

# GETTING CITIES RIGHT IN CHINA:

Urban design, smart transportation and institutional reform.

Hal Harvey & Chris Busch, December 2012

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## EXECUTIVE SUMMARY

The Paulson Institute and Energy Innovation LLC have identified urbanization in China as a primary determinant of future climate change. The sheer scale and speed of urbanization in China argues that it will have global implications. Getting urban planning right can drastically—and structurally—reduce carbon emissions, and make cities much more livable.

This paper lays out six elements of success necessary for China's cities to become great places to live and work, with great public spaces, breathable air, and drinkable water. These are necessary steps for China's cities to take the lead on climate change by increasing resource efficiency while lessening pollution and waste. This paper is a work-in-progress, and we seek specific feedback and suggestions.

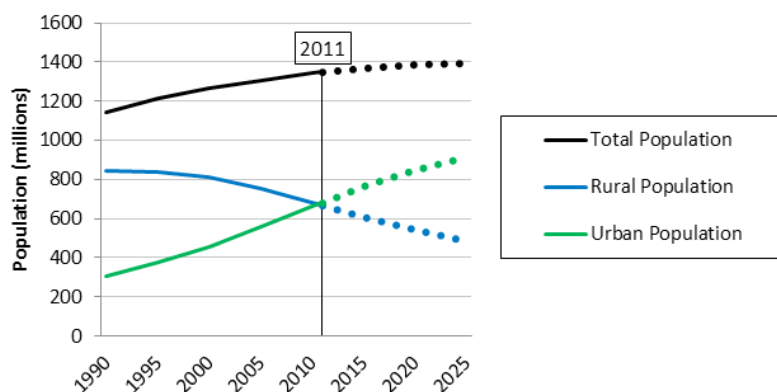
As China quickly grows from an undeveloped economy to a fully developed nation, a vast number of people are moving from rural areas to cities. Indeed, China is host to both the fastest urbanization as well as the largest migration in history. Between 2012 and 2025, China will add 230 million city dwellers, and will build one U.S.A.'s worth of housing, shops, factories, and infrastructure. China will have approximately 1 billion urban residents by 2030.

This is a trend of staggering importance, and how it unfolds will have profound implications for China's—and the world's—future.

## THE CHALLENGE

The most common pattern of development emerging in many fast growing Chinese cities – single use superblocks served by auto-centric transportation – is already producing negative effects, including stifling congestion and pollution. This is despite the fact that less than 10 percent of Chinese own a vehicle. It is obvious that replicating this pattern will not work, but will instead produce cities that are fundamentally unlivable.

FIGURE 1. CHINA'S RAPID TRANSFORMATION INTO URBAN SOCIETY



Source: Energy Innovation Analysis using United Nations data. UN 2011; UN 2012

## SIX INGREDIENTS FOR SUCCESS

In this paper, we describe six ingredients for success, critical to making China's future cities truly world class:

01. **Permeable urban form**
02. **Transit-Centered transportation systems that enable walking and biking**
03. **Effective building codes**
04. **Municipal finance reform**
05. **Better measures of urban sustainability**
06. **A strengthened planning process**

### 01. **Permeable urban form:**

- › The basic reform requires smaller blocks, mixed-use, and smaller but more numerous streets. A rich street network—with paired one-way auto traffic streets, inter-mixed with local streets and streets dedicated to transit and biking—makes for a far more efficient way of getting people around and creates more interesting neighborhoods. Mixing uses—work, shopping, living, recreation, restaurants, and schools all built into each neighborhood—both reduces demand for transportation (more necessities are available locally) and increases quality of life.

### 02. **Transit-Centered transportation systems that enable walking and biking:**

- › Walkable neighborhoods are a crucial element in any livable city. Rich local environments combined with easy access to shopping, recreation, school, and work make great cities. Of course, people often cover more than a few miles per day, and they need faster methods of transportation than walking. China has great experience with one—biking—and is gaining experience with another, Bus Rapid Transit (BRT). Cities that create good biking environments often attract a third or more of all commuters to bikes—and that mode of transit creates no pollution, helps people get in shape, is quiet, and is an incredibly efficient use of space. Bus Rapid Transit complements walking and biking: Done right, it reaches subway speeds at ten percent of the cost. BRT is a conceptually elegant, effective, and inexpensive approach to moving people in urban areas. Subways (metros) are terrific for moving large numbers of people, quickly, through dense urban areas. China is

building thousands of miles of metro lines, as it should, but because of tunneling, they are expensive and slow to build. BRT is an excellent complement.

### 03. **Effective building codes:**

- › Effective energy performance standards for new buildings will ensure that the millions of structures under construction in China are super-efficient. Effective standards must be: adequately ambitious in terms of the level of energy performance required; regularly updated to reflect continual improvements in energy efficient building technology; and rigorously enforced. Enforcement needs to be improved for all facets of environmental regulation in China.

### 04. **Municipal finance reform:**

- › One of the chief obstacles to sustainable urbanization has to do with the way cities are financed, and the type of development patterns that it creates. Chinese mayors are under intense pressure to perform. Cities simply do not have sufficient revenue to fund both the social services that must be provided as well as the investment in infrastructure. To cover the gap, China's mayors often lease land, in 99 year leases covering large swathes of land, to developers who put up apartment towers, shopping centers, or factories. This incentivizes sprawling, single-use development. Part of the challenge is that superblock, single-use development is the fastest and easiest to develop for both city leaders and developers. The type of permeable urban form and transit-smart cities envisioned here is not as simple to build. However, when implemented, these more complex forms yield clear social, economic, and environmental benefits. While this paper recommends changes to support the needed shift in municipal finance, it does not attempt a comprehensive treatment of the complicated topic.

### 05. **Sustainability performance metrics for mayors:**

- › The 12th Five Year Plan is the most ambitious yet in terms of sustainability goals, including the notion of people-centered development, as well as numerous ambitious commitments including clean energy production and pol-

lution control. How can cities best meet and surpass these goals? New performance metrics are needed to help understand where progress is occurring and where more action is required. New sustainability performance metrics can help set the right incentives for mayors. Until very recently, the performance of mayors has been evaluated almost entirely by their ability to increase their city's share of the regional GDP (Gross Domestic Product); that needs to change.

#### **06. A Strengthened planning process:**

- › A strengthened planning process is also needed if urbanization is to succeed. Too much discretion is currently given to developers in setting the texture and pattern of cities. Clearly, development should remain driven by local circumstances, but clear guidelines are required if livable, walkable neighborhoods serviced by transit are to emerge. The planning process must be guided by sound principles and pursued with serious technical capabilities—and that will require adding staff, budgets, and training for municipal planning bureaus. These early investments will affect cities for decades, and although they are tiny compared to their implications, they are crucial for sound, livable cities.

## **CONCLUSION**

We are optimistic that China can channel its dynamic energy and financial might into sustainable urban development. It is easy to worry that these efforts may be stymied by the sheer scale of China's growth, but experience around the world and in China argues that a great outcome is possible with the right ideas, resources, and political commitment.

## PURPOSE OF THIS PAPER

The Paulson Institute and Energy Innovation LLC have identified urbanization in China as an area of priority and an opportunity for collaboration. This paper lays out six elements of success necessary for China's cities to become great places to live and work, with great public spaces, easy transit, breathable air, and drinkable water. These are necessary steps for China's cities to take the lead in action on climate change. This paper is a work-in-progress, and we seek specific feedback and suggestions.

We describe *six ingredients for success*, critical to making China's future cities truly world class:

01. **Permeable urban form**
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## WHY CHINA? WHY URBANIZATION?

As China quickly grows from a less developed economy to a fully developed nation, a vast number of people are moving from rural areas to cities. Indeed, China is host to both the fastest urbanization as well as the largest migration in history. Between 2012 and 2025, China will add 230 million city dwellers, and will build one U.S.A.'s worth of housing, shops, factories, and infrastructure. China will have approximately 1 billion urban residents by 2030.

Urbanization is also one of the prime drivers of economic growth. Currently, China's cities produce 75 percent of the country's economic output. By 2025, that will increase to 90 percent or more (McKinsey 2009).

Those are staggering trends, and how they unfold will have profound implications for China's—and the world's—future. *How* urbanization happens is really important. If these vast cities are well designed, have efficient buildings, are easy to navigate, and have lots of public space, then China will have, at its core, a sound development pattern. Conversely, if

these cities are characterized by wasteful energy consumption, traffic jams, and uninviting public spaces, the damage will be extensive and difficult to reverse.

The Paulson Institute and Energy Innovation LLC have been working with three Chinese institutions: the China Center for International Economic Exchanges, the China Association of Mayors, and the Ministry of Housing and Urban Development. We have also been working closely with the Energy Foundation's China Sustainable Cities and the China Sustainable Transportation programs, and with other experts from China and other countries, to assess the current situation and identify priority actions to achieve sustainable urbanization. This inquiry focuses on public spaces, living patterns, physical infrastructure, economics, and public policy. We have looked at the factors that drive today's settlement patterns with an eye toward understanding how these factors can be influenced to improve future cities and reform existing ones. We have been fortunate to work with leading experts from around the world, as well as committed Chinese officials with vast real-world experience.

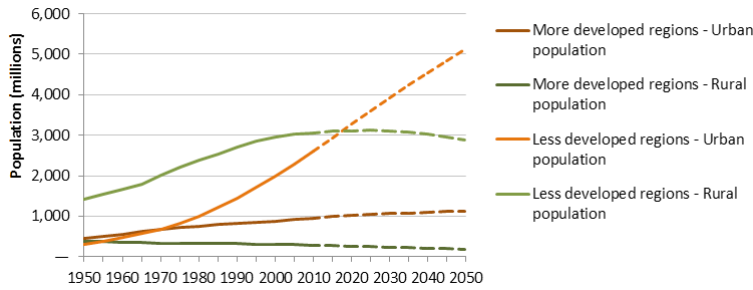
## THE WORLD'S FUTURE IS AN URBAN FUTURE

In the coming decades, demographers expect that essentially all of the world's population growth will take place in cities.<sup>1</sup> In fact, rural population is expected to shrink slightly, in both developing and developed countries. By 2030, urban residents will make up 67 percent of the global population, up from 45 percent in 2011.

By 2050, the United Nations predicts that 47 percent of all urban residents will live in cities of at least 1 million inhabitants (up from 30 percent in 2011). The number of megacities with at least 10 million inhabitants is expected to grow by more than half, from 23 to 37, by 2025.

Much of the tremendous growth in urban centers will be concentrated in the less developed regions of the world, where the urban population is forecast to increase from 2.7 billion in 2011 to 5.1 billion in 2050.

FIGURE 2. FUTURE POPULATION GROWTH IS IN CITIES



Source: Energy Innovation Analysis using United Nations data. UN 2011; UN 2012

Within the developing country segment, Asia is the largest source of growth, with more than half of the total. Asia’s population expansion is evident in the emergence of new megacities. Today, of the 23 existing megacities, 13 are located in Asia and four are in Latin America. Africa, North America, and Europe are each home to two megacities. By 2025, Asia is expected to gain nine additional megacities and Latin America is expected to gain four, while Africa, North America, and Europe are each expected to gain one.

Given China’s recent history – the nation’s urban population increased 42.7% between 2000 and 2010 – it is no surprise that China’s urban population growth is the dominant force in the global trend toward increasing urbanization. The UN estimates that, by 2030, China will gain 276 million urban residents, significantly larger than the 218 million residents that will be added to India’s cities. By 2030, approximately 1 billion people will be living in China’s cities.

A 2009 report published by the McKinsey Global Institute predicts very similar outcomes. McKinsey anticipates that China’s urban population will reach 926 million in 2025, compared to 912 million according to the UN estimate. Compared to 2011 levels, these imply increases of between 230 million (UN) and 244 million (McKinsey) by 2025.

## CITIES ARE THE ECONOMIC POWERHOUSES OF COUNTRIES

In China, and around the world, most economic value is created in cities. The amount of GDP generated in cities is expected to increase to an astonishing 90 percent by 2025 in China. By comparison, the share of US economic output

attributable to cities is expected to remain roughly constant around 80 percent. China’s surge in urban economic productivity is the largest in the world, but the trend of increasing relative importance of urban economic output is also reflected elsewhere.

## INGREDIENT ONE: PERMEABLE URBAN FORM

### 1.1 Livability

How urbanization happens is really important. The overriding principle, which sounds simpler on paper than it is in reality, is that China must design cities for people—not for cars, not for developers, not for splash or show. Take these simple but evocative facts: More than 90 percent of Chinese do not have a car...but traffic jams are now a significant urban problem. Recent events confirm the severity of the issue. China set a dubious record for the world’s largest traffic jam, 61 miles long, which took 11 days to untangle.

We are lucky to have outstanding examples of cities designed for people—bits and pieces in many Chinese cities, and with other examples across Europe and the United States. The essence is simple: it comes down to mobility and urban form. For more detail, see *Planning Cities for People*. (ClimateWorks, et al.).

### 1.2 Good public spaces make for good communities

What does the solution look like on the ground? Begin with the simple fact that every trip starts and ends with a walk. Walking is made enjoyable by decent spaces—with such inexpensive amenities as shade trees, reasonable crosswalks, sidewalks, safety day and night, and ideally a diversity of activities on the street—such as parks, playgrounds, restaurants, and shops. Examples all over the world show that if you provide these basic amenities, a rich street culture ensues: We see this in New York, Paris, Seoul, and in many neighborhoods in China’s cities. However, the counterexamples are also legion: 12 lane boulevards separating 500 meter blocks do not make for good walking spaces. Building great public space and making walking pleasant is cheap; doing so resuscitates neighborhoods and promotes social stability. From an economics perspective, there is ample evidence that good public spaces and mixed uses boost

property value.

### **1.3 Access and mobility for people who do not have cars (more than 90 percent of the total!)**

Chinese mayors need to ensure that new cities have terrific transit options beyond the car, including pedestrian amenities, bikeways, and clean, fast, efficient, and ubiquitous public transit. Since the trend toward increasing car ownership is not sustainable, but modern economies nonetheless require great mobility for people and goods, smart alternatives must be developed.

If ten percent of the population driving cars can utterly snarl up cities, cause massive oil imports, and pollute the air, then simple mathematics argues that trying to move the other 90 percent by car is folly. Faced with that math, it behooves China's mayors and planners to consider a new development topology. Again, the essence of the solution is simple: improve mobility and urban form.

### **1.4 World-class cities require world-class amenities.**

Ultimately, world-class cities that can attract top talent are defined and elevated by world-class amenities. Architecture, plazas, parks and lively street life can inspire and enliven citizenry.

The basic principles enunciated in this paper are the most important steps required to build world-class cities, but they must be complemented with attention to public spaces, municipal, sports, art, and theater facilities, parks, and more.

One world-class amenity that China has invested in is a large and growing high-speed rail system. Almost 10,000 kilometers of high-speed rail tracks have been built already, with plans to complete 25,000 kilometers by 2020. This will reduce the need for major freeways bisecting cities and increase mobility for those without cars.

### **1.5 Pollution**

Larger cities have been more effective in enforcing pollution regulations. For example, in 2005, China's megacities treated 68 percent of their wastewater, while cities of less than 500,000 residents treated 34 percent of their wastewater.

While the trend toward larger cities will likely improve regulatory enforcement to some extent on its own, more

must be done. China should pursue an aggressive campaign to increase efficiency, as well as to set and enforce more stringent emissions and effluent standards. A more active central government role is important.

The type of public transit systems advocated for in this paper are easier to modify, upgrade, monitor, and enforce performance levels, as compared to a dispersed fleet of millions of private vehicles. This is a desirable feature of the livable cities model from a pollution perspective. As quickly as possible, low- or zero-emission public fleets and transit options must be developed.

### **1.6 Noise**

Noise pollution has been shown to elevate stress levels and can be deleterious to health. Much noise pollution is related to traffic and congestion, so walkable cities with good transit would be a step towards reducing ambient noise levels. Ambient noise standards and monitoring are another element of livable cities.

### **1.7 Global warming**

Across the world, more densely populated cities have significantly (by two to three times) lower energy use and lower greenhouse gas emissions per capita than their sprawling cousins. This is true in the transportation sector, and also in electricity consumption by buildings and commerce. This efficiency is partially due to the greater technical capacities of larger cities, which leads to better technology implementation and enforcement.

China's urbanization is so large and rapid that the country is uniquely positioned to develop new modes of sustainable urban design, which could positively influence urban development elsewhere. China has already contributed greatly in reducing the costs of advanced energy technologies like solar photovoltaic.

### **1.8 Economics**

As nations rapidly urbanize, metropolitan areas are becoming hubs for innovation, investment, production, and trade. For the high value jobs that China aims to attract, innovation will be critical. Cities are natural centers for innovation clusters. Dense cities offer unsurpassed proximity to talent, funders, and customers. Communication and collaboration

are still best achieved face-to-face, despite the incredible advances in information and communication technology.

Even at Google, a company leading the development of the virtual reality where we spend more and more of our time, location in physical space matters. A scholarly study of information flows at the company showed that information is shared most easily and effectively among office neighbors, even though instant messaging and email are generally preferred over face-to-face discussion at the company. The strongest determinant of information sharing was location in space, trumping even friendship or other close social ties.

The importance of clusters in economic development is garnering attention, and rightly so. Clusters are essentially networks or ecosystems of successful business relationships, and effective cultivation of these will drive 21st century success. Clusters can provide powerful support for the research and development part of the value chain, as well as for the manufacturing segment. Compact supply chains avoid some of the risks associated with dispersed global production. This is just one of the reasons that cluster thinking is a growing component of policy development to compete and win manufacturing jobs.

### 1.9 Social stability

People want a good life. A livable urban design strategy will best handle the continuing flow of new urban residents in China and will create the best living conditions for the largest number of people going forward. The approach we describe next offers concrete tools to provide people with the quality of life they desire. Creating livable, walkable, mixed-use cities will encourage people to spend time on foot in neighborhoods. Scholars have found a direct correlation between face-to-face interactions, social wellness, and economic development.

## INGREDIENT TWO: TRANSPORTATION SOLUTIONS FOR LIVABLE CITIES

The basic reform requires smaller blocks, mixed-use, and smaller but more numerous streets. A rich street network—with pairs of one-way auto traffic streets, intermixed with local streets and streets dedicated to transit and biking—

makes for a far more efficient way of getting people around, and creates much more interesting neighborhoods. Mixing uses—work, shopping, living, recreation, restaurants, and schools all built into each neighborhood—both reduces the demand for transportation (more necessities are available locally) and increases quality of life.

That's a start. But people cover more than a few miles per day, and they need faster methods of transportation than walking. China has great experience with one—biking—and is gaining experience with another, Bus Rapid Transit.

The bicycle was the primary mode of transportation in China for many years. We have all seen the pictures of thousands of bicyclists making their way down China's great streets. Unfortunately, many of them have now been displaced by cars. Here, too, the necessary decisions are straightforward: If city planners build good bicycle infrastructure, such as dedicated bike lanes and bike parking, people will ride bikes. It is a cheap, fast, and effective strategy. Some argue that bikes are the choice of poor countries where cars are unaffordable. But in the world's richest and most interesting cities—across France, Germany, Denmark, and including New York, Chicago, and Portland, the bike is experiencing a renaissance. The city of Copenhagen just inaugurated a bike superhighway to try to encourage suburban commuters to bike to the city. It turns out that bike use is a great quality-of-life index. Bikes denote cities that are accessible, humane, and people-oriented.

Transit poses another challenge: Subways (metros) are terrific for moving large numbers of people quickly through dense urban areas. China is building thousands of miles of metro lines. But they are expensive and slow to build because of tunneling, and China cannot build metros fast enough to meet the demand for transportation in existing and new cities.

Some Brazilian mayors and planners invented a new method, which has been proven in dozens of cities and now is best exemplified in Guangzhou, China. This is Bus Rapid Transit, or BRT. BRT is conceptually elegant, sophisticated in design, incredibly effective, and cheap.

The basic idea is to think subway, but pay for bus. A subway

costs at least \$100 million per mile to build: BRT costs about \$5 million per mile. A 95 percent cost reduction is a good deal, but how does a BRT achieve subway speeds without the tunnels, trains, and stations?

Good BRT requires a half-dozen things be done well: First, buses need exclusive lanes, with no competition from cars. The middle two or four lanes of a boulevard need to be isolated with physical barriers for BRT use only. Why the middle lanes? To avoid conflict with turning cars, which plagues the outer edge lanes.

Second, BRT employs bus stations, not bus stops. The difference? A station is an area that people pay to get in, meaning their transaction is done before they board the bus; there is no bottleneck with people fishing for change. The buses, typically double or triple long, have a wall of doors, just like a subway, and they pull up level with the boarding platform. The doors open, a mass of people exit, another enters, and off the bus goes.

Third, the bus carries a transponder that turns traffic lights green as it approaches. This really increases transit speed.

The rest of the improvements include things like electronic ticketing, real-time schedule displays, coordinated feeder buses, free bike parking, clean, quiet buses, and so forth.

The net effect of this system? The Guangzhou line, built in nine months, hauls 800,000 people quickly per day. Properly designed, BRT is a game-changer.

### INGREDIENT THREE: EFFECTIVE BUILDING CODES

As China races onward and upward in a display of energy and ambition at an unprecedented scale, it must be recognized that future patterns are essentially being set. All the tons of concrete and steel being set in place will dictate the flow of Chinese life and commerce for many decades to come.

Getting it right from the start is far easier than later retrofit. Changing existing land use and transportation systems is inevitably much more costly than doing it right the first time. This is why our urban form recommendations are so impor-

tant. It's also true for buildings.

China has made good progress in the establishment of building codes. The country as a whole has made impressive gains in efficiency since this became an area of attention over the last decade, but there is more to be done in the area of enforcement. China already has stringent standards for many energy efficiency criteria, but suffers from inconsistent enforcement. There is also a need to build continuous improvement into the process. Very few places in the world have achieved all these elements: adequately ambitious standards, rigorous enforcement, and continuous improvement. Even California, a leader for years, needs to use more direct monitoring of building energy use, beyond ensuring a particular type of technology is being installed at the time of construction. Measurement of the installation quality and actual energy performance is needed.

### INGREDIENT FOUR: MUNICIPAL FINANCE REFORM

One of the chief obstacles we have found to sustainable urbanization has to do with the way cities are financed, and the type of development patterns that it creates. Chinese mayors are under intense pressure to succeed. They need to build new streets, civic buildings, schools, and more. They need to control pollution and energy waste, ensure that air and water are clean, and make the streets safe. They have to govern rapidly changing societies, including the peaceful incorporation of millions of rural migrants. And they have to do this in record time.

To finance this all, China's mayors lease land, in 99 year leases, to developers who put up apartment towers, shopping centers, and factories. The leases typically are for a large block—half a kilometer square—or even for several blocks, and are for one type of use, such as residential use or offices.

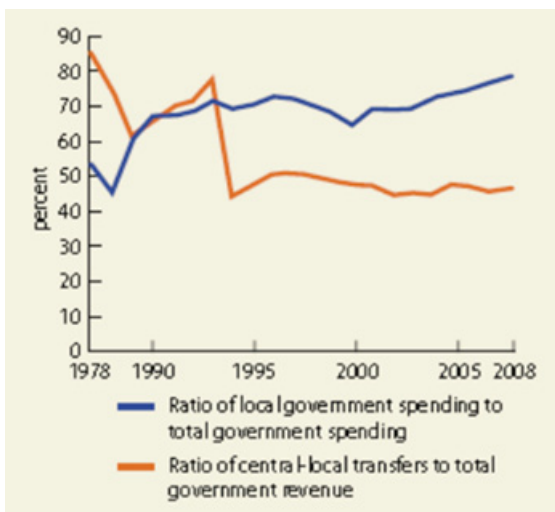
Developers are motivated by return on equity. This means they seek low costs, high priced sales, and fast turnover of properties. In China, this leads to a typical development, on these large blocks, of several exact copies of the same building, such as group of a dozen apartment towers, walled off from the streets.



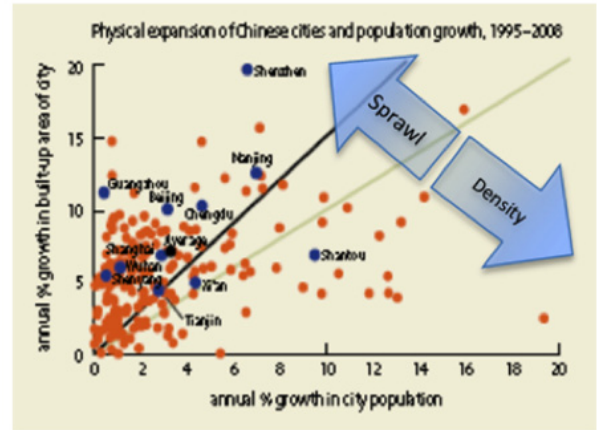
This arrangement suits the mayors, who get significant revenue with minimal hassle, and the developers, who can earn a generous rate of return. But when this pattern is repeated across town, the urban form that ensues is not suitable for a world-class city. The large blocks and single uses make the pedestrian environment difficult, and the remnant streets must be large, and get horribly congested. Single uses induce more travel, since over the course of a day, a typical person has to shop, work, recreate, and perhaps go to school, visit a clinic, or take care of other business, and that cannot be done in a single-use city without many long trips. Thus, finding an appropriate way to finance and manage sustainable development is a challenge for Chinese cities.

These dynamics are illustrated in the next two figures. Figure 4 illustrates the gap between central government transfers and levels of spending at the local level. Figure 5 illustrates how the physical extent of China's cities has grown much faster than urban populations, meaning population density has decreased. In sum, these two figures show how claiming land to help fill funding gaps would be a natural inclination (Figure 4), and the spatial trend that has been driven in large part by this (Figure 5). There is not an accepted definition of sprawl, but this trend of land usage surpassing population growth seems to indicate urban sprawl.

**FIGURE 3. GAP BETWEEN CENTRAL GOVERNMENT TRANSFERS AND LOCAL SPENDING**



**FIGURE 4. SPRAWL: EXPANSION OF URBAN BOUNDARIES OUTPACES POPULATION GROWTH SINCE MID-1990S**



Source: Figure 3: World Bank 2012 p.58, and Figure 4, p.31.

**DEVELOP STABLE REVENUE STREAMS FOR CITIES AND A MUNICIPAL BOND MARKET**

Beijing has already made it more difficult for cities to requisition rural land in order to fill funding gaps, making a strong step away from such unproductive incentives. Now cities must develop alternative revenue streams. There is movement in this direction: the Chinese government is reviewing many financing options, including the issuance of corporate bonds by state owned enterprises to fund municipal projects. There is likely to be many different tools tested before the government settles on a particular revenue solution. The establishment of reliable and adequate revenue streams, such as property taxes, is also being explored, and promises to be a more sustainable source of funds. The cities of Shanghai and Chongqing piloted residential property tax collection projects in early 2011.

**OTHER REVENUE STREAMS SHOULD BE EXPLORED AND UTILIZED, SUCH AS:**

- › Pollution fees can be collected directly on a per unit basis or through auctioning of permits. Such fees reflect the social costs of pollution that otherwise would not be reflected in market prices. Economists refer to this as the internalization of externalities.
- › User fees can be used to cover the administrative cost of a regulation or they can also be set to reflect the cost to

the government of treating pollution. Los Angeles, the home of the freeway, just started offering toll paying lanes on the 110 freeway between central and south LA with a guaranteed speed of 45 miles per hour for about US \$15.

- › Betterment charges for private developments to reflect the benefits they receive from public projects, chiefly the burden on public infrastructure that new developments will impose, including water, electricity, and transportation systems. An interesting approach has been pioneered in Portland, Oregon, where green buildings are encouraged through lower betterment fees than conventional developments.
- › Incentives should be put to greater use by the central government as a lever to encourage positive urban development patterns and distribute significant resources to cities. This is already happening to some extent. For example, the Ministry of Housing and Urban-Rural Development and the Ministry of Finance are in the process of offering grants for Eco-Neighborhoods. Funds of 15 million RMB are going to six initial projects.
- › Develop a bond market. Financing infrastructure, including robust public transit options, is a crucial challenge for China's mayors. Currently, the typical infrastructure investment is financed with two-thirds equity and one-third loans. If such investments could be equally divided between equity, loans, and bonds, the McKinsey Global Institute estimates the cost would be reduced by one to two percent, a huge savings for the scale of investments being made. The Ministry of Finance has issued a handful of local government bonds in a few limited circumstances, but current law does not allow for cities to participate in bond markets. In addition to legal changes, financial architecture to ensure efficient and effective bond markets is needed, including more effective controls to guard against overspending and a system of independent credit rating agencies to evaluate and provide credit ratings to cities.

Many countries use a capital improvement plan to prioritize investment within and across sectors. Such plans can be a

good tool for promoting fiscal integrity. Part of the planning process should also require a long-term financial plan that establishes how revenue needs will be met.

## INGREDIENT FIVE: SUSTAINABILITY PERFORMANCE METRICS FOR MAYORS

The notion of people-centered development and the numerous specific commitments across a range of economic and resource sectors make the 12th Five Year Plan the most ambitious yet in terms of sustainability. How can cities best help to meet and surpass these goals? New performance metrics are needed, quickly, to help understand where progress is occurring and where more attention is required. Until very recently, the performance of mayors has been evaluated almost entirely by their ability to increase their city's share of the regional GDP .

We need better measures of how cities are performing to help with management of the immense change they are experiencing. With the Paulson Institute, the China Sustainable Energy Program, and a host of partners, Energy Innovation is developing new metrics to support healthier, vibrant cities that are economic and innovation engines. We will produce a rapidly deployable assessment tool that will provide immediate feedback and help prioritization across a range of resource, waste, and pollution management choices.

Of course, while we must improve the quantity and quality of urbanization measurements, it is also notable that many important aspects of city management will not be quantifiable. This is why a well-designed and well-functioning planning process is important.

## INGREDIENT SIX: A STRENGTHENED PLANNING PROCESS AND TECHNICAL RESOURCES

Too much discretion about the form of a neighborhood is currently given to developers in China. Clearly development should remain driven by local circumstances, but greater detail and sophistication are required of the planning process if livable, walkable neighborhoods serviced by transit are to emerge.

Past practice has been that the central government reviews and approves master plans for larger cities and projects, but in reality all decisions are made by local mayors. The planning process needs to better reflect the local pace of change, so that plans are actually achievable.

Improved technical capacity is crucial. Currently the central government sets technical standards for cities in the areas of public transport and utility services. That is a good base to build upon, but the process needs more customization. For example, promoting transit-oriented development requires local knowledge. A new technical manual should be developed in an iterative process involving city leaders from around the country. It would be wise to develop new certifications for city planning, public accounting, engineering specializations and related technical fields. There is an acute shortage of well-trained urban planners. Some of the more mundane professions, such as building code inspector, also need better training programs and new talent.

Ideally, proposed plans would undergo stress testing, incorporating alternative future energy price scenarios, as well as water resource scenarios. Water is itself a complicated issue deserving of greater consideration. The McKinsey Global Institute report finds water pollution to be lowest in the most concentrated urban areas, essentially because they expect that regulation is more effective in larger cities. Such stress tests can help local officials understand the wisdom of the permeable city approach. It is important to recognize and plan around local variability.

## CONCLUSION

We are optimistic that China can channel its dynamic energy and financial might into leading a revolution in sustainable urban development. It is easy to worry that these efforts may be overwhelmed by the sheer scale of China's growth. However, we know that China's leaders are hungry for this type of practical, scalable advice for creating livable cities.

## ACKNOWLEDGEMENTS

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*2030: Building a Modern, Harmonious, and Creative High-Income Society.*

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