

Urbanization in developing countries: Current trends, future projections, and key challenges for sustainability

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Abstract

The purpose of this paper is to provide a broad overview of the recent patterns and trends of urban growth in developing countries. Over the last 20 years many urban areas have experienced dramatic growth, as a result of rapid population growth and as the world's economy has been transformed by a combination of rapid technological and political change. Around 3 billion people—virtually half of the world's total population—now live in urban settlements. And while cities command an increasingly dominant role in the global economy as centers of both production and consumption, rapid urban growth throughout the developing world is seriously outstripping the capacity of most cities to provide adequate services for their citizens. Over the next 30 years, virtually all of the world's population growth is expected to be concentrated in urban areas in the developing world. While much of the current sustainable cities debate focuses on the formidable problems for the world's largest urban agglomerations, the majority of all urban dwellers continue to reside in far smaller urban settlements. Many international agencies have yet to adequately recognize either the anticipated rapid growth of small and medium cities or the deteriorating living conditions of the urban poor. The challenges of achieving sustainable urban development will be particularly formidable in Africa.

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Keywords: Urbanization; City growth; Demography; Sustainable development

Achieving the United Nation's Millennium Development Goals (MDGs), the international community's unprecedented agreement on targets towards the eradication of extreme poverty and hunger, will depend to a large extent on how well developing country governments manage their cities. Cities are currently home to nearly half of the world's population and over the next 30 years most of the two-billion-plus person increase in global population is expected to occur in urban areas in the developing world. This represents a significant departure from the spatial distribution of population growth in the developing world that occurred over the past 30 years,

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which was much more evenly divided between urban and rural areas. The level of world urbanization today and the number and size of the world's largest cities are unprecedented. At the beginning of the twentieth century, just 16 cities in the world—the vast majority in advanced industrial countries—contained a million people or more. Today, almost 400 cities contain a million people or more, and about seventy percent of them are found in the developing world. By 2007, for the first time in human history, more people in the world will be living in cities and towns than will be living in rural areas and by 2017 the developing world is likely to have become more urban in character than rural [1].

If well managed, cities offer important opportunities for economic and social development. Cities have always been focal points for economic growth, innovation, and employment. Indeed, many cities grew historically out of some natural advantage in transport or raw material supply. Cities, particularly capital cities, are where the vast majority of modern productive activities are concentrated in the developing world and where the vast majority of paid employment opportunities are located.

Cities are also centers of modern living, where female labor force participation is greatest and where indicators of general health and wellbeing, literacy, women's status, and social mobility are typically highest. Finally, cities are also important social and cultural centers that house museums, art galleries, film industries, theaters, fashion houses, and other important cultural centers.

High population density may also be good for minimizing the effect of man on local ecosystems. High population density typically implies lower per capita cost of providing infrastructure and basic services. And despite the high rates of urban poverty that are found in many cities, urban residents, on average, enjoy better access to education and health care, as well as other basic public services such as electricity, water, and sanitation than people in rural areas.

Nevertheless, as cities grow, managing them becomes increasingly complex. The speed and sheer scale of the urban transformation of the developing world presents formidable challenges. Of particular concern are the risks to the immediate and surrounding environment, to natural resources, to health conditions, to social cohesion, and to individual rights. For many observers, however, the greatest concern is surely the massive increase in the numbers of the urban poor. Available data suggest that in a large number of the world's poorest countries, the proportion of urban poor is increasing faster than the overall rate of urban population growth [2]. An estimated 72 percent of the urban population of Africa now live in slums [3]. The proportion is 43 percent for Asia and the Pacific, 32 percent for Latin America, and 30 percent for the Middle East and Northern Africa [3]. Rapid urban growth throughout the developing world has seriously outstripped the capacity of most cities to provide adequate basic services for their citizens. Yet each year cities attract new migrants who, together with the increasing native population, expand the number of squatter settlements and shanty towns, exacerbating the problems of urban congestion and sprawl and hampering local authorities' attempts to improve basic infrastructure and deliver essential services.

To begin to deal with these challenges will, at a minimum, require accurate projections of future urban growth, which in turn must be based on both a solid foundation of high-quality statistics and a good understanding of the likely patterns and trends of urban change. But this is no easy task. There are enormous difficulties in obtaining reliable data on urban populations and quite major errors have been made in the past with respect to projections of some of the world's largest cities. Take for example, the case of Mexico City. In 1980, demographers predicted that Mexico City would contain over 31 million people by the year 2000 [4]. But the actual population of Mexico City in the year 2000 turned out to be only 19 million, a massive number

but nowhere near the 1980 projection [1]. Or consider for a moment, the case of Lagos, Nigeria: in 1980, the best data available led demographers to believe that the population of Lagos was around 1.2 million. At that time, they forecast that the city would grow to around 4.5 million by the year 2000 [4]. Despite the absence of reliable and up-to-date data, these estimates were periodically revised over the next 20 years. In 2001, the population of Lagos was believed to have been 4.4 million people in 1980 and 13.4 million in 2000 [5]. In 2002, however, when the results from the Nigerian Census of 2000 had begun to become available, demographers revised their estimates of the population of Lagos down dramatically. The current thinking is that there were probably around 2.6 million people in Lagos in 1980 and around 8.7 million by the year 2000 [1].

With such vagaries and uncertainties, there is a clear need to assess how demography can enhance our understanding of the current urban transition. The rest of this paper will attempt to update our general knowledge of the main features of the current urban transition as well as some of the major development challenges they suggest. In doing so, the paper documents the size and scale of the enormous urban transformation that has taken place in the developing world over the last 50 or so years, as well as the diversity of experience both within and across regions. Out of necessity the paper relies heavily on the United Nations' bi-annual publication world urbanization prospects because it is the only comprehensive source of estimates and projections of the urban and rural populations of all countries in the world and of their major urban agglomerations. Although this UN publication is an invaluable resource for those interested in studying urban change, the data in the report are somewhat deceptive in their apparent completeness and there is some degree of uncertainty about what these data mean and how they should be reported [6].

Given space constraints it is only possible to address these issues at a very high level of aggregation. The bulk of the paper is restricted either to comparisons between the developed and the developing world or between the major regions of the developing world. Only infrequently will reference be made to the differences between individual countries within any given region or differences between various cities within a particular country, which can be very significant with respect to some of the indications presented below.

1. The challenges of studying urbanization

Although already mentioned, it bears repeating that undertaking research on urbanization in the world and in particular in less developed countries presents major challenges. The most fundamental problem is that there is no global standard for the classification of urban environments. Virtually, all countries distinguish between urban and rural population, but the definition of what constitutes an urban area varies among countries and in some cases it even varies over time within a single country.

Urban communities can be defined in any number of ways including by population size, population density, administrative or political boundaries, or economic function. Some countries define their urban population as those people living within certain administrative boundaries—such as in administrative centers or municipios (as in El Salvador), municipality councils (as in Iraq), or in places having a municipality or a municipal corporation, a town committee, or a cantonment board (as in Bangladesh or Pakistan). Other countries prefer to classify their urban population using either population size or population density as the primary consideration.

The United Nations' report world urbanization prospects, upon which much of this paper is built, merely presents urban data that reflect national definitions, which are far from consistent.

Places that are classified as urban in one country may be classified as rural in another. In Angola, Argentina, and Ethiopia, for example, all localities with 2000 inhabitants or more are considered urban, while in Benin only localities with 10,000 inhabitants or more are classified as urban. Communities under 10,000 inhabitants are classified as rural. In yet other cases, urban boundaries are drawn up based on a mixture of population size or density and various economic or social indicators. In Botswana, for example, an agglomeration of 5000 or more people where 75 percent of the economic activity is non-agricultural would be considered urban [7].

Similarly, it is also hard to identify the population of a given city and even more hazardous to compare the size of various cities against one another. This is because the size of a city's population is a function of how and where the city administrative boundaries are drawn. And, this again can be quite arbitrary and may not include large numbers of people living contiguous to the city 'proper' at urban levels of residential density but who fall outside of the city's administrative boundaries. In some cases, the size of the city would be considerably larger if people residing in the urban fringe were included in official statistics [8]. While in other cases, official statistics undoubtedly overstate the true size of the city because city boundaries have been drawn up so generously. In China, the world's most populous country, the definition of what constitutes an urban area has changed quite substantially over time. In the early 1980s, China significantly lowered the criteria for qualifying localities as urban. Consequently, official Chinese statistics show a massive increase in the number of towns and cities and in the size of the total urban population in the mid-1980s. In 1987, for example, the newly created city of Zibo in Shandong Province contained 2.4 million residents within its (very generous) city boundaries. But sixty-six percent of the urban population of Zibo was principally engaged in agriculture [9]. Consequently, any estimate of the size of a particular city needs to be clarified in terms of whether it is an estimate of the central city, the greater metropolitan area, or a wider planning region that may include other subsidiary settlements. Estimates of the population of Mexico City in 2000, for example, legitimately ranged from 8.6 million for the population of the central Federal District to 23.2 million for the entire polynuclear megalopolis (see Fig. 1) [10].

Definitional complications aside, analysis of patterns of urban growth over time is still constrained by another problem, namely the lack of reliable and up-to-date demographic data. Census data are the principle source of information on individual cities but censuses usually occur only once per decade and then take several years to be analyzed and released. In some countries, no new census data has become available since the 1990s or even the 1980s so that in some cases, 'recent' urban statistics are in fact imputed from data that are completely out of date. And even when a recent census is available, crowded cities with large mobile populations are notoriously difficult to enumerate accurately with the result that urban populations are frequently under-enumerated.

A final complication is that it is hard to overstate the degree to which settlement systems have also increased in their complexity over the past 20 years. Innovations in transportation and communication, while not eliminating the need for cities entirely, have nonetheless resulted in the spread of urban functions over wide geographic areas. As a result, new settlement systems have emerged that are not easily captured by a simple urban-rural dichotomy [12]. In parts of Pacific Asia, for example, zones of intense economic activity have emerged in the intersection between cities and rural areas that are neither urban nor rural in the traditional sense although they contain essential elements of both. These extended metropolitan zones as known as *desakota* zones, derived from the Indonesia words for village (*desa*) and town or city (*kota*). The essential feature of these *desakota* zones is that the landscape appears essentially rural and almost all the land is still under cultivation yet a large proportion of household income is derived

Table 1
Urban population size and distribution by major geographic area, 1950–2030

Region	1950	1975	2000	2030
Total Population (millions)				
World	2,519	4,068	6,071	8,130
More Developed Regions ^a	813	1,047	1,194	1,242
Less Developed Regions ^b	280	3,021	4,877	6,888
Rural Population (millions of inhabitants)				
World	1,786	2,552	3,214	3,185
More Developed Regions	386	344	311	228
Less Developed Regions	1,400	2,208	2,902	2,958
Urban Population (millions of inhabitants)				
World	733	1,516	2,857	4,945
More Developed Regions	427	703	882	1,015
Less Developed Regions	306	813	1,974	3,930
Percentage of Population Living in Urban Areas				
World	29.1	37.3	47.1	60.8
More Developed Regions	52.5	67.2	73.9	81.7
Less Developed Regions	17.9	26.9	40.5	57.1
Distribution of the World's Urban Population				
(World)	100	100	100	100
More Developed Regions	58.3	46.4	30.9	20.5
Less Developed Regions	41.7	53.6	69.1	79.5

^a The more developed regions comprise Europe, North America, Australia/New Zealand, and Japan.

^b The less developed regions comprise all regions of Africa, Asia (except Japan), Latin America and the Caribbean, plus Melanesia, Micronesia, and Polynesia.

In 1950, just over one-half of the population of the developed world and just under one-third of the population of the entire world lived in urban areas (see Table 1). At that time, there were only around 733 million people living in urban areas around the world and eighty-three cities in the world that could boast a million or more residents. Continued urbanization over the last 50 years has resulted in a situation whereby close to half of the world's population (47.1 percent) now live in urban areas. In absolute terms, the numbers of urban dwellers almost quadrupled between 1950 and 2000 going from 733 million to 2.857 billion. Especially over the last two decades, globalization driven by advances in transportation and telecommunications, and a positive political climate has created a global economy characterized by unprecedented levels of urbanization and more and bigger cities than ever before. Many cities, particularly those in East Asian countries that have enjoyed robust economic growth have grown spectacularly over the past 25 years, in some cases more than quadrupling in size.

Over the next 30 years (i.e. 2000–2030), the world's population is projected to grow at an annual rate of 1.8 percent, or nearly double the rate expected for the total population of the world (almost one percent per year). At this rate of growth, the world's urban population can be expected to double in 38 years. By 2030, demographers predict that around 61 percent of the world's population will be living in urban areas, at which time the world's urban population will be approaching 5 billion (Table 1).

Compared against the rapid rise in the urban population, the growth of the world's rural population has been relatively slow (see Fig. 2). While the world's urban population increased four-fold between 1950 and 2003, the world's rural population less than doubled going from 1.8 billion in 1950 to 3.2 billion in 2000. And while the world's urban population is expected to increase by almost 2 billion over the next 30 years, the world's rural population is actually

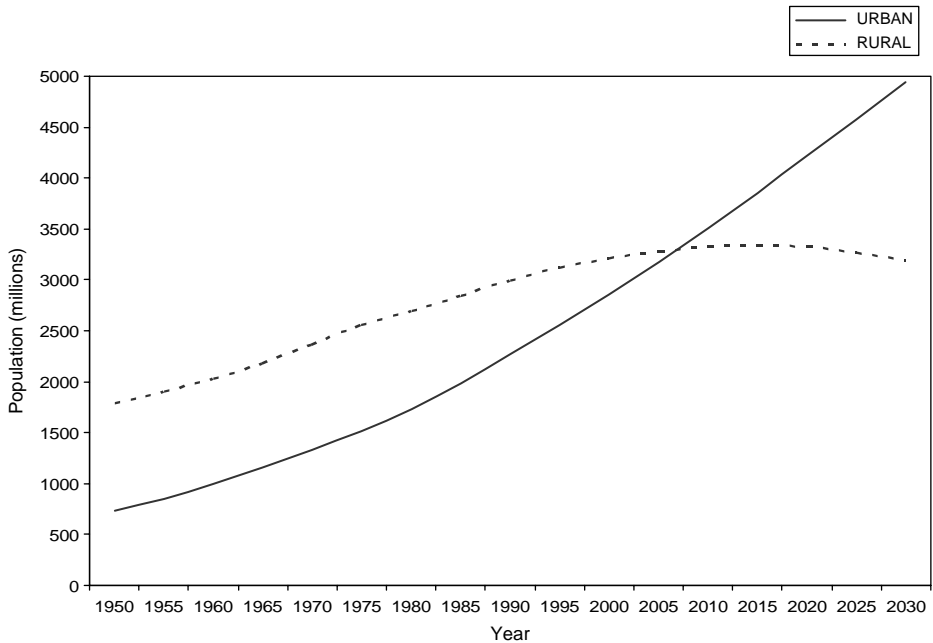


Fig. 2. Estimated and projected size of the world's urban and rural populations, 1950–2030. Source. Ref. [1].

expected to decline slightly falling from 3.3 billion in 2003 to 3.2 billion in 2030. Thus, all future population growth for the foreseeable future is expected to be absorbed in urban areas.

Urbanization and city growth are caused by a number of different factors including rural–urban migration, natural population increase, and annexation. Because rates of natural increase are generally slightly lower in urban than in rural areas, the principal reasons for rising levels of urbanization are rural–urban migration, the geographic expansion of urban areas through annexations, and the transformation and reclassification of rural villages into small urban settlements. The expansion of the metropolitan periphery can be caused both by the arrival of new migrants and by the sub-urbanization of the middle class out of the central city. The relative importance of each of these various causes of urbanization and suburbanization varies both within and between regions and countries.

As stated above, over the next 30 years, population growth in general and urban population growth in particular is expected to be particularly rapid in the developing world, averaging 2.3 per cent per year during 2000–2030. Although much of the popular rhetoric on urbanization has left the impression that cities are currently growing too fast and that growth should be limited or somehow diverted, it is important not to lose sight of the fact that, for the most part, there is an economic logic to the pattern of urbanization [14]. In most cases, high growth rates are an indicator of success rather than failure and most of the world's largest cities are located in countries with the world's largest economies. Many cities in Pacific Asia, for example, have experienced dramatic economic growth, reflecting the fact that the region is completely integrated into the new global economy. Cities on the forefront of global restructuring such as Hong Kong, Singapore, Seoul, and Taipei have enjoyed unprecedented growth rates of more than 10 percent per annum throughout the 1970s and early 1980s. All now rank among the top

trading cities in the world and in fact, the level of gross national product (GNP) per capita in Hong Kong and Singapore exceeds that of many European countries.

This extremely general descriptive of urban trends and projections naturally masks considerable regional diversity. There are enormous differences in the pattern of urbanization between regions and even greater variation in the level and speed with which individual countries or indeed individual cities within regions are growing. Latin America, for example, is far more urbanized than Africa or Asia (see [Table 2](#)). The level of urbanization in Latin America—around 76 percent—already matches that of North America as well as many European countries. Consequently, the rate of urbanization in Latin America is quite slow. Argentina, Brazil, Uruguay, Venezuela, and Chile, for example, are all well over 80 percent urban while levels of urbanization are somewhat lower in most of Central America and the Caribbean.

At the other end of the spectrum, Asia and Africa, still both heavily dependent on agriculture, are predominantly rural in character although both have around 37 percent of their populations living in urban areas in 2000. By being less urbanized, these two regions are expected to experience relatively faster rates of urbanization over the next 30 years. In the case of Africa, levels of urbanization are still below 20 percent in a number of the poorest countries in the region including Burundi, Ethiopia, Malawi, Burkina Faso, and Uganda. While in the rapidly industrializing economy of South Africa, approximately 60 percent of the population now lives in urban areas. Perhaps the essential difference with regard to regional patterns of urbanization and city growth is that, unlike rapidly growing cities in Asia and Latin America, many cities in Africa are economically marginalized in the new global economy. African cities are growing often in spite of poor macroeconomic performance and without significant direct foreign

Table 2
Urban population size and distribution by major geographic area, 1950–2030

Region	1950	1975	2000	2030
Urban population (millions of inhabitants)				
Africa	33	103	295	748
Asia	232	575	1367	2664
Europe	280	446	529	545
Latin America and the Caribbean	70	197	393	602
Northern America	110	180	250	354
Oceania				
Percentage of population living in urban areas				
Africa	14.9	25.3	37.1	53.5
Asia	16.6	24.0	37.1	54.5
Europe	51.2	66.0	72.7	79.6
Latin America and the Caribbean	41.9	61.2	75.5	84.6
Northern America	63.9	73.8	79.1	86.9
Oceania	60.6	71.7	72.7	74.9
Distribution of the world's urban population				
Africa	4.5	6.8	10.3	15.1
Asia	31.7	37.9	47.8	53.9
Europe	38.2	29.4	18.5	11.0
Latin America and the Caribbean	9.5	13.0	13.8	12.2
Northern America	15.0	11.9	8.8	7.2
Oceania	1.1	1.0	0.8	0.6

Table 3
Distribution of large cities by major geographic area, 1950–2015

Region	1950	1975	2000	2015
Distribution of the world's 30 largest cities				
Africa	1	1	2	3
Asia	7	14	16	15
Europe	12	6	3	2
Latin America and the Caribbean	4	4	6	6
Northern America	6	5	3	3
Oceania	0	0	0	0
Number of cities with at least one million residents				
Africa	2	8	35	63
Asia	27	86	194	288
Europe	20	47	62	60
Latin America and the Caribbean	7	21	49	73
Northern America	14	31	41	51
Oceania	2	2	6	6
Total	72	195	387	541

investment, making it next to impossible for urban authorities to provide adequate basic infrastructure or essential services. Nevertheless, if the population of Africa continues to grow as expected over the next 15 years, then by 2015, incredibly, there will be more cities with at least a million people in Africa than in either Europe or North America (Table 3).

The various continents are also quite different in terms of total population size—Asia is much larger—so that the number of urban residents in Asia is almost double the number in Latin America and Africa combined (see bottom panel of Table 2). By 2030, more than half of the urban population in the world will reside in Asia while Europe's share of the total urban population will have been reduced from 38 in 1950 to just 11 percent in 2030. Similarly, a majority of the world's large cities are now concentrated in Asia (see Table 3). In 1950, 12 of the world's thirty largest urban agglomerations were located in Europe while only seven were in Asia. By 2000, 16 of the world's thirty largest urban agglomerations were located in Asia. Only three were in Europe.

3. Key challenges for sustainability

3.1. The world's largest agglomerations

Given the increase in total urban population, it is not surprising to discover that the world is experiencing both an increase in the absolute number of large cities and seeing cities reach unprecedented sizes. For example, the average size of the world's one hundred largest cities has grown from under 200,000 in 1800 to over 5 million in 1990 [14]. In 1950, there were only eight cities in the world that had a population of over 5 million. New York, Tokyo, and London were the three largest, containing 12.3, 11.3, and 8.4 million residents, respectively. In 1950, Shanghai and Buenos Aires were the only cities in a developing country that contained more than 5 million residents while cities such as Mumbai (formerly Bombay), Mexico City, and Rio de Janeiro were still relatively small cities: each contained just under 3 million residents. By 2000, there were forty-two 5 million plus cities, thirty of which were in the developing world. Of

those forty-two cities, eighteen had surpassed the 10 million mark. In 1950, New York was the largest urban agglomeration in the world with a population of 12.3 million. Today, the record for the world's largest agglomeration is held by Tokyo at over 34 million and an urban agglomeration the size of New York in 1950 would barely make it on a list of the world's top ten cities. Nevertheless, it is always important to remember that although the number of very large urban agglomerations is expected to continue to rise, they still account for a relatively small fraction of the world's total population or even the world's total urban population.

One particularly alarming trend that has been observed is the rapid growth in the number of new urban residents every year to the world's largest urban agglomerations, although this is partly an artifact of the fact that several very large urban agglomerations in the developing world that had less than 10 million residents in 1975 have now crossed the 10 million threshold. Consequently, the number of people living in vast urban agglomerations of 10 million or more in the developing world has risen dramatically over the past couple of decades. Between 1975 and 2000, the number of 10 million plus urban agglomerations in the developing world rose from 2 to 13 and the number of people living in mega-cities catapulted from 22 million in 1975 to 165 million in 2000 [1]. Furthermore, even this may be a quite serious underestimate if the administrative boundaries of several large urban agglomerations were drawn somewhat more broadly. Because urban growth in developing countries has typically been associated with the physical expansion of metropolitan areas, to the extent that growth occurs outside of official administrative boundaries, it can lead to a serious underestimation of the true dynamics of the metropolitan area. Recent analysis of four large metropolitan areas in Southeast Asia—Bangkok, Jakarta, Manila, and Taipei—suggest that existing boundaries may be drawn too tightly, missing important recent developments in the underlying spatial dynamics of the city-region [8].

Similarly, the number of cities above any arbitrary threshold—half a million, one-million, five-million—has grown. For example, consider the number of cities with more than one million residents. At the beginning of the 19th century, Beijing (then Peking) was the only million-plus city [15]. Even by the turn of the 20th century, there were still only 16 million plus cities in the world. But, by 1950, the number of million-plus cities had grown to 72 [16], by 1975 it had grown to 195, and by 2000, there were almost 400. According to the latest projections, there will be more than 150 new million plus cities around the world over the next 15 years (see Table 3). Increasingly, new million-plus cities will be located in Asia, Africa, and Latin America.

Despite newspaper reports of 'exploding' large cities, the reality is that the world's largest cities have actually grown more slowly than was expected and are usually not even the world's fastest growing cities for the simple reason that, for this to be true, the absolute increase in population each year would quickly become enormous. As the scale of the city increases, the growth rate of a city's population typically declines and in fact, the growth of most of the world's mega-cities has slowed down recently, reflecting slower national population growth rates.

In many developing countries, a large proportion of the national population live in the largest city, which in many cases is also the capital. This is not the case in more developed countries, which tend to have more advanced urban networks. The concentration of population in large cities is particularly striking in Latin America where there are 13 countries where over 20 percent of the country's population resides in the largest city. In eight of these cases, over one-quarter of the national population lives in the largest city.

The speed and scale of increase in the world's largest cities and metropolitan areas can create enormous stresses on the immediate and surrounding environment and poses major challenges for sustainable development. A long-standing urban bias in social infrastructure investments has

contributed to the widely held belief in the development literature that living conditions must be far better in large cities than in smaller cities or towns. But with the locus of global poverty moving to cities, the long-assumed advantages enjoyed by residents of large cities have been called into question [17]. High rates of overall population growth, together with significant rural–urban migration, have contributed to the rapid and unplanned expansion of low-income settlements on the outskirts of many large cities, which has occurred without a concomitant expansion of public services and facilities. In addition, the international debt crisis has hit many African and Latin American countries hard, and the implementation of structural adjustment programs in many African countries led to a retrenchment of government subsidies and social expenditures that has affected urban residents disproportionately [18]. A recent study comparing levels of well-being by city size in various developing regions found that in Latin America and the Caribbean, the early survival advantage of big-city residents had declined since the 1970s and was no longer apparent by the early 1990s, while in sub-Saharan Africa, residents of ‘mega-villages’ of several hundred thousand people were underserved in terms of access to schooling, child health, and related services [17]. These findings, if replicable, suggest that congestion costs in large cities are indeed very real.

3.2. Small cities, big agenda

In thinking about an urban future, it is perhaps only natural to imagine a world in which everyone is living in mega-cities the size of Sao Paulo, Mexico City, Beijing, or Lagos. But that is not correct. In fact the bulk of urban population growth for the foreseeable future will take place in far smaller cities and towns, a point that receives little media recognition. Large cities will play a significant role in absorbing future anticipated growth, but for the foreseeable future the majority of urban residents will still reside in much smaller urban settlements of fewer than 500,000 residents (see Fig. 3). Exact data on this point is hard to find since no comprehensive database of cities under 750,000 exists in a readily available format. Nevertheless, according to the most recent estimates of the United Nation’s Population Division, the lion’s share of the increase in urban population over the next 15 years will continue to be in towns and cities with fewer than half a million inhabitants (see Fig. 4). Even by 2015, towns and cities under half a million will still account for just over half of the total urban population. By comparison, just under nine percent of the world’s urban population is expected to be living in cities of 10 million or more by 2015. When added together, the combined size of the population of smaller cities and towns makes them very significant.

While by no means suggesting that large cities be entirely neglected in the future, there are good reasons for putting smaller cities more centrally on the development agenda [19]. First, as discussed above, when combined, the total population of smaller cities and towns is demographically very significant. Second, because by definition they are starting from a smaller base, small cities typically grow faster than large cities. Third, according to a recent study of urban infrastructure, residents of small cities in developing countries are extensively underserved with respect to basic services. A recent study of the US National Academy of Sciences, which was based on an analysis of data from more than 90 countries, revealed that, across all major geographic regions investigated, residents of small cities suffer a marked disadvantage in the provision of piped water, waste disposal, electricity, and schools than residents of medium or large cities (see Fig. 5). Furthermore, there is some evidence to suggest that rates of poverty are higher in smaller cities and in many countries levels of infant and child mortality are negatively proportional to city size [18]. Finally, local government capacity is

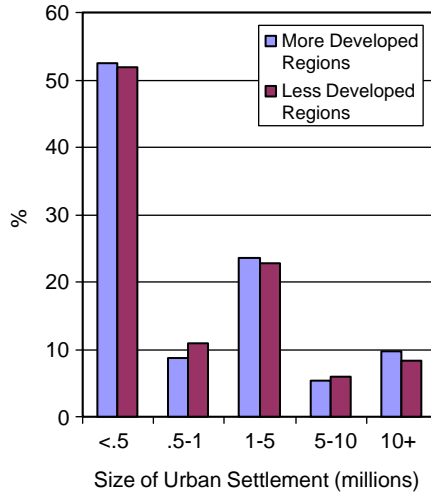


Fig. 3. Distribution of urban residents by size of urban area, 2000. Source: Ref. [1].

weaker in smaller cities [18]. In view of the role that will be played by small cities in accommodating future population growth, it is clear that their need for improved basic services must be urgently addressed.

Currently, many small cities lack the necessary institutional capacity to be able to manage their rapidly growing populations. As cities grow and evolve, the task of managing them becomes ever more complex. In addition, the nature and tasks of urban management and governance are also undergoing fundamental change. The policy and program environment has been altered in many countries as national governments have decentralized service delivery and revenue-raising to lower tiers of government. In the areas of health, education, and poverty alleviation, many

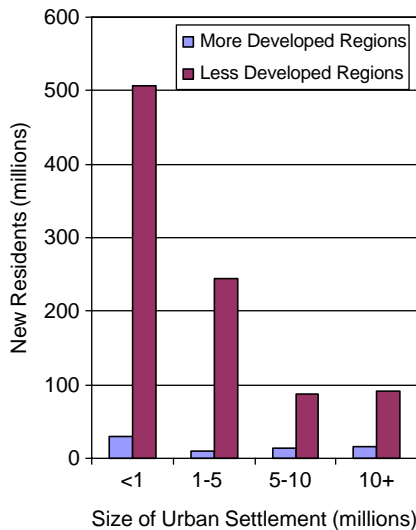


Fig. 4. Number of urban residents added to the urban milieu between 2000 and 2015 according to city size. Source: Ref. [1].

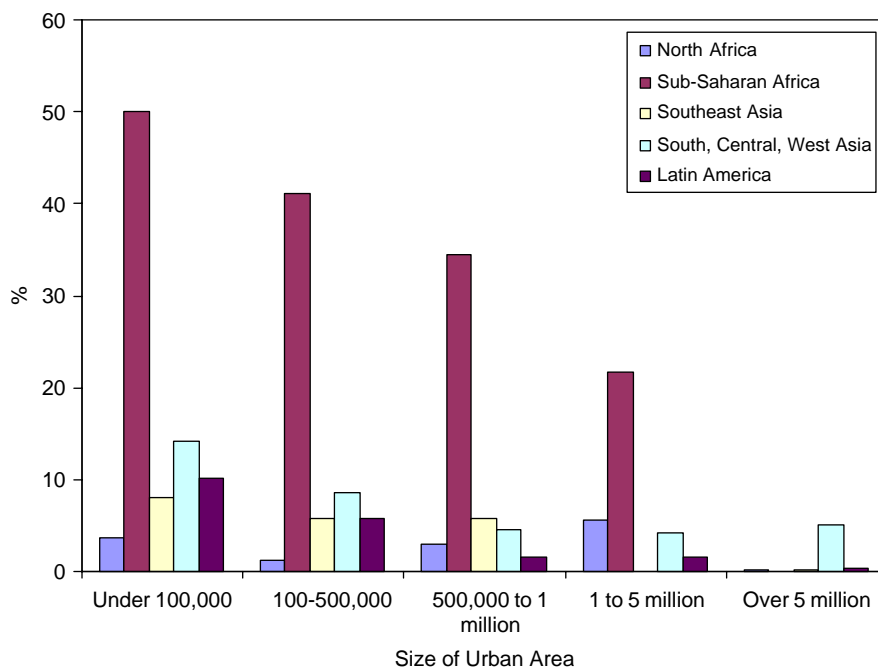


Fig. 5. Percentage of households lacking piped water, flush toilet, and electricity by size of urban area and geographic region. Source: Ref. [18].

national governments have begun to allow hitherto untested local governments to operate the levers of policy and programs. At present, few small city local governments are equipped with the technical and managerial expertise they need to take on these new responsibilities.

At the same time, there are advantages to being small. Small cities have time to address residents' basic infrastructure and service needs before the magnitude of the service gap becomes too overwhelming. Small cities that are growing rapidly also offer critical opportunities for bypassing old technologies and for implementing efficient, ecologically-sound practices that can contribute to shaping a more sustainable future.

3.3. Socioeconomic fragmentation within large and small cities

Cities throughout the world exhibit an incredible diversity of characteristics, economic structures, levels of infrastructure, historic origins, patterns of growth, and degrees of formal planning. Yet, many of the problems that they face are strikingly familiar. For one thing, as cities grow, they become increasingly diverse. Every city has its relatively more affluent and relatively poorer neighborhoods. But in developing countries, poorer neighborhoods can have dramatically lower levels of basic services. Consequently, a large number of urban residents in developing countries suffer to a greater or lesser extent from severe environmental health challenges associated with insufficient access to clean drinking water, inadequate sewerage facilities, and insufficient solid waste disposal. A major recent United Nations report on the state of water and sanitation in the world's cities found that water distribution systems in many cities in the developing world are inadequate, typically serving the city's upper- and middle-class

neighborhoods but not rapidly expanding settlements on the urban fringe. Furthermore, the current data on the provision of water and sanitation in urban areas is very weak and the true situation is actually far worse than most international statistics suggest [20]. The large projected increases in the numbers of urban residents in the developing world over the next 20–30 years implies that municipal authorities responsible for these sectors face very serious challenges in the years ahead. In many cities, the scarcity of public water supplies forces many low-income urban residents to use other water sources such as private water vendors who charge many times more than the local public rate. Consequently, people in slums often must pay much more for lower quality water than other urban residents [21].

Improving public sanitation is another major urban environmental challenge that needs to be immediately addressed in virtually all cities in the developing world. Failure to collect garbage as well as inadequate waste management and recycling policies and practices mean that cities are being inundated in their own waste. In African cities, waste management has been described as ‘a monster that has aborted most efforts made by city authorities, state and federal governments and professionals alike’ [22]. As is the case of the water supply distribution network, sewerage systems are far better at meeting the needs of upper- and middle-class neighborhoods than they are of servicing poorer neighborhoods, particularly unregulated neighborhoods on the urban periphery. A major environmental crisis is looming large as many developing countries as cities discharge ever increasing amounts of waste into the air or into freshwater bodies, threatening water quality and aquatic ecosystems.

The extent that urban growth affects the local ecosystem can be controlled to some extent by high quality land management. Land is an essential ingredient in all urban growth, yet in most cities there have been virtually no effective measures to control land development. Although many cities have formulated master plans at some time or another that included guidelines on land development and the future direction of urban growth, rarely, if ever, have these plans been realized. Reasons for this include poor urban governance, poor critical assumptions-urban population projections underpinning these plans have often been extremely weak-and the inability of plans to be adjusted and refined in the light of changing conditions, such as the invasion and settling of unused public space. Devising equitable land development policies remains one of the largest challenges facing planners and policy makers in many cities in the developing world.

Congestion in many large cities can also be extremely severe and air pollution is now a serious environmental concern in many cities. Concentrations of carbon monoxide, lead, and suspended particulate matter in many large cities greatly exceed World Health Organization guidelines. Among the greatest environmental health concerns are exposure to fine particulate matter and to lead which contributes to learning disability in young children. A popular response to urban transportation congestion problems has been government investment in large-scale public transportation systems such as underground or overland metro systems. Less attention has been devoted to expanding and improving public bus networks, which tend to be overcrowded and poorly maintained. In many cities, private mini-bus companies have filled a hole in the market by providing low-cost urban transportation where standard bus routes have proved insufficient.

3.4. Africa as a region of special concern

Despite gains in the second half of the 1990s, sub-Saharan Africa faces a greater set of development challenges than any other major region of the world. A current list of the

region's ailments includes low productivity in agriculture and industry, a lack of foreign exchange, high indebtedness, a poor balance of payments position, political instability, chronic mismanagement of economic resources, and high levels of corruption. Long the least developed and poorest continent, in many countries average income per capita is lower now than it was at the end of the 1960s [23]. Not surprisingly, the region contains a growing share of the world's absolute poor. In 1980, one out of every 10 poor people lived in sub-Saharan Africa. In 2000, that ratio had risen to one in three. And future projections predict that soon it will be one in two, with increasing numbers of the poor living in urban areas. In addition, the region has one of the lowest levels of literacy as well as the lowest levels of life-expectancy—much of the region's progress in this area over the last 40 years has been wiped out by the HIV/AIDS epidemic. One in five Africans lives in a country severely disrupted by conflict.

Compounding these problems, the population of Africa is growing rapidly—almost twice as fast as any other major region of the world. Although African fertility has started to fall, simple population momentum ensures that the total population of the region will continue to increase: from 794 million in 2000 to 1.489 billion in 2030. Approximately, 70 percent of this growth will take place in African cities and towns. By 2025, African society will become predominantly urban [1]. In absolute terms, Africa's urban population is projected to more than double, from 295 million in 2000 to 748 million by 2030 so that within 25 years, Africa's urban population will be larger than that in North America, Europe, or Latin America. An essential feature of current African urbanization, is that unlike cities in much of Asia and Latin America, urbanization appears to have become decoupled from economic development [18]. The vast majority of African cities are economically marginalized in the new global economy and most African cities are growing despite poor macroeconomic performance and without significant direct foreign investment. Perhaps not surprisingly then, a recent world development report observed that "... cities in Africa are not serving as engines of growth and structural transformation. Instead, they are part of the cause and a major symptom of the economic and social crisis that have enveloped the continent" [24].

While the need for sound scientific knowledge and technical expertise in the formation of urban policy in Africa is clear, a recent comprehensive review of the state of urban research in Africa found that in many parts of Africa urban research has been in serious decline both in quantity and quality since the 1970s [25]. The decline can be attributed to the ongoing economic crisis and to the undermining of institutional support for all aspects of scientific research. A large fraction of urban research is not undertaken through university-based or government-sponsored institutions but undertaken by consultants through non-government organizations or service organizations. One consequence of this is that much on-going research is never published in peer-review journals and therefore not well disseminated throughout the region. There is only one peer-review journal dedicated to urban issues published in Africa.

Recently, African nations have articulated a need both to contribute to science and to apply science to pressing needs, and have begun to formulate an urban strategy to respond to these needs. Through the New Partnership for Africa's Development (NEPAD), African Nations have collectively expressed the importance of pursuing research and the applications of science to address the challenges facing African cities [26]. Such an initiative has the potential to have a significant positive influence in the development of sound public policy in both the short- and the long-term. A strong, respected, balanced, impartial, and independent voice from the scientific, engineering, and medical communities can compel attention to objective evidence in public

policy debates, often with the result that decisions are made that are more clearly in the public interest.

4. Conclusions

In an increasingly urban world, almost half the world's total population and over three-quarters of the population of high-income countries now live in urban areas. While urbanization levels and trends closely mirror global patterns of industrialization and economic development, this is still a remarkable transformation when compared with the situation at the beginning of the 20th Century, when only 13 per cent of the population lived in urban areas and there were just sixteen cities in the world that contained at least a million people. Today, there are almost 400 cities around the world that contain more than a million residents and about seventy percent of these are in less developed countries. Rural–urban migration and the transformation of rural settlements into towns and cities have been important determinants of rapid urban growth but there has also been a general convergence in lifestyles between urban and rural areas as advances in transportation and telecommunication have caused distance and time to collapse. Urban functions are being spread over larger and larger geographic areas so that the traditional distinction between urban and rural areas is becoming increasingly redundant for many purposes.

The purpose of this paper was to describe these broad patterns of spatial change and highlight some of their implications for sustainable development. Critical in this regard is the fact that the United Nations predicts that virtually all of the world's population growth for the foreseeable future is projected to occur in urban areas in the developing world. By 2030, almost 60 percent of the population of the developing world will be living in urban areas. To the extent that this reflects an expectation of further strong economic development in the South, this must be good news. Nevertheless, many development programs of major international agencies have yet to adequately recognize the anticipated rapid growth of small and medium cities or the deteriorating living conditions of the urban poor. The critical challenge over the next 30 years will be to take full advantage of the potential benefits of urbanization in an inclusive way while lessening the obvious potential negatives. How well local authorities are able to respond to this challenge will shape patterns of regional and national development, as well as the social and political stability of many countries.

Of particular concern to many commentators is the absolute scale of urban change that will be faced in the world's poorest countries. Most of this growth will not occur in the largest cities but in smaller secondary cities and towns where poverty rates are higher and where existing coverage of basic public services is far from comprehensive [18], a realization that leads to a different set of challenges and opportunities than if growth were confined to a limited number of very large cities.

Managing urban growth has become one of the most important challenges of the 21st Century. At the same time, the concept of urban governance has itself undergone a major transformation over the last decade and a half. Governance of cities throughout the developing world has been affected by movements towards democratization and political pluralism, an emphasis on decentralization, and the rise of civil society. Numerous legal and institutional reforms in many countries have given shape to institutional reforms at the local and municipal levels [18]. Consequently, solutions to urban problems are increasingly being sought at the local rather than the state or national level. These trends underscore the urgent need to build and support the capacity of local governments to manage the environmental and social service problems that accompany rapid urban growth.

Finally, many of the problems facing rapidly growing urban areas are scientific problems or at least are amenable to scientific and engineering expertise. Working in close collaboration with our sister academies of science and engineering around the developing world, the USA's National Academy of Sciences is currently developing a large initiative to promote scientific exchange and to help build and support the capacity of local governments in smaller cities in the developing world to address their most serious urban challenges. If there is one lesson from recent comparative analysis it is that well-managed small cities are more able to cope with many of the challenges associated with rapid population growth.

Acknowledgements

The author is indebted to Mark Montgomery, Richard Stren, Charles Becker, Ellen Brennan-Galvin, Michael Cohen, Alain Dubresson, Gustavo Garza, Trudy Harpham, Terry McGee, Caroline Moser, Saskia Sassen, David Satterthwaite, Pravin Visaria, Michael White, Yue-man Yeung, and Holly Reed for innumerable discussions on these issues and to Kimberly Vilar for her assistance with background research for this paper.

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