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Smarter cities for smarter growth

How cities can optimize their systems for the talent-based economy



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By Susanne Dirks, Constantin Gurdgiev and Mary Keeling

In the twenty-first century, growth, economic value and competitive differentiation of cities will increasingly be derived from people and their skills, creativity and knowledge, as well as the capacity of the economy to create and absorb innovation. To compete in this new economic environment, cities will need to better apply advanced information technology, analytics and systems thinking to develop a more citizen-centric approach to services. By doing so, they can better attract, create, enable and retain their citizens' skills, knowledge and creativity.

More than ever before, the traditional “bricks-and-mortar” drivers of economic growth are giving way to an economy based on “brains and creativity.” Competitive differentiation today is more likely to be based on the ability of the workforce to create and absorb skills and innovation than on traditional drivers such as available natural resources, physical labor or manufacturing prowess. As a result, the skills, aptitude, knowledge, creativity and innovation of a workforce – which collectively can be viewed as the talent pool in the economy – have become increasingly important drivers of economic growth and activity.

Cities, as hubs of the global economy, are the focal points for this transformation. In the immediate future, three interconnected factors will place even more emphasis on the role of cities in talent-based economic development:

- The world is at an unprecedented level of urbanization.
- Cities contain an increasingly large share of the world's highly skilled, educated, creative and entrepreneurial population, giving rise to highly concentrated and diverse pools of knowledge and knowledge-creation networks.

- Cities can support large-scale business and investment networks that create economies of scale in absorbing and extending innovation.¹

Smart civic leaders will take advantage of the opportunities presented by the shift in economic development drivers, while addressing the challenges of demographic changes. They will alter their investment strategies from attracting and supporting mass labor pools to creating systems of services designed to optimize the city around highly skilled, innovative citizens and communities, as well as knowledge-intensive businesses. From building better transportation systems to supporting creative innovation and technological research and development, strategic design of public services systems can provide a supportive environment for delivering a higher quality of life, making a city more attractive to a knowledge-based population.

Such investments need not be in conflict with near-term economic realities. Investments in making a city's core systems smarter will create cost savings and increased efficiencies while positioning it for long-term economic growth.

Cities can begin building for this growth immediately. They can improve their current service delivery capabilities (as well as lay the foundation for new and expanded services) by making their core systems – transport, public safety, government services, education and health – “smarter.” This can be achieved through the application of advanced information technology, analytics and systems thinking to improve how a city works and how it stimulates a thriving, knowledge-driven economy.

While evidence indicates that job opportunities remain a primary consideration for the highly skilled in determining where they want to live, we believe cities that focus immediately on a few high-impact areas of improvement will be positioning themselves for a two-fold benefit: they will become more attractive to highly skilled, innovative people and communities; in turn, these people, communities and the businesses that support them will simulate more growth, creating a fertile environment for sustainable growth.²

Investments in making a city's core systems smarter will create cost savings and increased efficiencies while positioning it for long-term economic growth.

A critical question facing cities, though, is how do the cities apply the steps and principles outlined above *in the most cost-effective and productive fashion?* The answer is to focus initially on four high-impact areas of improvement:

- Reduce congestion in transport systems
- Improve public safety by reducing crime and emergency response time
- Streamline and tailor services for the citizen, including a heavy emphasis on education and training
- Enable appropriate access to healthcare data for better quality of care, early disease detection and prevention.

In addition, cities will need to continue building on other core services agendas such as energy, water and environmental sustainability, urban planning and architecture.

They will also cultivate a systems-level view of the entire city that allows them to capture the most value from their investments, optimizing improvements across different parts of the city. They will need to better understand behavior patterns in their systems and not just respond to events. Such improvements will derive from applying advanced technology capabilities – collecting and managing the right kinds of data, analyzing patterns in it and then optimizing system behaviors based on that analysis – as well as the policies that enable them.

Cities in an era of talent and innovation-led growth

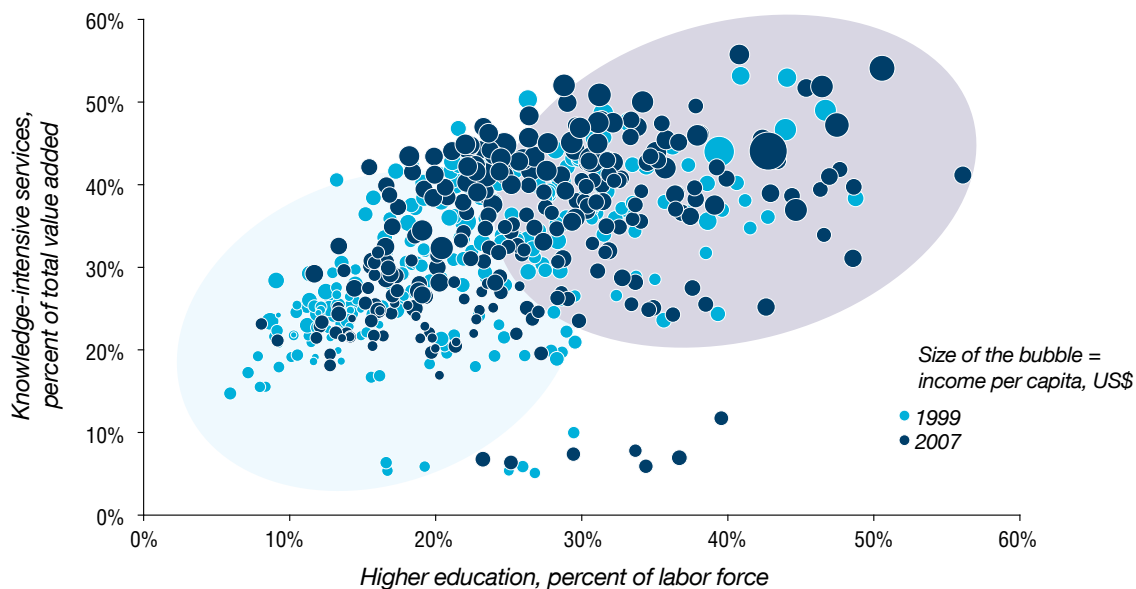
In the aftermath of the recent global economic crisis, cities around the world face serious economic challenges. Therefore, it is understandable that policymakers might be inclined to prioritize the need for basic job creation over longer-term objectives. However, sustainable economic vitality and effective methods to address near-term cost issues require cities to develop a more strategic response to job creation. Cities must focus more on the *quality* of jobs created – and the people who choose the city to create and fill those jobs – rather than just on the *quantity* of new jobs.

The evidence strongly suggests the capacity of a city to create and absorb talent and innovation into its economy will crucially depend on the delivery of core city services in a citizen-centric manner.

Skills, knowledge and innovation: Key drivers of growth

Over the past decade, a global shift toward a knowledge-based economy has accelerated dramatically. Superior talent – embodied in higher education, training, skills, creativity, aptitude, innovation capacity, and the cultural and social skills of the workforce – is rapidly becoming the key driver of economic growth and activity.

For instance, Figure 1 shows the growing importance of higher-quality skills and education in economic development between 1999 and 2007, which includes the economic slowdown of 2001 to 2002. The data suggest that the trend toward more skills and knowledge-intensive growth resists recessionary shocks.



Source: Organisation for Economic Co-operation and Development. Regional Statistics Database. 2010.

Figure 1: Growth in skills and knowledge is driving growth in regional and urban income.

This conclusion is further supported by evidence from the latest recession, during which higher-skilled workers had lower unemployment rates. For example, U.S. Bureau of Labor Statistics data shows that between the beginning of 2008 and the end of 2009, the unemployment rate for workers with less than a high-school diploma rose from 9 percent to 14.6 percent. The unemployment rate for high-school graduates rose from 5.7 percent to 9.7 percent, while the unemployment rate for those with a completed third-level education and higher increased from 2.6 percent to 4.6 percent – a much smaller rise in absolute terms.³

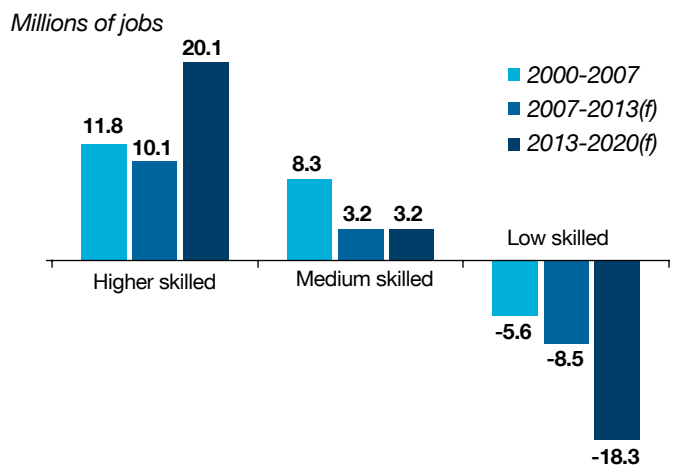
In addition, the contribution of knowledge-intensive and skills-intensive sectors, such as modern manufacturing and internationally traded services, to overall economic activity in urban and regional economies has increased.⁴ During the next 20 years, this trend will continue to gather momentum. As gross domestic product (GDP) is increasingly based on the knowledge, creativity and ability of workers to innovate, the direct contribution of talent to economic value is expanding.

This connection between talent and innovation and growth can be seen in modern industries, characterized by greater skills and technology intensities, where the relationship between growth in economic value added and skills, workforce education levels and innovation has been changing dramatically in recent years. Instead of technology innovation serving primarily as a strong *substitute* for labor, it is becoming a *supportive enabler* for people and their skills, knowledge and creativity. This new relationship is forecast to strengthen by over 70 percent by 2020. At the same time, evidence indicates traditional, less skills-intensive industries are now on the cusp of a similar change.⁵

Increasing demand for higher quality, more diversified workers

As cities in rapidly developing economies continue to mature, talent becomes an increasingly valued resource, especially when combined with technological innovation.⁶ Demand for highly skilled, creative workers is expected to almost double by 2020 in mature economies (see the European Union example in Figure 2). Demand for low-skilled employees (less than secondary education) is expected to decline dramatically – a major and rapidly accelerating trend.

At the same time, diverse skills, aptitudes and experience, along with different types of available education and training, are becoming crucial contributors to economic growth. Over time, improved knowledge and diversification of the workforce mean better competitiveness and lead to growth in knowledge intensity.⁷ Data for the 50 largest U.S. cities suggests that a more diverse base of citizens, together with knowledge and creativity-intensive sectors, is associated with higher *per capita* income.⁸



Sources: European Centre for the Development of Vocational Training, 2009 and 2010; IBM Global Center for Economic Development analysis.

Figure 2: Changes in demand for skills in European Union.

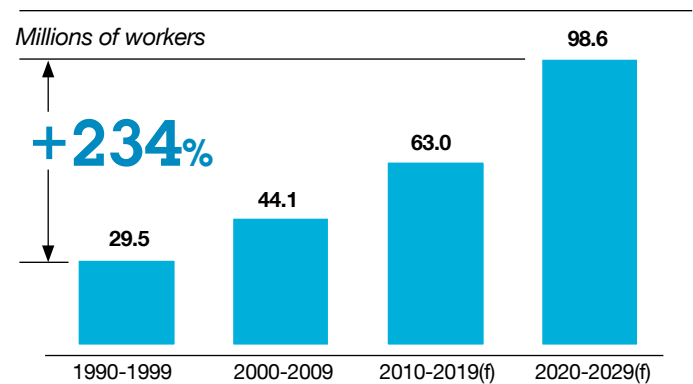
For cities, this translates into the potential for higher tax revenues and fees that can help address current fiscal constraints. But it also implies increased demand by citizens for new services that reflect the expanding role of middle and upper-middle classes.

Many in this new group of highly skilled, knowledgeable citizens come from a generation that has been brought up with the Internet and has increasingly high expectations for service and transaction convenience and flexibility and for an overall wider range of services. They will by nature migrate to cities that allow them the flexibility and quality of services and better quality of life that meet their standards.

Increasing global competition among cities for talent and innovation

The number of highly educated international migrants around the world is expected to more than triple, from 29.5 million workers in the 1990s to almost 99 million in the next decade (see Figure 3).⁹ A mobile pool of highly skilled workers already exists and is on the move within mature economies – 35 percent of migrants to mature economies have a college/university degree.¹⁰

Existing data indicates that these workers, unlike past waves of lesser-skilled migrants, do not chase the *possibility* of opportunity. Instead, they elect to follow specific *jobs* and make their decisions on location based on complex criteria, including considerations of financial and career returns, as well as quality of life. Growth of this mobile pool suggests increasing demand for the skills, knowledge, creativity and other attributes these workers bring to host cities.



Sources: UN Human Development Report, 2009; IBM Global Center for Economic Development analysis.

Figure 3: Global migration flows of highly educated workers.

So while the number of skilled international migrants is likely to continue to rise, the competition cities face to attract them could grow as fast or faster, especially as skills, knowledge, creativity and technology innovation drive greater amounts of economic growth. By 2020, Asian economies alone (one of the few regions in the world where net demand for foreign skills slightly declined in 1990 to 2000) are expected to attract over 17.5 million new educated migrants – an increase of 77 percent over 2010. Virtually all of these higher-skilled migrants will go to cities.¹¹

While it may seem obvious that cities competing on the basis of innovation and a viable knowledge economy also must compete for an internationally mobile, highly educated workforce, the entire picture is a bit more complex. Attracting this type of workforce is one thing; retaining it is another.

A growing city cannot expect to import wholesale the highly skilled and knowledgeable workers it needs. The city itself must cultivate a smarter citizenry, together with an academic and business population, capable of absorbing and commercializing innovation – creating, in effect, a holistic knowledge and innovation ecosystem.

Some cities, able over the past few years to improve both knowledge competitiveness and intensity, are already competing successfully for skilled and innovative workers. But a large number of others have experienced significant deterioration in their relative knowledge competitiveness and intensity, indicating that they are in a weaker position to succeed.¹²

It is clear, then, that cities will face intensifying competition, not just for a highly skilled class of citizens, but also for the right and diverse mix of talents necessary for sustained growth. Historically, expertise and innovation capacity – including a thriving academic and creative culture, a critical mass of industry-specific skills and learning, vibrant cultural institutions and communities, and fluid conduits through which knowledge flows across all these communities – have been built over decades or even centuries.

Living conditions have a profound influence on location decisions – sometimes weighing higher than potential earnings.

Since these attributes are often difficult to replicate, they constitute powerful, long-term competitive advantage for those cities that possess them. Indeed, as they shape their development and competitive strategies, leaders in many cities around the world choose to focus on whatever unique or differentiating attributes and capabilities they already possess.

Optimizing core systems for an innovation-enabling environment **Core systems play a crucial role in attracting and expanding skills and innovation**

As highly educated, innovative people choose where they want to live from many possible urban locations, cities are engaged in a “battle for talent” for which many are often ill-equipped. While wages are a primary factor influencing such decisions – and the equally important decision to remain in a city – research from the World Bank indicates poor public-service delivery, public safety issues or unemployment play a large part as well.¹³ Other important factors include the local climate for available career opportunities and quality of place: natural amenities, cultural options and a city’s environmental health.

In fact, living conditions have such critical influences on the attractiveness of a location that migration to locations with more attractive living conditions can occur even if earnings in a destination are lower.¹⁴ Quality of life and the attractiveness of a city are profoundly influenced by the core systems of a city: transport, government services and education, public safety and health.

Therefore, these systems are critical for attracting, creating, enabling and retaining this new kind of workforce and the innovation-enabling environment it requires to be productive.

And this applies not just to individuals making a location decision; businesses also examine similar criteria.

While business location decisions have traditionally been determined by factors such as costs, access to markets and raw materials, quality of life is now becoming an important factor as well. Knowledge-based businesses, in particular, are sensitive to “push-factors” such as crime, environmental degradation and traffic congestion because they make some areas less desirable to skilled workers.¹⁵ Efficient transportation facilities; high quality of life; and school systems that provide good primary, secondary, tertiary and vocational education to students and specialized training, post-graduate education and life-long learning opportunities for workers can be more effective in attracting businesses than financial incentives.¹⁶

As skilled, creative and diverse groups of workers are attracted to or stay in a location, this improves the attraction and retention of innovative businesses. Relocation of firms, establishment of new enterprises and improved functioning of existing enterprises can collectively act as an engine of growth, while increasing employment and incentive to improve skills. Conversely, cities can find themselves in a vicious circle where lack of skilled and creative workers discourages attraction or retention of businesses, which, in turn, depresses demand for skills.

Based on our research, we believe cities should focus on four areas to succeed in attracting, creating, enabling and retaining talented workers and innovative businesses:

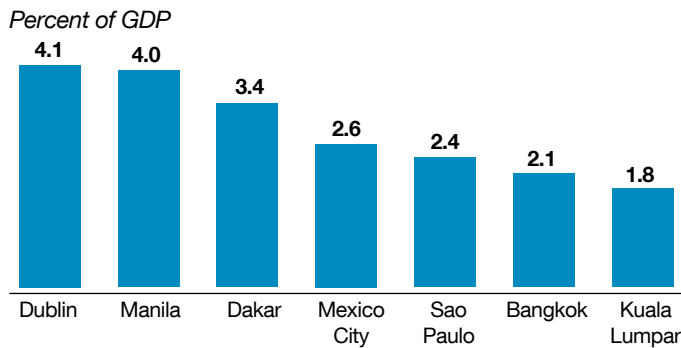
- Reduce congestion in the transport system
- Improve emergency response and reduce crime
- Improve education delivery and streamline government services
- Improve access to patient-centric healthcare.

Reduce congestion

The management and operation of transport systems have an important influence on the economy of cities. Well-managed, easily accessible public transportation attracts workers into cities, brings commuters to and from work, and moves goods from where they are produced to where they are consumed. Congestion negatively impacts the quality of life in a city by decreasing personal and business productivity, lowering air quality and creating noise pollution.¹⁷

The financial impact of inefficient transport systems is considerable and will increase if not addressed by cities:

- Congestion is one of the main urban transportation problems faced by almost all cities and incurs significant costs, ranging from 1.5 to 4 percent of GDP (see Figure 4). In the United States, congestion in urban areas results in annual costs of 4.2 billion hours of wasted time and US\$87 billion from wasted fuel and lost productivity.¹⁸
- Congestion also affects public safety – globally more than 1.2 million people are killed in transport accidents, and there are 50 million road accidents per year.¹⁹



Sources: Ley, E. and J. Boccardo. "The Taxation of Motor Fuel: International Comparison." The World Bank, Poverty Reduction and Economic Management Network, Economic Policy and Debt Department Working paper series 5212. February 2010; Central Statistics Office. County Incomes and Regional GDP 2007. 2010.

Figure 4: Congestion imposes significant costs on cities.

- Urban transport pressures are intensifying. For example, car ownership in Sao Paulo is increasing at the rate of 1,000 cars a day, and traffic is growing four times faster than the population in Mumbai, Delhi, Ahmedabad, Bangalore, Chennai and Hyderabad.²⁰

More efficient and effective transport systems can reduce the costs of congestion on cities. For example, in the United Kingdom, it is estimated that a 5 percent reduction in travel time on roads alone could generate around £2.5 billion of cost savings – some 0.2 per cent of GDP.²¹ Intelligent transport systems can improve quality of life – the European Union, for example, has highlighted intelligent transport as one of its flagship initiatives for improving the quality of life for its citizens.²² Smarter transport can also help improve safety, reduce delays and cut maintenance costs. For example, vehicle

failure can be predicted and avoided through wireless sensor networks that provide periodic reports and realtime alerts about the mechanical condition of trains, buses and trucks. Accidents and congestion can also be reduced by balancing traffic across routes or modes. Because smarter transport makes an area more attractive and accessible to firms and workers, it can serve as a powerful incentive to businesses looking to relocate jobs.

Many cities are sitting on potential treasure troves of data that could help them improve their transport systems. First, leaders need to assess the full range of what they already know and then couple that with data being collected outside the traditional definition of their portion of the transport system (adjacent service and infrastructure providers). For example, mainline rail operators can link up with rapid transit operators to collect and collate data reflecting usage of their systems to capture demand across the transportation network. Similarly, they can equip their transport systems to collect data in real time that is not being gathered today. Once obtained, careful analysis of integrated data will support, or even suggest, new ways to reduce costs or more efficiently manage and deliver transport services.

One strategic approach to reducing congestion is to apply collected data and a systems view to encourage increased use of public transport. Singapore has successfully encouraged its citizens to use public transport and minimized congestion by leveraging such smart technology (see Singapore case study).

Singapore's Land Transport Authority (LTA) leverages smarter transport to increase ridership and reduce traffic congestion

- A seamless national transport fare system was created that enables riders to use a single card of their choice to pay for all modes of travel as well as vehicle congestion charging and car parking. The solution creates a user-centric service that simplifies and streamlines fare payment for riders, making it a virtually invisible part of their public transportation experience.
- The system also generates insights from the 20 million trip-related transactions generated each day – information on where, when and how riders are traveling – and translates them into a more convenient, affordable travel experience for Singapore's citizens by allowing the LTA to optimize routes, schedules and fares.
- The Singapore Land Transport Authority has created one of the most modern, affordable and heavily used public transportation networks in the world, with nearly 3 million people riding buses and 1.6 million people riding trains on any given day.
- Other benefits include an 80 percent reduction in revenue leakage from “lost” transactions because of systems issues and a 2 percent reduction in the overall lifecycle cost of the fare processing system – all while doubling the system's performance capacity to 20 million fare transactions per day.
- Shorter delays and lower traffic congestion on expressways alone result in US\$28 million annual savings; usage of mass public transport increased by 14.4 percent to 4.5 million between 1996 and 2007.

Sources: “Singapore Land Transport Authority maximizes ridership to minimize traffic congestion.” IBM Web site. 2009. http://www-01.ibm.com/software/success/cssdb.nsf/CS/USTS-7VKL75?OpenDocument&Site=default&cty=en_us; Singapore Land Transport Masterplan. 2008.

Improve emergency response and reduce crime

In mature and rapidly developing economies alike, the levels and quality of a city's talent pool – the education, skills, creative and innovation capacity of a city – can be directly correlated with the overall levels of public safety.²³ A recent study based on Brazilian data shows that within urban populations, demand for public safety services increases with higher individual education and higher average level of education in the area of residence.²⁴

Cities with lower crime and better emergency services find it easier to attract and retain a diverse and higher-quality skilled workforce. For example, in the United States, cities with higher crime rates tend to have a lower proportion of employment in high-technology services.²⁵ The deterrent effects of crime and poor public safety on foreign direct investment and domestic entrepreneurship, especially in skill-intensive sectors such as internationally traded services, have also been documented in rapidly developing economies.²⁶ Today, information technology is being used as a primary tool to improve the safety of citizens.

- Crime prevention and emergency response both rely on getting the right information to the right people at the right time.
- Smarter public safety systems can provide centralized and integrated security surveillance and emergency response systems that collect information for analysis in realtime.
- This collected information can also be analyzed to understand patterns of incidents so that cities lower the cost of the provision of emergency services or crime fighting and prevention, while eliminating potential sources of problems.

Additionally, public safety systems lend themselves to being highly interconnected with other city systems, such as health (emergency response systems, access to accident and emergency units, etc.) and transport (traffic management) to enable cities to deliver a coordinated response to a range of events, leading to improved citizen-centric services (see Madrid case study).

City of Madrid raises public safety to a new level through coordinated emergency response

- *The Centro Integrado de Seguridad y Emergencias de Madrid's* (CISEM's) mission was to reduce emergency response time, integrate information, standardize procedures and protocols, provide seamless coordination and planning, enable shared use of resources, optimize information management and promote prevention through better planning.
- An integrated, smarter system was implemented and, because of insight generated by a comprehensive, realtime view of events across the city, emergency managers can better assess needs, prioritize and coordinate actions, and proactively deploy assets to address – and potentially prevent – multiple, complex incidents.
- Benefits from the smarter system include:
 - Enablement of end-to-end coordination of emergency and municipal assets.
 - Unified view of incident data enables faster, better decision making and the ability to handle multiple, complex situations simultaneously.
 - Emergency response time is reduced by 25 percent.
 - Emergency management has improved as commanders are now able to understand how complex and/or multiple incidents affect the entire region and can allocate and deploy emergency resources in a truly coordinated and effective manner that takes into account all of Madrid's needs, not just those of a single incident.

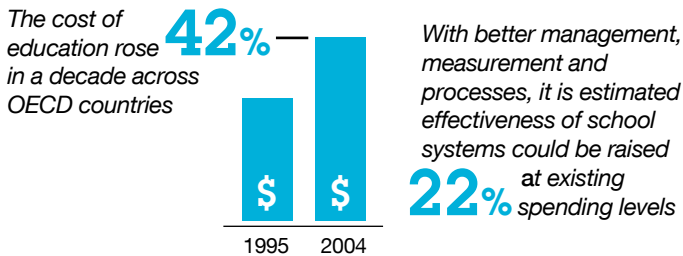
Source: "City of Madrid: Coordinated emergency response raises public safety to a new level." IBM Web site. 2010. http://www-01.ibm.com/software/success/cssdb.nsf/CS/JSTS-7ZWSPF?OpenDocument&Site=default&cty=en_us

Improve education delivery and streamline government services

A strong education system focused on lifelong learning is critically important in a city's efforts to attract and retain skilled and diverse workers and helps improve the city's overall attractiveness and quality of life. The key to attracting and retaining talent is nurturing skills and educating people so they can further absorb and extend innovation. A city's comprehensive education system – not just its primary school system – generates more diverse skills and aptitudes through different types of education, training and cultural experiences.

Studies show that education is a key push and pull factor in the decision to migrate.²⁷ In particular, access to quality education for children factors strongly in the decision for households to leave or stay in a particular location.²⁸ Tertiary education is just as important, as colleges and universities help educate the creative workers and leaders of tomorrow – entrepreneurs and knowledge workers who are often likely to remain in an environment with a vibrant emphasis on lifelong learning.

However, the challenges facing education systems are daunting. School and higher education institutions are straining under rising costs at a time when budgets are static or shrinking in many cities around the world (see Figure 5). Yet, demand for knowledge workers with specialized skills is growing by 11 percent a year, and many jobs will require lifelong training and continuous updating of skills.²⁹ These trends, together with changes in technology, commerce, politics and demographics, demand new approaches to teaching and learning.



Source: IBM. "Education for a Smarter Planet." 2010. http://www.ibm.com/smarterplanet/us/en/education_technology/ideas/?re=spf

Figure 5: Education systems are straining under rising costs.

Applying advanced information technology across the education system of a city provides a means to improve the quality of education, increase access and reduce costs. Smarter education enables learning services and resources to become more interconnected and seamless (see New South Wales Australia case study). Decision making is influenced by intelligent insight based on an integrated view of available and newly collected data: information about individual students' needs, skill gaps, prior learning, range of available educational experiences, etc. – all available for analysis and central to the teaching process. Smarter education helps reduce administrative costs and inefficiencies and reshapes learning around the two key components of any education system: the student and the teacher.

Education institution in New South Wales Australia leverages smarter education to improve service delivery for students and reduce costs

- The Edmund Rice Education Australia Flexible Learning Centre Network (EREA FLCN) manages enrollment and student information for over 500 students enrolled at 13 sites.
- Rapid online access to accurate status reports for all students was required, as the existing paper-based management system was causing delays and errors in managing sensitive student data.
- An integrated document management and e-mail system was implemented to provide tailored reporting to meet funding and government reporting requirements, as well as built-in alerts during the enrollment phase to identify any students with specific needs.
- The system has streamlined service delivery for students and significantly reduced courier costs for documents. This has enabled:
 - Improved service for students, enhanced enrollment information and more detailed student reporting
 - Substantial productivity improvements arising from immediate online access to student data
 - Elimination of paper-based data collection, leading to faster and more accurate management of student data by teaching staff
 - Tracking of emerging trends in student needs to support planning for future resource requirements.

Source: "Edmund Rice Education Australia transforms student record management across a multi-site learning network." IBM Web site. 2010. http://www-01.ibm.com/software/success/cssdb.nsl/CS/CLE-82535X?OpenDocument&Site=default&cty=en_us

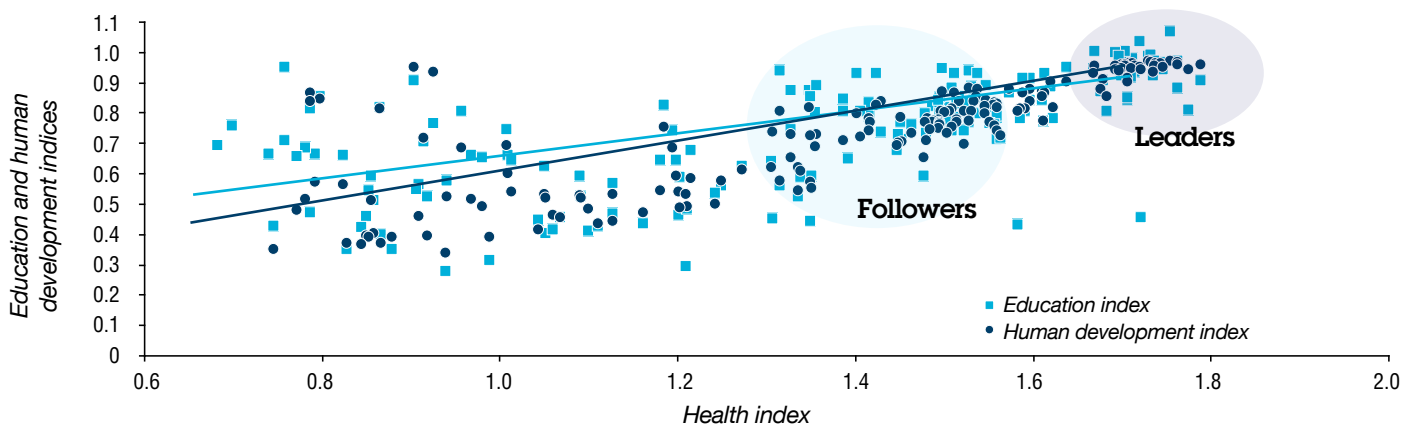
Improve access to patient-centric healthcare

Improving healthcare in cities is an urgent priority. Healthcare demand continues to grow, as urban areas worldwide gain 67 million people a year.³⁰

But health and well being are not just crucial components of a city's overall survival and attractiveness. They are fundamental to the quality and productivity of a workforce – especially a workforce that must be able to think and innovate at peak capacity at all times to help the city economy grow. As Figure 6 shows, a health index calculated from United Nations data is positively correlated with a higher quality workforce, quality of life and economic development.³¹

Smarter healthcare systems integrate various aspects of often disparate healthcare delivery mechanisms, making use of electronic patient records and streamlined processes. These elements of smarter healthcare lead to improved quality of life by reducing risks, provide more patient-centric services tailored to individual needs and improve access to healthcare (see Xicheng case study).

Smarter healthcare's optimization around the patient actually increases efficiency, reduces errors, achieves better quality outcomes and saves more lives. And, by extension, smarter healthcare supports a more productive workforce as it reduces risks to health and improves general well-being.



Sources: UN Human Development Report, 2010 database; IBM Global Center for Economic Development analysis.

Figure 6: Better health is positively correlated with higher quality of skills and knowledge.

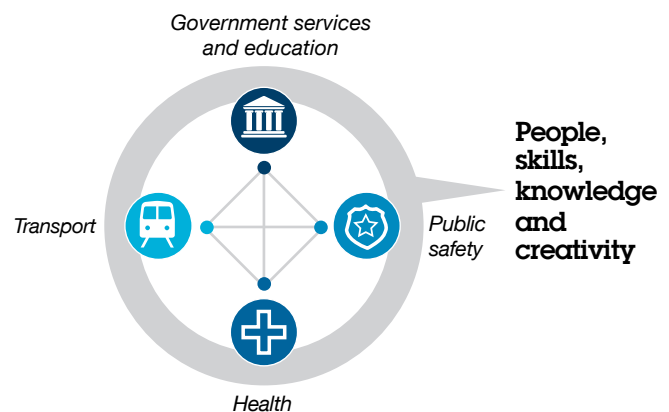
Beijing Xicheng district in China leads in integrated healthcare systems and detection of potential epidemics

- The Xicheng district in China has a population of more than 1 million and is home to 500 fragmented medical institutions.
- Its mission is to establish a healthcare management system that facilitates fast, automated and quality healthcare services throughout the treatment lifecycle.
- The district created systems and standards to streamline the medical care delivery process and provided a platform to integrate patient and medical information to create unified healthcare management system.
- With the new health management system, healthcare services have been evenly distributed among health facilities so that citizens can obtain healthcare services in their local community, rather than going to central hospitals even for minor illnesses.
- An integrated healthcare management system across the Xicheng district provides speedy and less expensive delivery of care.

Source: "Beijing Xicheng District Health Bureau chooses IBM DB2 9 with pureXML to provide EMR healthcare information exchange." IBM. 2008. http://www-01.ibm.com/software/success/cssdb.nsf/CS/LWIS-7LQVDE?OpenDocument&Site=default&cty=en_us

Cultivating a cross-systems perspective to optimize investments

As almost each cursory investigation of a city's core systems has revealed, the challenges cities face in their core systems are interconnected (see Figure 7). For example, a reliable, well-run transport system does not just reduce congestion. It improves the health of a city's citizenry by reducing carbon dioxide emissions, stress and vehicular accidents. It frees up more time for people to work – or to relax. Some cities have even seen significant increases in retail sales as vehicular traffic has decreased.



Source: IBM Global Center for Economic Development.

Figure 7: There are many varied and interrelated connections between a city's core systems.

Forward-looking cities that want to fully leverage the improvements in efficiency and effectiveness from smarter core systems must therefore adopt crucial principles of *systems thinking*:

- Seek to understand behaviors in their systems and not just respond to events.
- Look for and make connections to other related city systems to understand root causes of problems, the total value changes to systems behavior can have and multi-pronged strategies for effecting those changes.
- Recognize the value of making the right kinds of information widely available outside their specific domains and to the innovation-enabling ecosystem that is driving city growth.

The last principle is noteworthy, as it acknowledges that optimizing the integrated management of smarter urban systems and making the information and knowledge it uncovers available also helps optimize the overall performance of a city for its base of diverse citizens. It, too, is an example of “citizen-centric” optimization of the city.

What steps should city leaders take next?

Growth for cities in the twenty-first century will increasingly be driven by people – the skills and knowledge of a highly educated, innovative workforce – and by the ability of citizens and city economies to absorb, commercialize and extend innovation. Cities that want to thrive will need to plan, invest and work to improve their core systems with this in mind.

But how do cities begin to make such improvements, especially in times of extreme financial constraints? There are a few basic steps and consistent guiding principles to help direct them.

Decide what your city should be – determine its brand

- Identify the city’s differentiating strengths that will attract skills, knowledge and creativity.
- Create a strategy that emphasizes these strengths.
- Prioritize investments in core systems: transport; government services and education; public safety and health; as well as energy, environmental sustainability, urban planning and design in line with the strategy.

Adopt policies conducive to skills, creativity and knowledge-driven growth

- Attract internationally mobile talent by enhancing quality of life services and services responsiveness to changes in demand.
- Create a domestic talent base by offering education services and training, with significant emphasis on investing in education infrastructure.
- Enable better opportunities for deploying skills and abilities to help citizens realize their potential by using better deployment of data collection and analytics on changes in the labor force and skills supply and demand.
- Retain the existing base of talent to reduce potential “brain drain.”

Optimize around the citizen

- Begin to shift from standardized, uniform services to a model for the delivery of tailored services that meet individual needs.
- Create digital linkage across city core systems and the analysis and actions triggered by patterns in the data.
- Develop a clear and transparent system of user fees and charges that reflects the real costs of providing citizen-centric services, thus encouraging both more direct demand for services management by the citizens and lower costs burden on public finances.

Employ systems thinking in all aspects of planning and management

- Consider problems, solutions and the value that improvements will create in the context of related and interconnected city systems, not just within the confines of one area of operation.
- Identify, map and appeal to constituencies essential to the success of city improvements, especially those that may be outside traditional city systems bounds.
- Focus on system behaviors instead of singular events and examine multiple approaches to changing system behaviors.
- Fully leverage the value of data, data analytics and systems thinking across systems by making information widely accessible to citizens.

Develop and apply information technologies to improve core city systems

The most important question facing cities, then, is, *how* do they improve these core systems in the most cost-effective and productive fashion? The answer: focus on leveraging the power of the vast amounts of real-world data they already collect about the behavior patterns of the city's people and systems, taking care to equip their systems with three basic levels of ability:

- Collect and manage the right kind of data.
- Integrate and analyze the data.
- Based on advanced analysis, optimize the system to achieve desired system behaviors.³²

Recognizing talent – skills, knowledge, creativity and innovation ability – as an ever more important driver of sustainable growth implies significant changes in how we think about managing and improving cities. It shifts our thinking from appealing to mass audiences to appealing to individual citizens *en masse*. Modern information technology makes this seemingly daunting challenge not only practicable, but also, over the long term, cost effective and prudent.

Cities that adopt this thinking and make such wise investments now to build a smarter city can position themselves to thrive. Those that continue to invest in traditional infrastructure improvements designed for a mass population are very likely to struggle.

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References

- 1 “OECD Territorial Reviews: Competitive Cities in the Global Economy.” Organisation for Economic Co-operation and Development. http://www.oecd.org/document/2/0,3343,en_2649_34413_37801602_1_1_1_1,00.html; “State of the world’s cities 2010-2011. Urban trends – Wealth of Cities.” United Nations Human Settlements Programme. March 2010. <http://www.unhabitat.org/documents/SOWC10/R6.pdf>
- 2 “Gallup Soul of the City in Europe.” Gallup Europe. <http://www.gallup-europe.be/soulofthecity/>
- 3 Bureau of Labor Statistics database, Household Data Annual Averages, Table 7. United States Department of Labor. <ftp://ftp.bls.gov/pub/special.requests/lf/aat7.txt>
- 4 Shapiro, Jesse M. “Smart Cities: Quality of Life, Productivity, and the Growth Effects of Human Capital.” *The Review of Economics and Statistics*. May 2006.
- 5 Institute for Business Value estimates based on data from KLEMS. <http://www.euklems.net/>
- 6 “International Mobility of the Highly Skilled.” OECD Policy Brief. July 2002. <http://www.oecd.org/dataoecd/9/20/1950028.pdf>
- 7 Huggins, Robert, Hiro Izushi, Will Davies and Luo Shougui. “World Knowledge Competitiveness Index.” July 2008. <http://www3.uwic.ac.uk/English/uwicresearch/news/Pages/280708WorldKnowledge.aspx>
- 8 Institute for Business Value estimates based on the original data from: Cortright, J. “City Vitals.” CEOs for Cities. http://www.ceosforcities.org/work/city_vitals; Abel, Jaison, Ishita Dey and Todd Gabe. “Productivity and the Density of Human Capital.” Federal Reserve Bank of New York. March 2010; Fu, Shihe and Junjie Hong. “Testing Urbanization Economies in Manufacturing Industries: Urban Diversity or Urban Size?” University of Munich. MRPA 10078. 2008. <http://mpr.ub.uni-muenchen.de/10078/>
- 9 IBM Institute for Business Value forecasts based on the data from UN Human Development Report, 2009 database. Forecasts are carried out based on regional country-level data using linear regression estimates.
- 10 Abel, Jaison, Ishita Dey and Todd Gabe. “Productivity and the Density of Human Capital.” Federal Reserve Bank of New York. March 2010.
- 11 Institute for Business Value estimates are based on the data from the UN Human Development Report, 2009 database.
- 12 Ibid.
- 13 Mansoor, Ali and Bryce Quillin. “Determinants of Migration. Migration and remittances: Eastern Europe and the former Soviet Union.” 2006. http://siteresources.worldbank.org/INTECA/Resources/257896-1167856389505/Migration_Chapter3.pdf
- 14 Massey, Douglas, Joaquin Arango, Graeme Hugo, Ali Kouaci, Adela Pellegrino and J. Edward Taylor. “Theories of International Migration: A Review and Appraisal.” *Population and Development Review*. 1993.

- 15 Salvesen, David and Henry Renski. "The importance of quality of life in the location decisions of new economy firms." Center for Urban and Regional Studies, University of North Carolina at Chapel Hill. 2003. <http://curs.unc.edu/curs-pdf-downloads/recentlyreleased/neweconomyreport.pdf>.
- 16 Breznick, Alan. "Incentives Play Minor Role in Attracting Foreign Firms." BNET. March 2003. http://findarticles.com/p/articles/mi_qa5314/is_200303/ai_n21326652/
- 17 Rodrigue, J.P. "Transportation and Economic Development." Department of Global Studies and Geography, Hofstra University. <http://people.hofstra.edu/geotrans/eng/ch7en/conc7en/ch7c1en.html>
- 18 Rodrigue, J.P. "Urban Transport Problems." Department of Global Studies and Geography, Hofstra University. <http://people.hofstra.edu/geotrans/eng/ch6en/conc6en/ch6c4en.html>
- 19 "World Report on Road Traffic Injury Prevention: Main Messages." World Health Organization. 2004. http://www.who.int/violence_injury_prevention/publications/road_traffic/world_report/main_messages_en.pdf
- 20 Suri Singh, M. "Tax alone can't decongest city roads." *Times of India*. <http://epaper.timesofindia.com/Default/Scripting/ArticleWin.asp?From=Archive&Source=Page&Skin=TOINew&BaseHref=CAP/2010/02/15&PageLabel=4&EntityId=A00400&ViewMode=HTML&GZ=T>; Uddin, Azeem. "Traffic congestion in Indian cities: Challenges of a rising power." 2009. http://www.vision-website.eu/UserFiles/File/filedascaricare/Scientific%20Partners,Papers%28Kyoto%29/Draft_koc_Azeem%20Uddin.pdf
- 21 Eddington, Rod. "The Eddington Transport Study: The case for action." 2006. UK Department of Transport. 2006. <http://www.dft.gov.uk/about/strategy/transportstrategy/eddingtonstudy/>
- 22 "Social inclusion, better public services and quality of life." European Commission. http://ec.europa.eu/information_society/eeurope/i2010/inclusion/index_en.htm; "Delivering a Sustainable Transport System: Main Report." UK Department of Transport. November 2008. <http://www.dft.gov.uk/about/strategy/transportstrategy/dasts/dastsreport.pdf>
- 23 Dasgupta, Partha and Ismail Serageldin. "Social Capital: A Multifaceted Perspective." World Bank. 1999; Ayres, Robert. "Crime and Violence as Development Issues in Latin America and the Caribbean." World Bank Latin American and Caribbean Studies Viewpoint. 1997.
- 24 Ravallion, Martin and Menno Pradhan. "Demand for Public Safety." World Bank Policy Research Working Paper No. 2043. November 1998. <http://ssrn.com/abstract=604914>
- 25 Based on IBV analysis plotting violent crime rate per 100,000 population from the FBI (http://www.fbi.gov/ucr/cius2008/data/table_06.html) against the proportion of population employed in high-tech services for cities included in the World Knowledge Competitiveness Index 2008 (see <http://www.cforic.org/downloads.php>).

- 26 Krkoska, Libor and Katrin Robeck. "The Impact of Crime on the Enterprise Sector: Transition Versus Non-transition Countries." European Bank for Reconstruction and Development Working Paper No. 97. 2006. <http://ssrn.com/abstract=948551>; Ahrend, Rudiger. "Foreign Direct Investment Into Russia - Pain Without Gain? A Survey of Foreign Direct Investors." Russian Economic Trends. May 2000. <http://ssrn.com/abstract=620122>
- 27 United Nations. "World Population Monitoring 2003: Population, education and development." Department of Economic and Social Affairs, Population Division. 2004. http://www.un.org/esa/population/publications/2003monitoring/WorldPopMonitoring_2003.pdf
- 28 Hercog, M. "The role of the State in attracting highly-skilled migrants: The case of the Netherlands." EIPAScope 2008. Vol. 3. pp.1-6. http://aei.pitt.edu/11032/01/20090130170607_SCOPE2008-3_3_MetkaHercog.pdf
- 29 "Education for a Smarter Planet: The Future of Learning." IBM. 2010. <https://www-935.ibm.com/services/us/gbs/bus/html/education-for-a-smarter-planet.html>.
- 30 "Population Reports: Meeting the Urban Challenge." U.S. Agency for International Development and The Johns Hopkins University. 2002. <http://info.k4health.org/pr/m16/m16.pdf>
- 31 Using UN Human Development Report (UNHDR) data, we compute Health Index as a measure of the two health-related metrics reported by UNHDR: UN Life Expectancy at birth (reweighted to correspond to Life Expectancy Index) and UN Life Expectancy index, combined into one index. This allows us to introduce an additional control for measurement differences in the UNHDR data. IBV Education Index is similarly composed of the UN Education Index and Combined Gross Enrollment Ratio in Education also reported by the UN.
- 32 Chen-Ritzo, C.-H., C. Harrison, J. Paraszczak, and F. Parr. "Instrumenting the planet." *IBM Journal of Research & Development*. 2009.



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