

A photograph of a modern city skyline, likely Singapore, featuring several tall skyscrapers with glass facades. The buildings are reflected in the calm water in the foreground. A bridge with multiple arches spans the water. In the bottom right corner, there is a green triangular overlay with a white line-art pattern of various icons representing technology, industry, and infrastructure.

The shift to an innovative paradigm.

Conventional models, while still solid, are no longer up to the heightened challenges of the present. Exponentially improving technologies for the Internet of Things (IoT) and artificial intelligence are enabling urban developments with much higher levels of efficiency and flexibility to conserve resources, promote security, and boost the quality of life.

The key development is not the technologies themselves, but their integration around a holistic view of urbanization that enables a series of smart services. Instead of focusing on single services, or specific buildings or highways, leading organizations around the world are using IoT and analytics to optimize infrastructure generally and evolve with changing needs. While getting there will take a great deal of investment and expertise, the result will be places where residents thrive in unexpected ways in their personalized urban developments.



The Future of Urbanization

To understand the business opportunity, it's helpful to break urbanization down into three phases. Over most of history, Urban 1.0, this happened with little general direction or coordination. People gradually moved into towns and cities, and new and old residents adjusted largely on their own. Urban 2.0 started in the early 20th century, as reformers launched ambitious city plans to improve the cityscape and its governance.

Urban 3.0 came at the beginning of the 21st century, as planners applied computers, automation, and systems thinking to improve efficiency and coordination. This smart urbanization brought many advances. But its focus on solutions for a specific area (a building, street, or factory), or sector (transportation, energy, waste), led to static efforts that failed to realize many potential gains. To take a simple example, buildings got sensors that turned off lights when not in use. But those sensors failed to learn from all the data they were seeing, and they didn't connect to air-conditioning and other systems.

With more than 3 million people moving to cities each week¹, it's time to go to the next level—Urban 4.0. The Internet of Things enables residents and planners to monitor and adjust much of the urban infrastructure. These sensors generate a flood of data, but with

machine learning, cloud communication, and advanced analytics, we can optimize planning and operations across multiple components. Buildings can have smart controls that adjust lighting and HVAC according to expected usage, and that predict and indicate when equipment needs to be repaired, replaced, upgraded, or modified altogether. We can also monitor energy usage across a portfolio of buildings, and share efficient practices such as overnight battery storage to reduce demand in peak daytime periods.

Developers and officials can now “future-proof” their designs by calculating citywide dynamics over time. They can look on a city as a living organism, where all the components have to be healthy for residents to thrive.

Urban 4.0 goes beyond the direct provision of municipal services. It helps companies take advantage of telecommunications to improve the quality of life. Residents can choose to provide data on their wants and needs, along with their geo-location. Businesses granted access to this information can serve urbanites more efficiently and boost their margins. While these offerings, at least in theory, will eventually be made available everywhere, they'll initially concentrate in large, mixed-use urban developments to gain scale economies. That's because many of the large developers are better funded than cities, and eager to distinguish themselves in the marketplace. Thanks to IoT and AI, their developments will make full use of ubiquitous connections.



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While technology is pulling the world to Urban 4.0, serious social and environmental challenges are pushing. Developing countries are in the midst of an urbanization wave the world has never seen, both in scale and rapidity. China alone expects 200 million new city residents in the next 10 years, or 15% of its population, and other Asian countries are similarly shifting. We're seeing the emergence of supercities, such as the agglomeration around Shanghai, which could exceed 100 million residents by 2050. That's when 70% of the world's population is expected to be urban, up from 54% today. Such a massive concentration could overwhelm those societies.²

Even developed countries, many of which have little absolute population growth, are still seeing a continual move to metropolitan areas. City centers are attracting residents, reversing decades of suburban sprawl. Despite early predictions that the internet would encourage people to live and work anywhere, they're voting with their feet and concentrating in urban clusters. Those same cities, often suffering from decades of underinvestment, are now struggling to handle the newcomers and their high expectations for services.

Besides the usual difficulties of serving people unaccustomed to urban ways, cities face heightened environmental constraints. Unchecked growth in previous decades has left many areas choking on traffic and smog. Managing water and waste is a challenge in many developing countries and even some developed ones. Climate change has added to the urgency to reduce emissions from vehicles and factories.

Cities will increasingly compete with one another for high-value investment and trade. The winners will be those that combine efficient services with a good quality of life, enabled by integrated technology.

Enabling the Transformation

Government officials, developers, and their suppliers around the world are increasingly interested in this integrated transformation. They're eager for new approaches that take optimization to a new level. The trouble is, most cities are focused on short-term fixing and maintaining legacy infrastructure. They're reluctant to commit to new systems, especially since those emerging IoT and AI technologies are still in flux. Rather than fancy technological solutions, they want to lay the foundation for new possibilities that can be built gradually and evolve with the changing city.

Fortunately, the marketplace is similarly evolving to help make that possible. Instead of transactional relationships around one-off projects, some vendors are now willing to work and plan with cities and developers as long-term partners. Instead of the conventional vendor relationship, these providers are taking on some of the risk and responsibility for improvements. This is especially true for large mixed-use developments within cities.

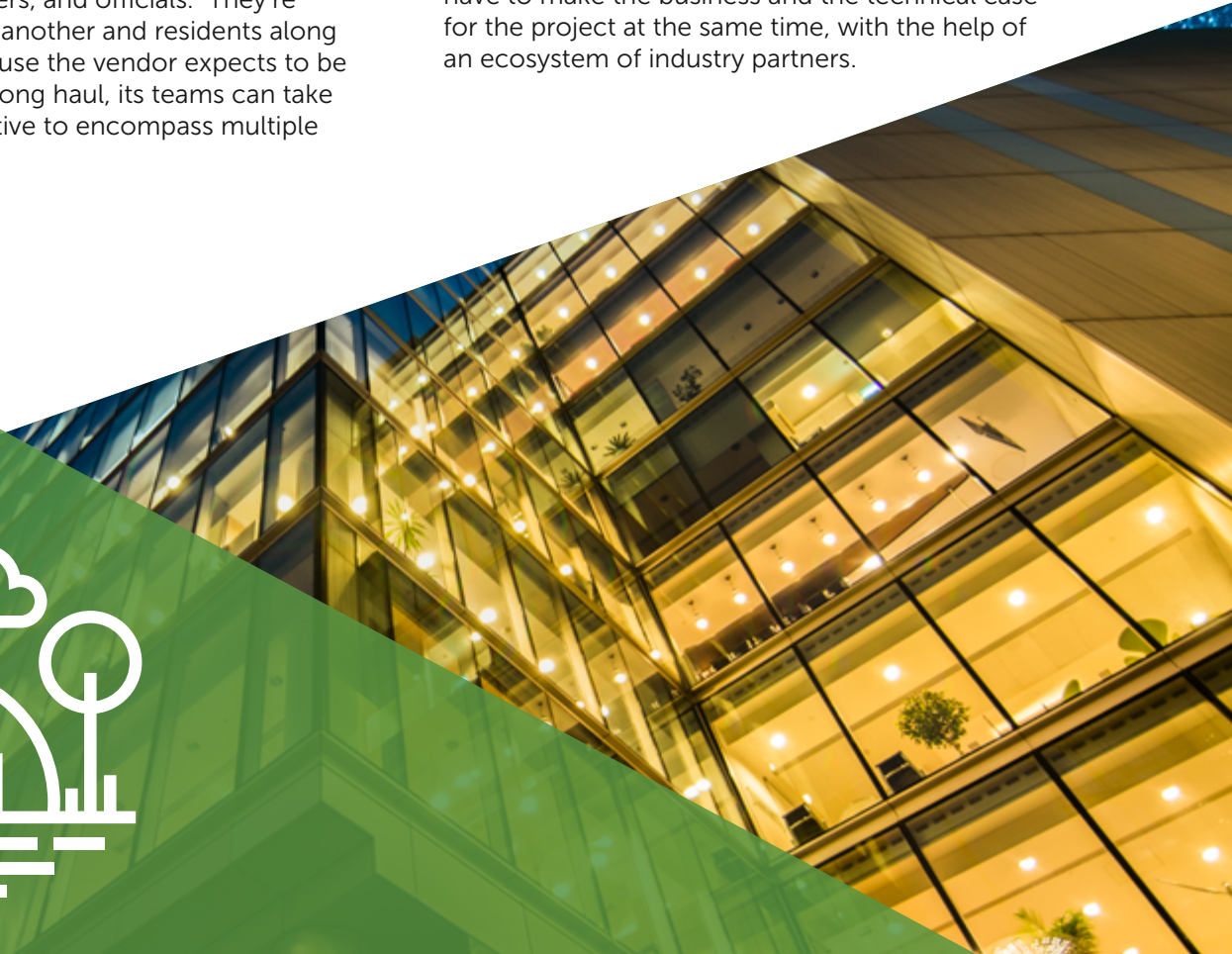
Rather than implement point solutions, they're signing on for 10- to 15-year journeys with developers, suppliers, and officials. They're learning from one another and residents along the way. And because the vendor expects to be involved over the long haul, its teams can take the wider perspective to encompass multiple

systems in a building or multiple components in a city. This long-term perspective is also essential for combating the inherent uncertainty of such complex developments.

Another innovation is "smart infrastructure as a service," where the client owns the asset but the vendor builds and operates it, and simply charges the city or private client for usage. Here, the vendor takes on most of the financing and risk, and works with the user to provide continued satisfaction and development. Both of these steps can go a long way to realizing ambitious city dreams.

These partnership-oriented approaches, however, fit poorly with established vendor-management practices, which tend to focus on RFPs for projects limited to a single product or service. Developers will need to adjust their mindset, at least for the more ambitious integrated developments, for both financial and operational reasons.

To fully realize these possibilities, it's not enough for city governments and private developers to evolve toward this more integrated, partnership-based approach. Vendors must as well, and move beyond specific areas, such as design, IT, or mechanical. To make integration work, vendors must be able to speak the language of architects, construction contractors, and engineers. They have to make the business and the technical case for the project at the same time, with the help of an ecosystem of industry partners.



Integration in Practice

What does this holistic approach mean in actual urban development? For example, the island city of Maui, Hawaii, is rethinking its energy infrastructure. Most electricity comes from expensive imported fossil fuels. Municipal officials wanted to build a few large solar power plants, to take advantage of the abundant sunshine. Then they expanded their view and considered transportation dynamics. They realized that most vehicles in the future would run on electricity, not oil. Instead of centralizing electrical production, it would be more efficient to locate it where people would likely charge their cars. With this holistic perspective, Maui officials are shifting their energy investments and licensing. They're looking for help from sensors that can track evolving patterns of consumption. By preparing the island for charging stations, they'll reduce not just oil imports but also air pollution.

Mixed-use urban projects are a major opportunity for businesses, especially in the burgeoning cities of Asia. These projects range from single buildings to clusters of towers with millions of square meters of floor space. Despite those projects' enormous scale, the owners are working to integrate smart services in energy, water, telecommunications, predictive maintenance, video analytics, security, traffic, and parking. Everything will run on a single IoT-driven platform and command center—even projects that include office, retail, hospitality, and residential areas. Embedded sensors and analytics capabilities will enable property managers to continually adjust and optimize building operations and the ongoing resident experience.

A number of these projects are expected to open between 2019 and 2022, and the largest will serve as many as 60,000 people daily. (Hitachi Consulting is assisting on one of the larger projects.) Success here can make these projects into demonstration sites for renovating existing building complexes as well as greenfield applications. Developers could deploy many of these smart services throughout their local and international portfolios.

Southeastern Australia is another case in point. Sydney and Melbourne are two of the most expensive cities in the world. In response, people are sprawling out to faraway suburbs, which damage both the environment and quality of life. To address these issues, private enterprise in partnership with government is considering the creation of eight new densely settled cities between these two metropolises, which are about nine hours apart by car. High-speed rail would connect the eight cities with the two endpoints, so each one would be no more than an hour's ride from either Sydney or Melbourne. The satellite cities would have all of the amenities and efficiencies of urban life, while reducing energy use and aggravation and preserving the environment.



Holistic Urban Development

The worldwide pressures for urbanization are powerful, and the opportunities from smart, integrated infrastructure are compelling. Over time, we expect holistic urban development to become the norm, facilitated by cities, developers, and vendors taking the long view. Companies that stay with the old approach to urbanization will lose out.

Keys to Success with Urban 4.0



1. Focus on the city's main goal or identity.

While cities and large developments share many concerns and challenges, each one has a unique mix of issues. Is it concerned about accommodating existing growth or attracting more growth? Is it looking mainly to improve livability, or to make it easier for businesses to operate? Would it like to double down on its existing strengths as a city, or shift the economy in new areas? While any smart urbanization project should lay the foundations for future capabilities in many areas, it's essential to focus actual investments in a few areas with the greatest consensus and payoff. Pursuing multiple areas will make timely delivery on these already complex projects nearly impossible.



2. Rethink your RFP relationships with vendors.

Governments and developers have relied on the RFP-based vendor management process for good reasons, but this structure gets in the way of integrated developments. It's especially important to start working early with a knowledgeable guide that can work with you for the long term. It's time to create new negotiating processes that enable Urban 4.0 while still featuring accountability and protecting the public.



3. Focus on transformational improvements.

Smart urbanization involves an array of sophisticated technologies that offer big benefits over the status quo. With political and budgetary pressures, it will be tempting to aim at a flashy, short-term gain rather than to invest in capabilities that will pay off much more in the long term. Avoid that fate by setting out a blueprint for the vision that will drive public plans and accountability, without constraining your ability to adjust with evolving technology and city or client needs. Quick wins can help build momentum and support, but should not divert you from achieving even more valuable results.



4. Reassess the citywide approach.

With the rise of supercities, governments and developers will want to break the urbanization challenge into pockets of about five square kilometers. That's large enough to deliver all the smart services—energy, education, micromobility, food, recreation, entertainment, and job creation—within a contained and sustainable ecosystem. In especially dense areas, a large single mixed-use development could serve as an urban pocket. These highly integrated neighborhoods, combining work and residence, can improve transportation and overall livability while reducing the cost of living. They are also commercially attractive to private developers.

¹ International Organization for Migration 2015 World Migration Report

² Urbanization and the Mass Movement of Peoples to Cities," by Bret Boyd, Grayline, Jan. 17, 2017. <https://graylinegroup.com/urbanization-catalyst-overview/>

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