy use, drainage, and future patterns of growth. UN-Habitat's principles for sustainable neighbourhood planning favour high densities.[54] However, density is no blanket solution: it takes careful, proper coordination, location and design (including mixed uses) to reap the benefits more compact urban patterns can bring to the environment (such as reduced noxious emissions) and quality of life.

New urban configurations

Large and small cities are expanding and merging to create urban settlements in the form of city-regions, urban corridors and mega-regions. These urban configurations act as nodes where global and regional flows of people, capital goods, research and science, services and information combine and co-mingle, resulting in faster economic and demographic growth than that of the countries where they are located.[55] These new configurations are spatially connected, and are functionally bound by their economic, socio-political and environmental link-

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Mega-regions are playing an increasing role in various dimensions of prosperity far beyond their own boundaries

ages. Examples include the Hong Kong-Shenzhen-Guangzhou (Pearl River delta) region in China and the Rio de Janeiro-São Paulo region in Brazil, including the linear systems of urban corridors like the industrial corridor connecting Mumbai and Delhi in India (Chapter 8), and the regional economic axis forming the greater Ibadan-Lagos-Accra urban corridor in West Africa.[56]

These configurations facilitate intense division of labour and knowledge, offering opportunities for economic development and prosperity (Chapter 8).[57] Mega-regions are playing an increasing role in various dimensions of prosperity far beyond their own boundaries. However, while these engines of growth are transforming the global economy, they can also lead to unbalanced growth in a country's development. Additionally, ineffective and fragmented urban governance across these vast urban regions poses major challenges for the post-2015 development era.

Urban sprawl, suburbanization and peri-urbanization

More dispersed patterns of urbanization in the form of suburbanization, peri-urbanization, or urban sprawl have constituted a significant trend over the last two decades

More dispersed patterns of urbanization in the form of suburbanization, peri-urbanization, or urban sprawl have constituted a significant trend over the last two decades. This trend is hotly-debated; opponents view it as poor land management or as automobile-driven, uncontrolled growth. Proponents on the other hand view it as a choice to move outside the congested urban core where land is less expensive to suburbs where land and housing are cheaper, with low-density living often resulting in better quality of life and improved access to amenities.[58] The reality of urban expansion and dispersal is evidenced in most cities, spurred not only by individual preferences for a suburban lifestyle, but also due to: poor land management and lack of sound regulatory control over peri-urban areas; new land subdivisions accommodating highway and automobile expansion; and enhanced ease of mobility due to improved commuting technologies.

The need to move from sectoral interventions to strategic urban planning and more comprehensive urban policy platforms is crucial in transforming city form

The role of the privately owned car in urban form cannot be underestimated. As important as prior transportation innovations have been, private car ownership has had a more dramatic effect on the city.[59] Chapters 5 highlights some of the impacts of the car-dominated urban landscape, which include: higher costs of public infrastructure, social isolation, higher energy consumption, fiscal problems associated with inner cities supporting services consumed by suburban residents, loss of farmland and reduced biodiversity.

The ensuing pattern of urban development due to formal or informal peri-urbanization processes is characterized by the displacement of population, industries and services from the city centre to the periphery, and the creation of new centres with their own economic and social dynamics. As opposed to the upscale suburbanization of developed countries, the peri-urban areas in developing countries have become divided cities, characterized by of spatial segregation along socioeconomic lines. These large peri-urban areas consist of informal land-use patterns, accompanied by lack of infrastructure, poor or non-existent public services, with inferior quality housing and families living in poverty.

The transformative potentials of urban space

Urban space can be a strategic entry point for driving sustainable development. However, this requires innovative and responsive urban planning (Chapter 7) and design that utilizes density, minimizes transport needs and service delivery costs, optimizes land-use, enhances mobility and space for civic and economic activities, and provides areas for recreation, cultural and social interaction to enhance quality of life. By adopting relevant laws and regulations, city planners are revisiting the compact and mixed land-use city, reasserting notions of urban planning that address the new challenges and realities of scale, with urban region-wide mobility and infrastructure demands.

The need to move from sectoral interventions to strategic urban planning and more comprehensive urban policy platforms is crucial in transforming city form. For example, transport planning was often isolated from land-use planning and this sectoral divide has caused wasteful investment with long-term negative consequences for a range of issues including residential development, commuting and energy consumption. Yet, transit and land-use integration is one of the most promising means of reversing the trend of automobile-dependent sprawl and placing cities on a sustainable pathway.

The more compact a city, the more productive and innovative it is and the lower its per capita resource use and emissions. City planners have recognized the need to advance higher density, mixed use, inclusive, walkable, bikeable and public transport-oriented cities. Accordingly, sustainable and energy-efficient cities, low carbon, with renewable energy at scale are re-informing decision making on the built environment.

Despite shifts in planning thought, whereby compact cities and densification strategies have entered mainstream urban planning practice, the market has resisted such approaches and consumer tastes have persisted for low-density residential land. Developers of suburbia and exurbia continue to subdivide land and build housing, often creating single purpose communities. The new urbanists have criticized the physical patterns of suburban development and car-dependent subdivisions that separate malls, workspaces and residential uses by highways and arterial roads. City leaders and planning professionals have responded and greatly enhanced new community design standards. Smart growth is an approach to planning that focuses on rejuvenating inner city areas and older suburbs, remediating brown-fields and, where new suburbs are developed, designing them to be town centred, transit and pedestrian-oriented, less automobile dependent and with a mix of housing, commercial and retail uses drawing on cleaner energy and green technologies.[60]

The tension in planning practice needs to be better acknowledged and further discussed if sustainable cities are to be realized. The forces that continue to drive the physical form of many cities, despite the best intentions of planning, present challenges that need to be at the forefront of any discussion on the sustainable development goals of cities. Some pertinent issues, which suggest the need for rethinking past patterns of urbanization and addressing them urgently include:

i. competing jurisdictions between cities, towns and surrounding peri-urban areas whereby authorities compete with each other to attract suburban development;
ii. the true costs to the economy and to society of fragmented land use and car-dependent spatial development; and
iii. how to come up with affordable alternatives to accommodate the additional 2.5 billion people that would reside in cities by 2050.[61]

In reality, it is especially these outer suburbs, edge cities and outer city nodes in larger city regions where new economic growth and jobs are being created and where much of this new population will be accommodated, if infill projects and planned extensions are not designed. While densification strategies and more robust compact city planning in existing city spaces will help absorb a portion of this growth, the key challenge facing planners is how to accommodate new growth beyond the existing core and suburbs. This will largely depend on local governments' ability to overcome fragmentation in local political institutions, and a more coherent legislation and governance framework, which addresses urban complexities spread over different administrative boundaries.

2.3

The Essential Role of Cities in Sustainable Development

While there are numerous definitions of sustainable development, many start with the definition provided in the 1987 Brundtland Report: "Development that meets the needs of the present without compromising the ability of future generations to meet their own needs."[62] The goals for sustainable cities are grounded on a similar understanding— urban development which strives to meet the essential needs of all, without overstepping the limitations of the natural environment. A sustainable city has to achieve a dynamic balance among economic, environmental and socio-cultural development goals, framed within a local governance system characterized by deep citizen involvement and inclusiveness.[63]

Despite shifts in planning thought, whereby compact cities and densification strategies have entered mainstream urban planning practice, the market has resisted such approaches and consumer tastes have persisted for low-density residential land

The newly adopted 2030 Agenda for Sustainable Development presents 17 Sustainable Development Goals that replace the previous Millennium Development Goals (MDGs). While cities were not specifically represented in the MDGs, Goal 11 of the new Sustainable Development Agenda (Box 2.1) seeks to: "Make cities and human settlements inclusive, safe, resilient and sustainable."[64] This stands-alone goal on cities recognizes the transformative role of urban areas towards building sustainability in the post-2015 Development Agenda.

A core component of a sustainable cities agenda is sustainable infrastructure— the interconnected physical and organizational structure, set of services and system that supports the daily functioning of

Box 2.1: Goal 11— Make cities and human settlements inclusive, safe, resilient and sustainable

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

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

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

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

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

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

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

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

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

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

11 SUSTAINABLE CITIES AND COMMUNITIES

Source: United Nations, 2015a.

Investment in sustainable infrastructure is pivotal in planning for the sustainable development of cities

a society and its economy. Sustainable infrastructure is that which is designed, developed, maintained, reused, and operated in a way that ensures minimal strain on resources, the environment and the economy. It contributes to enhanced public health and welfare, social equity, and diversity.[65] Investment in sustainable infrastructure is pivotal in planning for the sustainable development of cities. Despite the importance of urban infrastructure, there is a clear under-investment as characterized by the backlog and state of deficient infrastructure. Globally, US$57 trillion is needed for infrastructure investment between 2013 and 2030 in order to support economic growth and urbanization.[66] This is of particular concern with regard to developed countries, where many large cities experience serious congestion, and to developing countries, where improved basic socioeconomic conditions have been long overdue.

Singapore, Hong Kong and Tokyo are examples of cities where the costs of car ownership and use have been set high and planning strategies have emphasized development patterns oriented to transit, walking and cycling

Urban mobility

As a factor of inclusion and integration,[67] urban mobility has a specific transformative role. Urban mobility is a multidimensional concept, encapsulating the multitude of physical components pertaining to urban transport (air, road, and rail systems, waterways, light and heavy rail, cable cars) including the economic, environmental and social dimensions of mobility. Sustainable urban mobility provides efficient access to goods, services, job markets, social connections and activities while limiting both short- and long-term adverse consequences on social, economic, and environmental services and systems. A sustainable mobility strategy serves to protect the health of users and the environment, while fostering and promoting the city's economic prosperity.[68]

City dwellers are negatively impacted by inadequate and inefficient public transit systems; low-density development; urban sprawl; and by the growing distance between residents and their place of employment, markets, education and health facilities. Although faced with enormous challenges, behavioral, technological and political shifts, cities remain at the forefront of transformative changes to improve quality of life through investing in connected, sustainable urban mobility.

An evolving trend is the cultural shift away from auto-dependency. Singapore, Hong Kong and Tokyo

Use of green energy in Dali, People's Republic of China.

Source: Asian Development Bank, CC BY 2.0, https://creativecommons.org/licenses/by/2.0/legalcode

are examples of cities where the costs of car ownership and use have been set high and planning strategies have emphasized development patterns oriented to transit, walking and cycling. In Europe and the US, the popularity of the share economy has allowed people to move to more walkable, livable urban communities.[69] Consequently, urban space is being reimagined, leading to denser and greener cities, enhanced flow of traffic, improved walkability, and increased use of public transit.[70] This shift could catalyze reinvestment in public transport and a reduction in automobile subsidies,[71] while also allowing for equitable access. New mobility services and products such as e-hailing (Box 2.2), autonomous driving, in-vehicle connectivity and car sharing systems offer multimodal, on-demand transportation alternatives.

More compact, better-connected cities with low-carbon transport could save as much as US$3 trillion in urban infrastructure spending over the next 15 years.[72] This would simultaneously result in substantial annual returns due to energy savings, higher productivity and reduced healthcare costs. The private sector and civil society can also help city leaders advance sustainable mobility, with improvements in telecommunications technology. For instance, the Paris-based company *BlaBlaCar* has developed an online platform that connects passengers with private drivers and allows them to book seats for long-distance journeys. Increased passenger numbers per car reduce carbon emissions and improve quality of life.[73]

Box 2.2: E-hailing: Technological advances in the transportation industry

Uber is an example of an e-hailing mobile app that connects passengers with drivers of vehicles for hire. However, unlike conventional taxis, Uber drivers use their personal vehicles. Currently, Uber operates in 401 cities worldwide.

Uber recently launched *UberMOTO*, a motorcycle ride-hailing service, in order to beat the infamous traffic in Bangkok. The service is aimed at providing short trip services for passengers around the city, where heavy traffic has become notoriously commonplace. *UberMOTO* is significantly cheaper than its automobile counterpart. Apart from its benefits in price, the service is also quite safe, as *UberMOTO* motorcyclists are instructed to always bring a helmet for their passengers.

In some cites, Uber is larger than the traditional taxi industry. In China alone, 170 million people use some forms of e-hailing app. Long waits for taxis, over-pricing, uncomfortable old vehicles, and safety concerns are the shortcomings of some traditional taxi services, and provide the reasons why Uber is prospering.

In Australia, diverse jurisdictions are undertaking regulatory changes to cope with the disruptive nature of Uber to the taxi and third party driver industry. This is occurring within an environment of hostility from the incumbent industry providers and citizens seeking more cost effective and better service delivery to meet their needs. The growth and development of e-hailing services continues to increase as regulatory hurdles are addressed.

Sources: Rempel, 2014; Wambugu, 2016; Cendrowski, 2015; Skyring, 2016; www.uber.com, last accessed 28 March 2016.

Energy in cities

If the world is to achieve its sustainable development goals, and reach targets that range from eradicating poverty and social inequity, to combating climate change and ensuring a healthy and livable environment, global efforts in the transition to sustainable energy are pivotal. As cities represent more than 70 per cent of global energy demand,[74] they have been playing a central role in moving the sustainable energy agenda forward. The current global share of renewable energy supply is 11 per cent.[75] The diversity of renewable energy resources is vast and research indicates a potential contribution of renewable energy reaching 60 per cent of total world energy supply.[76]

While many renewable energy technologies remain more costly than conventional sources and are often site-specific, it is important to note that investment in renewable cleaner energy can reduce health impacts from air pollutants, which can severely impact quality of life and place strains on health care systems.[77] Increasing renewable energy sources, maximizing conservation and lessening dependence on non-renewable

More compact, better-connected cities with low-carbon transport could save as much as **US$3 trillion** in urban infrastructure spending over the next 15 years sources of energy, particularly those most damaging and contributing to global warming, are critical steps to sustainable cities.

Cities are harnessing local capabilities to develop green technologies and renewable energy sources that enhance their ability to withstand climate-related shocks as well as boosting local economies.[78] Governments are investing in green technologies, presenting an excellent opportunity for cities to channel their innovation capabilities into a new sector of the economy.[79] The economies of scale and concentration of enterprises and innovation in cities make it cheaper and easier to take actions to minimize both emissions and climate hazards.

A critical aspect of the creation of resilient cities is the construction of physical infrastructure that has the capacity to absorb the shocks and stresses created by extreme weather events

Resilience of cities

The risks that cities are now facing as a result of climate change and natural disasters (Chapters 1 and 5), the pressing short-falls in urban water, sanitation and waste management services, and the deteriorating quality of air and water, are being experienced in the context of their rapid growth. A growing international focus on resilience is a core agenda item for cities today. The increase in severe weather events and natural disasters has highlighted the need for cities to augment their ability to withstand the disaster risks they may face, and to mitigate and respond to such risks in ways that minimize the impact of severe weather events and natural disasters on the social, environmental, and economic infrastructure of the city. Consequently, city leaders have been making significant transformative changes and investments in the resilience of their cities.

Any city's resilience to external shock relies primarily on effective institutions, governance, urban planning and infrastructure. In this respect, the UN Office for Disaster Reduction (UNISDR) has set out a number of general practical recommendations for urban authorities.[80] Since then, UN-Habitat, together with the Technical Centre for Disaster Risk Management and Urban Resilience (DiMSUR) has developed and successfully tested a participatory methodology, known as the City Resilience Action Plan (CityRAP).[81]

A critical aspect of the creation of resilient cities is the construction of physical infrastructure that has the capacity to absorb the shocks and stresses created by extreme weather events. Climate change is putting pressure on infrastructure that is already overtaxed from deferred maintenance, population growth and development.[82] As municipalities plan, design, and implement sustainable infrastructure projects, they need to consider the impact of extreme weather and natural disasters on the city's physical infrastructure in order to build resilience.

Moving the cities agenda forward: The core challenge of governance

There is a growing consensus that good governance is crucial to developing, maintaining, and restoring sustainable and resilient services and social, institutional, and economic activity in cities.[83] Many city governments are weakened due to limited power and responsibility over key public services, including planning, housing, roads and transit, water, land-use, drainage, waste management and building standards. As shown in Chapters 1, 6 and 8, city governments also often lack the power to raise the revenues to finance infrastructure and build more sustainable and resilient cities. When governance capacity is weak and constrained, cities are limited in their abilities to take programmatic action on climate change mitigation and adaptation. The multiple forms of risk and vulnerability in cities call for more integrated approaches, combining established policies (urban governance, planning and management) with additional policy leverage, powers and responsibilities for local government.[84]

Sustainable, resilient and inclusive cities are often the outcome of good governance that encompasses effective leadership; land-use planning; jurisdictional coordination; inclusive citizen participation; and efficient financing. Strong effective leadership is critical for overcoming fragmentation across departments, multiple levels of government and investment sectors when building consensus and eliciting action on specific agendas. Land-use planning across these broad urban regions is another key criterion for effective governance. Territorial and spatial strategies are central in addressing climate change risks and building effective mitigation and adaptation strategies. Coordination across the metropolitan area is fundamental not only in areas such as land, transport, energy, emergency preparedness, and related fiscal and funding solutions, but in addressing issues of poverty and social exclusion through innovative mechanisms of inter-territorial solidarity.[85]

Sustainable, resilient and inclusive cities are often the outcome of good governance that encompasses effective leadership; land-use planning; jurisdictional coordination; inclusive citizen participation; and efficient financing

Including stakeholders in the urban planning process is critical to creating liveable, sustainable cities, where citizens are active players in determining their quality of life. Including stakeholders in the design of infrastructure, urban space and services legitimizes the urban planning process and allows cities to leverage their stakeholders' expertise.[86] Finance, however, can be a major impediment to effective governance (Chapters 1, 6 and 8). Municipal governments around the world are increasingly looking for new and innovative ways to finance sustainable projects. Consequently, partnership with the private sector is increasing since the private sector has capital not available to the public sector.

2.4

The Transformative Power of Connected Cities

Over the last two decades, the transformative power of urbanization has, in part, been facilitated by the rapid deployment of Information and Communications Technology (ICT), and by a revolution in city data to inform decision-making and propel a global movement to smart cities. This has been accompanied by deeper connectivity and networking of cities and citizens at both the local and global levels.

Cities have to contend with a wide range of challenges— from crime prevention, to more efficient mobility, to creating healthier environments, to more energy efficient city systems, to emergency preparedness among others. To address these challenges, ICT, the Internet of Things— or networked connections in cities and data— are deployed to improve service delivery and quality of life. The use of data allows cities to measure their performance and to re-inform investments in city infrastructure. Cities are increasingly relying on metrics and globally comparable city data to guide more effective and smarter city decision-making that build efficiencies in city budgets.

ICT and sustainable urban development

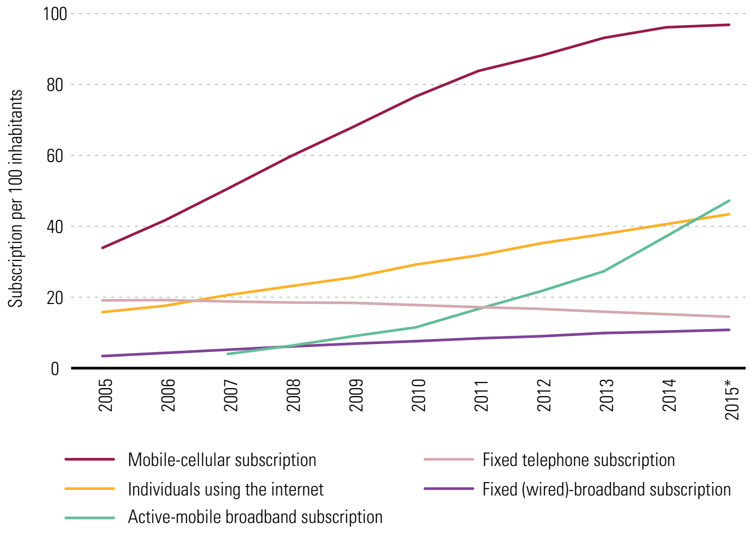
Central to the communications revolution is the deployment of ICT in cities. High-quality infrastructure, innovation, investment, well-connected firms, efficiencies in energy and budgets, are often cited as ICT-driven benefits to cities. However, the potential consequences of this deployment are yet not well understood. When ICT is deployed unevenly in cities, it can create a *digital divide*— which can exacerbate inequality, characterized by well-connected affluent neighbourhoods and business districts coexisting with under-serviced and under-connected low-income neighbourhoods. The affluent tend to have greater access to these technologies, and ICT can often serve to extend their reach and control while curbing that of the more socioeconomically marginalized residents.

Over the last two decades, the transformative power of urbanization has, in part, been facilitated by the rapid deployment of ICT

Over the past two decades, the growth and expansion of mobile networks has been extensive (Figure 2.5) and overtaken most predictions, changing the course of development for the post 2015 era. According to the Ericsson Mobility Report, the total number of mobile subscriptions in the third quarter of 2015 was 7.3 billion, with 87 million new subscriptions.[87] For the vast majority

Figure 2.5: Global ICT developments (2005-2015)

Source: ITU World Telecommunication /ICT Indicators database, last accessed 16 March 2016.



Note: *estimate

For the vast majority of low-income population in developing countries, mobile telephony is likely to be the sole connectivity channel

of low-income population in developing countries, mobile telephony is likely to be the sole connectivity channel.[88] Although an affordable and reliable Internet is not yet a reality for the majority of people in the world, the network, both in terms of infrastructure and content, has grown rapidly since inception, spurring enormous innovation, diverse network expansion, and increased user engagement in a virtuous circle of growth. The number of Internet users stood at one billion in 2005 and two billion in 2010, reaching over three billion by 2015.[89]

As a transformative force, the deployment of ICT in cities supports innovation and poverty eradication, by promoting efficiencies in urban infrastructure leading to lower cost city services

As a transformative force, the deployment of ICT in cities supports innovation and poverty eradication, by promoting efficiencies in urban infrastructure leading to lower cost city services. In some cases, urban economies are able to leapfrog stages of development by deploying new technologies in the initial construction of infrastructure. Cities like Hong Kong and Singapore are notable examples of economies that were able to make this leap by digitizing their infrastructure.[90] Box 2.3 shows how the city of Kigali in Rwanda is providing internet connectivity to its residents via the public bus system. In 2010, Curitiba, Brazil was the first city in the world to connect public buses to a 3G mobile-broadband network. Such innovation opened up new possibilities for traveler services that helped commuters plan their route and enabled them to purchase tickets wherever and whenever it is most convenient.[91] Cities worldwide, such as Chicago, London, and Vancouver are implementing digital inclusion programs to ensure that all citizens have the tools to thrive in an increasingly digitalized world. As cities depend increasingly on electronic information and technology for their functioning and service delivery, city leaders are proceeding with caution to avoid an unequal distribution of ICT and to examine ways to bridge the digital divide.

Box 2.3: Smart Kigali: Connecting 400 buses to 4G Internet

As part of the broader Smart Kigali initiative, 487 buses belonging to Kigali Bus Services were connected to 4G broadband network in February 2016. This has allowed passengers on board have full access to free super-fast internet. This makes Kigali the first city in Africa to provide citizens with the free wireless internet in public transport.

The initiative comes after the City of Kigali in partnership with the Ministry of Youth and ICT and other stakeholders launched the Internet Bus Project in 2015, which will see all buses not only within Kigali, but also across the country offer internet to passengers. Following the launch of the project, last year, five buses were connected as a pilot project before the general roll out.

The Smart Kigali initiative has seen the start of the implementation of the 4G solutions for the benefit of general population in Rwanda, and the aim is to scale up broadband adoption in the country.

Source: Bizimungu, 2016.

The evolution of data in cities

Local governments have come under increased pressure to collect and monitor data in connection with governance, infrastructure, urban planning, services, the economy, health, education, safety and the environment. Performance measurement has become fundamental if policymakers and planners are to make evidence-based decisions. At the other end of the process, data collection enables cities to assess and benchmark performance.

Data-driven decision-making has evolved over time,[92] due to advancements such as performance indicators, big data, data analytics, machine learning, predictive metrics and geo-spatial measurement. Data is essential for evidenced-based policymaking and effective investment in and management of infrastructure in a city. Comparative analysis and knowledge sharing is crucial to respond to emerging global challenges the associated demand for sustainability planning, resilience and emergency preparedness.[93] The Internet has played a significant role in increasing the data availability for cities and the speed at which it is collected.

The rapid pace of city growth requires comparable high-quality city data and indicators, which are essential for effective leadership and decision-making. International standards bodies, such as the International Electrotechnical Commission, the International Organization for Standardization (ISO) and International Telecommunication Union have begun to address the pressing cities agenda with work ranging from smart grids and smart city infrastructure, to international telecommunications and management systems. Additionally, the ISO Technical Committee for the Sustainable Development of Communities is developing a new series of international standards designed for a more integrated approach to sustainable development and resilience. Among these standards is ISO 37120: *Sustainable Development of Communities— Indicators for City Services and Quality of Life,* which is the first international standard on city indicators.[94] Box 2.4 illustrates how cities under the World Council on City

Data (WCCD) network are using standardized indicators from ISO 37120 to compare their performance, exchange knowledge and share solutions.

In response to decision-makers' demand for measurement tools, UN-Habitat developed the City Prosperity Index in 2012, which advocates for a broader understanding of prosperity in cities, taking in six criteria: productivity, quality of life, infrastructure, equity, environmental sustainability and governance. The broader City Prosperity Initiative provides cities with locally adapted monitoring capabilities and the possibility to devise indicators and baseline information.[95]

Open data

Open Data is significantly transforming the way local governments share information with citizens, deliver services and monitor performance. The system enables public access to information and more direct involvement in decision-making. The Urban Open Data movement aims to foster understanding of government information by the average citizen and is driven by commitments to transparency and accountability.[96]

In the US, New York, San Francisco, Chicago, and Washington, DC, have been at the forefront of the movement.[97] Other cities around the world are also now emerging as leaders. In Helsinki, data is released and managed through the city's Urban Facts agency, in collaboration with neighbouring municipalities, who in turn release regional data through Helsinki Region Infoshare.[98] In New York, businesses are leveraging open data to disseminate various types of information from public transport schedules and delays to crime statistics to healthcare services.[99] In the UK, the Greater London Authority has set up London DataStore, a free and open data-sharing portal where people can access over 500 datasets for a better understanding of local issues and possible solutions.[100] Opening up data enables local governments to support innovative business and services that deliver social and commercial value.

Open Data is significantly transforming the way local governments share information with citizens, deliver services and monitor performance

Big data

With Big Data and the Internet of Things, city leaders are gaining more detailed, real-time picture of what is happening within their city. The Internet of Things is reaching a tipping point. As more people and new types of information are connected, Internet of Things becomes an Internet of Everything— a network of networks where billions of connections can create unprecedented opportunity for cities. Notably, the volume of digital data is almost doubling every two years.[101] Moreover, the increasing use of Geographical Information Systems allows spatially referenced data from diverse sources to be linked, thus providing a clear picture of what is going on within cities. In Santander (Spain), solid waste, parking spaces, air pollution and traffic conditions are monitored through 12,000 sensors installed around the city, providing city officials real-time information on service delivery.[102]

Box 2.4: An open data portal for cities and globally standardized city data

The World Council on City Data (WCCD) is the worldwide leader in standardized city metrics and is implementing its dedicated standard in many regions. Formally known as *ISO 37120: Sustainable Development of Communitie— Indicators for City Services and Quality of Life*, the WCDD standard is a set of 100 worldwide comparative indicators that enable municipalities to track annual performance and benchmarking data across 17 different categories. Most importantly, ISO 37120 is a demand-led standard, driven and created by cities, for cities.

In 2014, the WCCD devised the first international certification system and Global Cities Registry™ for ISO 37120, which provides a consistent and comprehensive platform for standardized urban metrics. The WCCD hosts independently verified ISO 37120 data on its Open City Data Portal, which displays data using cutting-edge visualizations and customized trend analyses, and enables cross-city comparisons.

The first 20 cities to become ISO 37120-certified and added to the WCCD Global Cities Registry™ include: Amman, Amsterdam, Barcelona, Bogotá, Buenos Aires, Boston, Dubai, Guadalajara, Haiphong, Helsinki, Johannesburg, London, Los Angeles, Makati, Makkah, Melbourne, Minna, Rotterdam, Toronto, and Shanghai. The ISO 37120 Standard and the World Council on City Data can offer accurate independently certified data to support measurement of cities' progress against Sustainable Development Goal 11 ("Making cities and human settlements inclusive, safe, resilient and sustainable").

Source: www.dataforcities.org, last accessed 28 April 2016.

Today, smartphone tools and apps proactively provide citizens with useful contextualized information, while supercomputers are able to query vast quantities of unstructured data and suggest solutions to more complex

Today, smartphone tools and apps proactively provide citizens with useful contextualized information problems. In Los Angeles, software developed by the city is processing big data to address traffic congestion. Using magnetic sensors, real-time updates on traffic flow are transmitted, with simultaneous data analysis making second-by-second adjustments possible to avoid bottlenecks.[103]

Smart cities

The ever-increasing application of data and the Internet of Things is supporting a much more collaborative relationship between city governments, citizens, and businesses. This trend is driving the smart cities phenomenon worldwide. The definition of a smart city continues to evolve, but a consistent component is the application of ICT and the Internet of Things to address urban challenges. Many conceptual frameworks of smart cities also consider sustainability, innovation, and governance as important components in addition to the application of ICT. The International Telecommunication Union defines a smart sustainable city as "an innovative city that uses information and communication technologies and other means to improve quality of life, efficiency of urban operation and services, and competitiveness, while ensuring that it meets the needs of present and future generations with respect to economic, social, environmental as well as cultural aspects."[104]

A smart city can guide better decision-making with respect to prosperity, sustainability, resilience, emergency management, or effective and equitable service delivery. The city of Rio de Janeiro collaborated with IBM, to create a municipal operations centre that combines data and information from city and state agencies, and private utility and transportation companies to collaborate on logistics and management challenges. The city, faced with growing concerns in flooding and traffic gridlock, can now monitor data and provide citizens with important information via mobile phones and other warning systems.[105] Barcelona is a leading smart city for its application of innovative solutions aimed at improving city services and the quality of life of its citizens. Barcelona's smart city model aims "to use ICT in order to transform the business processes of public administration…to be more accessible, efficient, effective and transparent."[106] Singapore has also been at the forefront of the smart city movement; its Smart Nation Programme seeks to harness ICT, networks and data to support better living, create more opportunities, and to support stronger communities.[107] Singapore was the first city in the world to introduce congestion pricing and now by using more advanced systems, can analyse traffic data in real time to adjust prices.[108] Technology solutions and the effective use of data are providing city leadership with new tools and opportunities for effective change.

Estimates show that the global smart city market will grow by 14 per cent annually, from US$506.8 billion in 2012 to US$1.3 trillion in 2019.[109] Over the next two decades, city governments in the US will invest approximately US$41 trillion to upgrade their infrastructure and take advantage of the Internet of Things.[110] With China's cities projected to grow by 350 million people over the next 20 years, investment in smart cities is expected to exceed US$159 billion in 2015 and US$320 billion by 2024.[111] In 2014, India announced plans to build 100 smart cities in response to the country's growing population and pressure on urban infrastructure.[112] In order to realize the potential of ICT towards sustainable development, an enabling environment has to be created, with participatory governance models, the right infrastructure and technical platforms, including capacity building, ensuring inclusion and bridging the digital divide.[113]

Estimates show that the global smart city market will grow by

14% annually,

from US$506.8 billion in 2012 to US$1.3 trillion in 2019

Notes

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