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- Examining the origin of cities
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- Looking at population changes
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Chapter 1

Comprehending the Past, Present, and Future of Cities

For thousands of years, humans were wanderers, existing only in small groups and consumed primarily with daily survival. Then everything changed. The story of why humans went on to eventually build cities is essential for understanding the future of humankind. In this chapter, I briefly describe the origin of cities, including the important impact and role of the industrial revolutions in defining the world today. I also explore how urbanization continues to change the planet, and I introduce the next stop for many major urban areas: megacities.

Discovering the Origin of Cities

The writer and philosopher George Santayana is reported to have said, "Those who cannot remember the past are condemned to repeat it." In other words, ignoring, or being blind to, the lessons of the past puts you at a disadvantage. It makes sense to me: I believe that if you're going to create better and smarter cities, you need to understand a little about their origin. Figuring out why we humans

started living in ever-growing urban centers and have now decisively made them our future home helps you understand the present and — even more importantly — what it means for the future of cities.

I don't bore you with an extensive history lesson on the origin of cities, but I do provide you with enough information to give you a sense of the key milestones that have resulted in the urban planet humans now inhabit.

I also help you explore the consequences of urbanization and look at trends that are contributing to today's rapid city growth, and I begin to tease out the impact and challenges to be solved in a future of *megacities* (cities with a population of more than 10 million inhabitants).

What is a city?

But wait — first, what is a *city?* It's a physical location that is permanently settled by a large number of people and has defined boundaries. It has formal systems for supporting areas such as land use, housing, sanitation, energy, and transportation. Most occupants in a city work on nonagricultural activities. A city has some recognized form of governance that facilitates the operations of the area and interactions between the community, businesses, and government.

Charles–Édouard Jeanneret, the internationally influential Swiss architect and city planner, said that cities are "a machine for living in."

Today, most people live in a city. You know, cities are quite popular now. Opportunities that range from employment to entertainment and from education to healthcare all tend to be better in an urban context. For most of human history, as you can read later in this chapter, it wasn't this way at all.

Do you know the origin of the city where you're living now? I'd bet that some people do, but I'm also confident that many don't. After all, for most people, there's little utility in this knowledge.

REMEMBER

If you find yourself in a role today that's directly related to the function and success of your city, historical context is golden. It can inform all manner of future decision-making, by highlighting strengths and challenges, ensuring alignment to culture, and exploring untapped opportunities.

For everyone else, wouldn't it be fascinating to know how your community came to be? I'm a naturally curious person, so this type of detail fascinates me. Learning about your city might surprise you. It may make you happy or perhaps even make you sad. Whatever the emotional response, my guess is that you'll become enlightened and likely curious to go deeper into the areas that spark your curiosity.

TIP

Go online and search for your city's website. (Let's assume it has one.) Then find out the answers to these questions about your city:

- When was it established?
- Why was it started?
- What are the current challenges of the community?
- What are the current priorities of the city?
- Oh, and does your city have a smart city strategy or something similarly named?

There's no grade for doing this assignment, but isn't it interesting? Talk about it with your family. I'd bet that the discussion is fascinating and enlightening for everyone.

For extra credit, you might repeat this exercise for another city somewhere else in the world that you're curious about.

Okay, let's move on.

Why each of the world's cities came to be is a big part of the broader narrative of the human story. Humans can't change the past, so we're stuck with the current outcome of a myriad of decisions and their consequences — some good and, frankly, many not-so-good. Some of the past humans have been able to control, but there's a fairly good chunk that we haven't been able to. For example, being invaded probably wasn't something the residents of any city welcomed. Natural disasters are acts that humans have no role in creating but must deal with the aftermath of (although the role of human behavior in climate change apparently is making many of these disasters much worse).

On the positive side, getting lucky and establishing a human presence in places that had abundant, in-demand resources like oil or coal created what some could consider unfair advantages, and being strategically located in the supply chain for products that humans fell in love with also helped. The human thirst for coffee and tea, their love of silk, and an addiction to tobacco are all examples of the development of certain urban areas over others. This is because all sorts of intermediaries and services were required along the complex global supply-and-trade routes. An exchange of ideas resulted from diverse traders from different geographic areas meeting at the urban centers of these trade routes. This was a catalyst for innovation. Cities became engines for a whole new generation of creative solutions.

(Hang on. Writing that last paragraph made me thirsty. I'm going to make a cup of tea.)

The origin of cities, like so much of the human story, is the result of a series of unpredictable and surprising events. Human history certainly didn't progress in a straight line — and any change along the way would have resulted in a world far different from the one we live in today. But this is simply a thought experiment. It doesn't help much to wonder what the world would look like, for example, if there hadn't been colonialism by European nations. What matters is understanding what did happen and what that means for you today and for the future.

Building the first cities

Humans living in cities is a relatively new phenomenon. For most of human history — around 200,000 years of that history, by our best guesses — members of *homo sapiens* lived and wandered together in relatively small groups, tending to their crops and hunting for animals and fish. It was a basic and crude existence. Life span barely ever reached 40 years. Nothing much changed for most of that 200,000 years. The world in which people were born was identical to the world they exited.

A little over 10,000 years ago, the first significant urban areas emerged. Damascus, in Syria, is often cited as the oldest continually inhabited city. Athens in Greece wasn't far behind and, like several other urban centers of that period, was a source of rapidly maturing human development. (Figure 1-1 illustrates Athens' Agora, an important center of developing commerce, political, and artistic life.) A handful of these cities, spanning from the Middle East through Europe and into China and India, were founded in this general period. Though many of these cities were instrumental in defining civilization, they were all modestly sized compared to the massive, industrial megacities of today. Athens, at its peak of enlightenment, was populated by mere thousands of people.

REMEMBER

For most of human history, there really weren't that many people, and most of us lived a rural lifestyle. Until as recently as the early 1800s, the entire world had fewer than a billion people. Compared to today, where over 55 percent of humans live in cities, back in 1800 only 3 percent occupied urban settings.

Cities emerged and grew because they offered a compelling alternative to life in rural areas. For example, rather than hunt, gather, or farm all the materials needed to survive, in a city a person could trade in a specialization to earn money to live. Not to get too technical, but this behavior originates as a consequence of the Neolithic revolution, a time defined as the transition from a rather ad hoc approach to wandering and hunting to settling into permanent areas and formalizing farming. The subsequent agricultural revolution created food abundance, which was highly liberating to humans. No longer tethered to the obligation of acquiring food, humans were free to focus on other tasks (like invent and watch television).

FIGURE 1-1: The Ancient Agora of Athens: An early marketplace and the center of political, artistic, and athletic life.

Once humans started to settle in large numbers in these cities, everything started to change. Needs inspired innovation. Neighborhoods were defined. Law-and-order took shape. Products began to be mass produced. Communities created wealth. Conditions improved, albeit gradually. Cities became bustling centers of commerce, production, social activity, and leisure activities, with increasing varieties of arts and new models for education. Challenges grew in lockstep with prosperity. Crime, poverty, worker exploitation, disease, and other problems all weighed heavily on the emergence of cities and the lives of the new urbanites.

It's an unfortunate fact that early cities were unpleasant places. They had poor sanitation, and deadly diseases ran rampant. Rats thrived. Crime was commonplace because few public safety protocols existed. Before electricity was discovered, lighting was provided by candles and gaslights, and with most buildings made of wood, fires were all too frequent.

The Great Fire of London, in 1666, destroyed the homes of 70,000 of the city's 80,000 inhabitants. Many other cities suffered the same fate.

As a consolation, the vast destruction caused by these fires did force the rebuilding of the cities with improved design. It also resulted in the introduction of building codes, regulations, and fire services — most of which had never existed.

For a small minority of inhabitants, life was good, but for the majority, one set of problems was replaced by another. Chaotic urban planning and rapid population growth all aided in creating issues that, frankly, still haunt humans to this day. In many respects, the phenomenon of smart cities is a late-in-the-game response to these originating circumstances.

Comprehending the Impact of the Industrial Revolutions

For much of the 200,000 years that *homo sapiens* has been around, not a great deal happened. But suddenly, after 199,000 years, a series of significant revolutions occurred that dramatically changed the trajectory of humanity.

Around the year 1300, the Renaissance began in beautiful Florence, Italy. Historians define this time as the transition to the modern era. It was a time of reasoning, scientific discoveries, advances in art, intellectualism, and improved management of knowledge. And more. This period spanned over a few hundred years and set the stage for the age of enlightenment and the scientific revolution. During this time, humans made leaps in their understanding of the world and the universe, but also in mathematics, physics, biology, and chemistry. Today, you might take it all for granted, but if it weren't for these breakthroughs, the world might be quite different. Some argue that humans would be at a better place today had this science emerged considerably earlier in those long, lazy 200,000 years. (It depends on one's perspective, I suppose.)

Though all this may or may not be all that interesting to you, it's all driving me to the punchline: The stage was set for a series of three industrial revolutions that would change the world beginning in the 1700s — and a fourth, which is now under way — that would solidify the path toward the cities people live in today.

The first industrial revolution

The first industrial revolution begins in Britain. The invention of the steam-powered motor is a game-changer. Truly awesome machines could be powered by steam. Until that time, animals, humans, and windmills did much of the pulling and pushing. With the addition of steam, the production of products could be kicked up a notch. Steam also enabled railways to flourish. Britain began producing low-cost iron and steel, and then big machines and bridges could be built. All manner of new production techniques across industries — and particularly in textiles — were introduced.

This industrialization supported the development of mass-production factories, which were typically built in urban areas. These facilities needed increasing numbers of workers. Homes were built around the factories to keep those workers close. Farm workers seeking better economic circumstances flocked to these factories. City populations in these areas began to grow quickly.

New, positive social systems were hatched during this period. This included schools and mandatory education for children, labor unions for workers, and the arrival of the first law enforcers: the police. Healthcare options and sanitary conditions improved. For the first time, the notion of free time and discretionary income meant increased demands for entertainment and other ways to spend nonworking time. In the scheme of things, all this change was happening quite fast. Of course, it wasn't restricted to Britain, either. Similar progress was occurring across Europe and in some of the outposts of the various European empires that spanned the globe at the time.

Still, this period was no utopia. With insufficient safety nets, many people suffered in this new, urban, and industrial landscape. History books are replete with descriptions of undesirable circumstances, including poor housing conditions and air quality, little or no sanitation, long working hours, and rampant, violent crime.

REMEMBER

Sadly, and surprisingly, even in the 21st century, these conditions still exist in many global cities. One in three humans still live in poor urban living circumstances. Come on, let's fix this. Smarter, sustainable, and resilient cities, anyone?

(The United Nations' 2030 sustainable development goals, SDGs, are an earnest global effort to improve these poor conditions. Details can be found in Chapter 2).

The second industrial revolution

Within just 100 years, the second industrial revolution would be under way. It would be defined by the achievement of the wide-scale use of electricity. It's hard to overstate the difference between the world before electricity use and the world after. That truly is the definition of a revolution. Pause for a moment to consider all the items you use that require electricity. Wild, right?

Electricity brought light bulbs to homes and streetlights to cities. It enabled the invention of the telegraph and telephone. Telephones! It powered new levels of manufacturing. Eventually, electricity changed the lives of everyone living in most cities. Today, electricity continues to change lives, though it's fair to say that few people think of it that way. You also need to recognize that 11 percent of the world's population *still* has no access to electricity. There's work to be done.

The third industrial revolution

In the 1940s, a third industrial revolution began. Built on the progress of the previous revolutions, and in particular electricity and telecommunications, the information age began.

In many ways, humans are all now living through this revolution, and it could be argued that we're still only at the beginning of it. It seems like computers, software applications, smartphones, and the Internet have already radically changed the world, but the potential seems only partially met. Just in the past few years, we have moved from static web pages to dynamic websites that support e-commerce to apps that enable people to manage and coordinate many aspects of their lives.

REMEMBER

With still another 45 percent of the world to come online in the years ahead (that's over 3 billion people yet to be connected!) and the potential for the technology to be even more disruptive, this revolution has some ways to go.

The game-changing technology of the information age has been the miniaturization of the transistor. This revolutionary technology uses a special material, called a *semiconductor,* to control the flow of electricity. Like a light switch, a transistor uses electricity to turn a switch on or off. Assigning a value of 1 to the On state and a 0 to the Off state provides the 1s and 0s that are the language of computers. Today, over a billion of these tiny transistors can fit on some of the fastest microchips. My head nearly explodes trying to comprehend the tiny scale of this technology that enables so much of the modern world.

The third industrial revolution has enabled the Internet, the World Wide Web, word processors, spreadsheets, all sorts of cool devices (including everyone's beloved smartphones and their apps), massive automation and artificial intelligence, videoconferencing, online banking, and on and on.

The third industrial revolution is creating new business models such as on-demand taxi services, and slowly destroying others. Consider the fate of the newspaper or the challenge to brick-and-mortar retail coming from the popularity of shopping online.

For most people living in cities, all they have to do is look around to appreciate the vast ways in which computing technology supports their environments.

As this revolution progresses, the cost of computing and storage drops, more devices get connected, software grows smarter, richer data becomes available, and the entry barriers to wild ideas is lowered.

WARNING

Soon it won't be just a question of whether humans *can* create some groundbreaking innovation, but rather a question of whether we *should* create it.

No doubt, this revolution becomes the basis for building smarter cities.

The fourth industrial revolution

Even while the third industrial revolution unfolds, you can now see evidence of yet another revolution. As examples, on the streets of several cities self-driving cars are carrying people to their destinations, drones are delivering packages, experimental flying cars are zooming across the sky, and any number of services, such as surgery and caregiving, that were once the exclusive purview of humans are being augmented by robots and artificial intelligence. The third and fourth revolutions will overlap considerably, just like the first and second industrial revolutions. The fourth industrial revolution will be powered by the convergence of new technologies, new scientific breakthroughs, emerging behaviors, changing demographics, and global economics. It's my view that this revolution is when the vast majority of smart cities will emerge. (I discuss this specific topic in greater detail in Chapter 8.)

In Figure 1-2, I've summarized the timeline and some of the major breakthroughs in each of the four industrial revolutions.

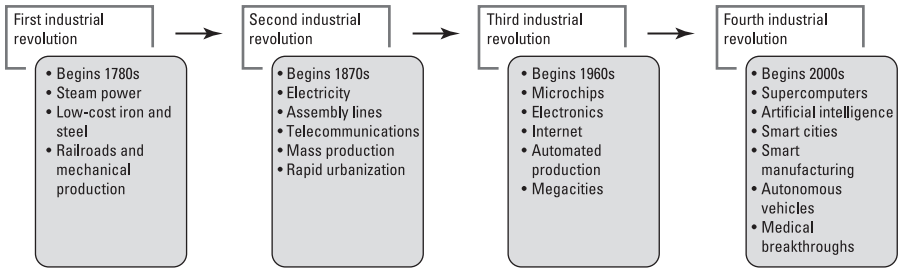
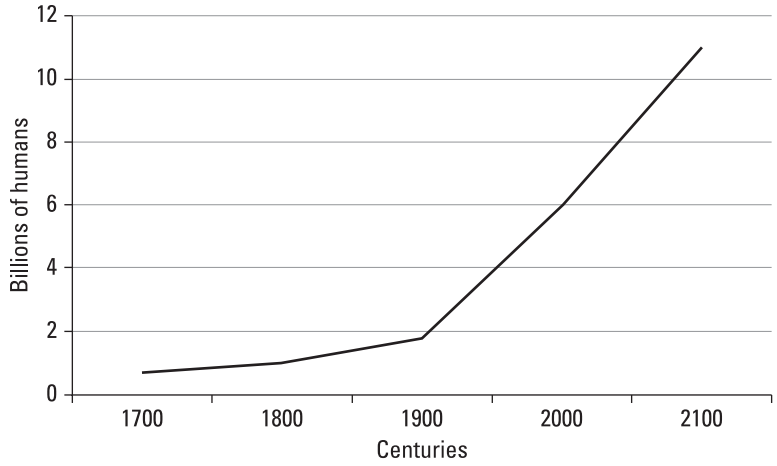


FIGURE 1-2: The core characteristics of the four industrial revolutions.

Responding to population growth

Check out Figure 1-3. The truly striking aspect is that, for most of human history, the population of people on Planet Earth was low. It remained well below a billion for a very long time. *Population growth* is based on the difference between birth and death rates. Poor nutrition and environmental conditions, the absence of healthcare, and other dangers contributed to short life expectancy and high death rates among babies and infants. As a consequence of the eventual positive outcomes of the Renaissance, the scientific revolution, and the subsequent industrial revolutions, birthrates increased and premature deaths decreased.



Data source: United Nations

FIGURE 1-3: Population growth since the 1700s.

REMEMBER

Living in cities, despite often terrible conditions in the first and second industrial revolutions, actually made the largest positive contribution to growing population rates.

By 1800, the world's population passed 1 billion, and in just over 100 years, it reached 2 billion. From the 1920s onward, the rate of population growth began to skyrocket, increasing from 2 billion to 3 billion in just over 30 years and then adding another 3 billion by 2000 to reach 6 billion. The world is now approaching 8 billion humans. It is estimated that almost 10 percent of all humans who have ever lived are alive now!

However, this rapid population explosion won't continue. The rate of growth has begun to slow and may, in fact, peak at around 11 billion and then begin to decrease. A primary driver of population decline is the increasing number of women receiving an education in developing nations. As women get more education, they have fewer children.

REMEMBER

Some experts suggest that global population decreases in the future might be humanity's biggest challenge. This is because a declining population cannot sustain economic growth and an aging population has less labor to innovate and support productivity. There's certainly a role for robots here, but that's a discussion for another book. Population decline seems counterintuitive, considering that we spent most of the 20th century worrying about the challenges of a population explosion.

Comprehending and responding to population growth and demographic shifts is vital to planning for the future of the world's cities. Urbanization is clearly a product of rapid population growth. It's probably not lost on you that the smart city

movement is partially motivated by unmanaged population increases and the attendant dysfunction that has ensued.

The increase in the number of humans is all happening in cities, powered by better healthcare and living conditions and by the recent unprecedented migration of humans from rural to urban areas. It is estimated that as many as 3 million people now move into cities each week. By midcentury, that number will likely result in an increase of 2 billion people living in an urban setting.

TIP

A smart city strategy for a given city must accommodate population and demographic trends.

Though for many cities this strategy will reflect projected increases in populations (see my discussion on megacities later in this chapter, in the section "Building megacities"), many cities in developed nations could see challenges emerging from population declines. In both scenarios, the use of technology and new approaches to problem-solving will be essential to future community success.

Urbanizing the Planet

I'm hoping that you'll pick up on three essential ideas in this chapter. First, the scientific era is a recent development. For 199,000 of their 200,000 years on this planet, nothing much changed for humans, and life was a miserable experience. Only since the 1300s has the human condition radically shifted in a positive direction. Second, during the first 199,000 years, the population of humans on Earth remained low. The population passed 1 billion in 1800 and added 5 billion in the 1900s — in just 100 years. Finally, until the 1800s, most cities remained relatively small. For example, during the time of the Roman Empire, with the exception of Rome and a handful of other areas, many Italian cities ranged only from 5,000 to 15,000 people.

The conclusion? The nature of cities today is a recent phenomenon. Big, dense urban areas are a product of just the past few decades. (See Figure 1-4.)

China, for example, has undergone a dramatic urban transformation that began in the latter part of the 20th century and continues to this day. Today, over 160 cities in China have a population of over 1 million.

Major global urbanization has occurred over the past 200 years, but at different rates and time periods. Though the regions of Europe, North America, and Australia and others were early to urbanize at a gradual rate, Southeast Asia, China, India, the Middle East, and parts of Africa have progressed later but more rapidly.

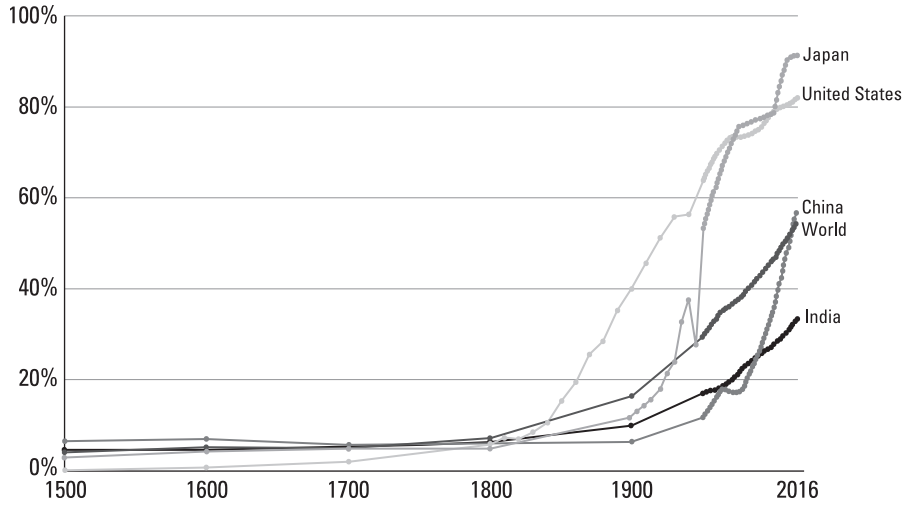


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FIGURE 1-4: Share of population living in an urban setting over the past 500 years.

For example, in 1966 Dubai in the United Arab Emirates (UAE) was a cluster of small settlements. Today, it's a glistening modern city with a population of over 3 million.

From 2000 to 2010, Shanghai, China, grew by 7.4 million inhabitants, from 16.4M to 23.8M. This has created a stunning, sprawling, and chaotic megacity. In fact, China's urbanization has been the most notable. In 1960, about 110 million Chinese lived in cities. By 2015, the number was closer to 760 million (about 56 percent of the country).

In Africa, the migration to cities continues at a rapid pace. By the 2040s, it's estimated that African city dwellers will increase by 400 million. Today, cities power 80 percent of the global economy. By 2025, it's projected that just 600 cities around the world will generate 60 percent of the gross domestic product (GDP) of the planet.

In the United States, just ten cities alone are responsible for generating one-third of all GDP.

I am hard-pressed to think of another human achievement that has defined the world more than the urbanization of the past 100 years. With more than half of humans living in cities and billions more joining over the next 50 years, the future belongs to cities.

Changing landscapes resulting from urbanization

Imagine for a moment what Manhattan must have looked like before New York (or what used to be called New Amsterdam). Let's go way back, before there were any buildings and infrastructure. It's a rocky, hilly island covered in chestnut, oak, and hickory trees. There are streams, swamps, salt marshes, and grasslands inhabited by turkeys, elks, and black bears. It's a beautiful, rich ecosystem of life.

Fast-forward to today, and, well, Manhattan looks a just little different.

Urbanization has forever changed the planet. An estimated 3 percent of the world's land has been paved over. Cities are now dense areas of human activity, knitted together with a mix of concrete and asphalt, roads and pathways, wires and pipes, tunnels and bridges, industrial areas and housing, parking lots, apartments, stadiums, warehouses, skyscrapers, and more. They are beautiful and ugly, messy and clean, organized and chaotic, modern and historic.

Humans have built a variety of systems to connect their urban areas — from roads and canals to airports and seaports. Few mountains or other natural obstacles have limited the urban sprawl, as humans have built over them and as they have dug deep tunnels under their feet and through the hills.

Cities have created more opportunities, more prosperity, and a longer life span than any other human invention. But they've also enacted a toll on humanity, from creating bad health conditions to radically altering Earth's climate. Urbanization is accelerating the effects of the *Anthropocene,* the period of Planet Earth's history that continues to this day, when humans became responsible for altering the environment and climate.

Humans are now responsible for the cities we've created, and we could argue that we didn't fully anticipate their massive success and great challenges. Either way, humans now have to deal with the consequences, both good and bad. Many costs were not considered, and now we're faced with the obligation to act.

WARNING

Without a smarter approach to delivering cities, many communities face a daunting future.

Building megacities

In many countries, fire marshals insist on enforcing maximum occupancy regulations for commercial rooms. For example, you'll see placards in hotel meeting

spaces or movie theaters that state the limit of how many people are allowed to occupy the space. It's wise, because with too many people in a defined area, the possibilities of problems increase.

However, with a few exceptions, no such limitation exists for cities.

That's right. In most instances, people can move into cities with no consideration of population size, housing availability, job opportunities, healthcare options, or other support systems. It means that, as long as no constraint is imposed, popular cities will continue to see their populations increase and be burdened with the responsibility of responding to the potential crisis this creates.

Curiously enough, though, large, growing cities are often more successful than smaller ones. Increasing populations generate economic and employment activity that benefits everyone. Larger tax yields enable better public services. Diversity creates richer cultural experiences. More people often result in a larger number of social services. Many of them have the resources to prioritize their smart city initiatives.

Today, I'm encouraged that so many of the world's biggest cities are prospering. However, not to get to too far ahead of myself, the challenges of managing a big city are significant and severe. I discuss many in this book.

The future growth of cities, including population and geographic areas, will follow one of these three patterns:

- **No growth:** Stable and consistent population size with varying economic outcomes
- **Declining growth:** Shrinking communities and budgets sometimes resulting in almost complete abandonment
- **Increased growth:** Significant changes as city immigration and natural growth (more new babies than deaths) continues unabated

Though the first two patterns clearly have challenges, the biggest urban phenomenon of the next few decades will be the last one — the rapid growth of many cities. While recognizing the many positives of large urban populations, the demands of cities that exceed a million occupants will continue to challenge the ability of city leaders to deliver. But these cities will begin to pale in comparison to the emergence of an increasing number of cities that exceed 10 million people. These are the megacities! Today, there are almost 50 of them on the planet.

REMEMBER

If the 20th century human experience was defined by population growth, the 21st century will be defined by the power and footprint of megacities. These massive urban centers will demand completely new systems of support, green energy options, sustainability strategies, economic diversity, alternative transportation, and much, much more. In the future, it will be successful megacities that ultimately define the notion of smart cities.

Figure 1-5 lists the top ten megacities in the world, as of 2019:

Ranking	City	Country	Population
1	Tokyo	Japan	38,001,000
2	Delhi	India	25,703,168
3	Shanghai	China	23,740,778
4	São Paulo	Brazil	21,066,245
5	Mumbai	India	21,042,538
6	Mexico City	Mexico	20,998,543
7	Beijing	China	20,383,994
8	Osaka	Japan	20,237,645
9	Cairo	Egypt	18,771,769
10	New York	United States	18,593,220

FIGURE 1-5: The top ten global megacities.

That so many of these cities succeed despite their size and complexity is a testament to human ingenuity.