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In This Issue: **Infrastructure Financing and Public-Private Partnerships**

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The Role of Finance and Private Investment in Developing Sustainable Cities

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Three unstoppable trends will drive urban development, investment, and entrepreneurship in the next two decades. Investors and corporate managers need to be aware of these trends and understand how to invest in this context.

The first of the three global trends is urbanization. During the next 20 years, the population of the world's cities is expected to more than double, swelling from some three billion urban dwellers to over five billion by 2030.[1] These people will not all be moving to cities like New York and Mumbai and Shanghai. Instead, they will live in hundreds of cities whose names are largely unknown to today's finance community.

The second major trend is the growing shortage of resources that we commonly regard as "public goods." The world already has shortages of energy, clean water, clean air, and places to put garbage and waste water. Such shortages will become only more chronic as the urban population explodes.

The third trend is that no government has the funds, or even access to the capital, that will be required to properly design and deliver the buildings, transit, and water/power infrastructure that will be necessary for effective development of new cities and renovation of old ones.[2] As reported in newspapers nearly every day, few nations have even reached a political consensus about where to direct their infrastructure spending.

Business leaders can throw up their hands in dismay. Or, as I argue in these pages, the private sector can be aggressively involved in financing and investing in scores of new cities, with capital exercising a constructive influence on both planning and policy. The opportunity is enormous, but it is not well understood. The concrete, asphalt, and power lines are going down *today* that will determine the configuration and the future of these cities for a hundred years. This is big and it is urgent.

This article presents a four-part framework for thinking about where and how to invest, demonstrates the application of the framework with research examples from three cities in the developing world, and concludes with best practices for how to evaluate and structure investment and entrepreneurial opportunities in the world's new cities.

Why the focus on cities? First, as already noted, this is where the people are; the world will be increasingly urban. Second, this is where the value is created, and where the resources are used. According to the C-40 Cities Climate Change Group,[3] cities consume over two-thirds of the world's energy and account for more than 70 percent of global CO^2 emissions. And perhaps even more important, city governments have often shown greater ability for decisive action than federal or provincial governments. The mayors of many cities have exercised influence on planning, zoning, approvals, regulations, vendor selection, economic incentives, and public housing in ways that are unthinkable for state or national politicians.

A Framework for Creating Value in Sustainable Cities

Let's start with a working definition for today of "sustainable." The groundbreaking Brundtland Report[4] defines sustainability as meeting today's needs without diminishing resources for the future. In a pragmatic investment-oriented approach, I apply this logic to urban resources and commodities like water, clean air, power and their less desirable counterparts: solid waste, sewage, and greenhouse gases. For me, "sustainability" in cities, in property, and in transit can best be pursued by increasing the productivity of resources—that is, by stretching the finite resources we have today. This is of course a quite narrow definition; but it's one that can lead to substantial action steps beyond the hand-wringing about glaciers and rain forests. It's also a very large opportunity for private investment.

1. United Nations Department of Social and Economic Affairs: "World Urbanization Prospects," February 2008.

2. For example, the McKinsey Global Institute points out that India needs to invest $1.2 trillion in urban infrastructure over the next 20 years; at a rate more than eight times current annual spending. This funding gap has to be made up by the private sector. (MGI, "India's Urban Awakening," April 2010).

3. Mayor Michael R. Bloomberg of New York City is the current chair of the C40, whose mission statement includes the following: "C40 is a group of large cities committed to tackling climate change. By fostering a sense of shared purpose, the C40 network offers cities an effective forum in which to work together, share information and demonstrate leadership. Through a partnership working with the Clinton Climate Initiative, the C40 helps cities reduce greenhouse gas emissions through a range of energy efficiency and clean energy programs." (http://www.c40cities.org/).

4. The Brundtland Report of the World Commission on Environment and Development defines sustainable development as follows: "Humanity has the ability to make development sustainable—to ensure that it meets the needs of the present without compromising the ability of future generations to meet their needs." (WCED 1987).

Figure 1 **Government and Private Sector; Supply and Demand**

	Focus on policy and actions by government	**Focus on design and finance and actions by private sector**
Focus on solutions to increase supply	"We need to subsidize renewables" "The government needs to build subways"	"We need to invest in smart grid active sensor photovoltaic LEED biomass"
Focus on solutions to reduce demand or increase efficiency	"We need laws about mileage and carbon"	**"We need to figure out businesses and configurations that make money from resource efficiency"**

Following the trail of a finance-oriented resource productivity framework leads to four main concepts that can help us distinguish the high-impact investments from all the other distracting, enticing ways to spend money in the "sustainability" space. I'm looking for large-scale, replicable interventions with well-defined risks and reasonable returns.

- First, it's useful to distinguish between approaches and initiatives that aim to increase the *supply* of resources and those that aim to reduce the *demand* for resources (or to make the same finite resources go farther in serving businesses and citizens).
- Second, it's useful to separate the steps (interventions, investments, or policies) that depend on *government* action as compared to investments or interactions led mainly by the *private sector*.
- Third, *physical configuration* can matter a great deal with respect to return on investment. Effective planning and design of cities, roads, waterways, and buildings can have a much greater impact on power and water productivity than more esoteric interventions like smart sensors or renewable energy.
- Finally, and maybe at the most elementary level, investors need to consider the ramifications of "*developed economy vs. emerging economy*" and "*new construction vs. retrofit and rejuvenation*." For investors there is a big difference between "need for services" and "risk-adjusted return." I will argue below that a subset of investments in a subset of new cities in a subset of emerging markets provide some of the largest and most promising investments that will become available over the next 20 years.

The Case for Private Investment in Demand Side Infrastructure

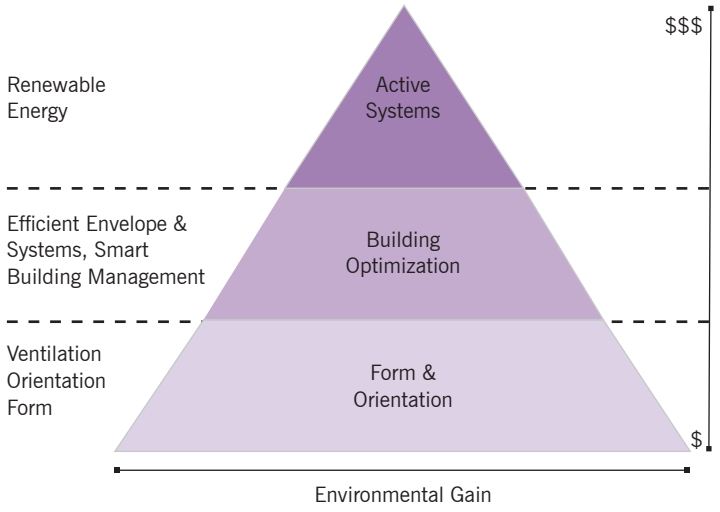
Much of the popular debate on infrastructure has taken the form of calls for government spending on roads and highways, high speed rail, and water plants. Such initiatives can be thought of as government responses to the "supply side" of the global resource shortage. While such initiatives and projects—which are represented graphically in the upper left quadrant of Figure 1—are clearly worth attention (and public and private capital), most governments cannot fund this investment alone, and cannot agree on how to invest. Thus such initiatives cannot be the sole answer to the challenge of creating sustainable cities—and they are not the main focus of this paper.

Another major focus of the public debate are "demand-side" initiatives such as government mandates of more energy-efficient building codes, higher mileage rules for auto manufacturers and, the granddaddy of them all, "a global price for carbon." The aim of such policy initiatives—which are represented in the lower left of Figure 1—is to restrict the use of scarce resources by decree. Although I happen to endorse many if not most of these policy initiatives, I don't expect them to materialize any time soon given the realities of the global political context. And, again, although critically important, they too are not the focus of this paper.

In the case of private investment and entrepreneurship, there is already quite a bit of attention on increasing the supply of resources like energy. One manifestation of this is in public-private partnerships for those kinds of infrastructure projects that generate cash flows to support such investments. Such projects are aimed at expanding supply—but since most also result in further depletion of many resources, they too fail to address the core issue of how to make resources go farther.

Also on the supply side, a number of my research and investment colleagues are involved in the development of what I like to call "cool tools." In the sustainability space, this would include technologies such as photovoltaics, carbon

Figure 2 **Pyramid of Environmental Gain x Cost**



Source: "Exploring Masdar City," www.masdarcity.ae

capture and sequestration, wind energy, nuclear energy, and water desalination. For venture capitalists, this is the set of activities and investments that are known as "clean tech" or "green tech." Although these are all promising initiatives that are based on defensible intellectual property, they are also all encountering difficulty in attracting significant R&D and start-up capital.[5] And almost all require both a large amount of capital to become mature businesses, as well as significant operating subsidies or usage mandates for their pricing to be competitive for energy buyers.[6] These tools alone are not a large scale "right now" answer to the problems of rapid urbanization, resource depletion, and lack of public capital.

This leaves private-sector investment and entrepreneurship aimed at stretching resources. As represented by the lower right corner in Figure 1, this is a vast, and as yet largely untapped, area where I believe investment prospects will explode in the next 20 years. These will take the form of both corporate entrepreneurial opportunities and city-scale infrastructure investments that are designed to *reduce* per capita demand for a public good by using it more efficiently. As discussed in the pages below, the new cities of Suzhou, China and South Saigon, Vietnam provide good examples of the use of foresight to provide efficient power, to invest in district scale water harvesting and processing, and to carve out rights of ways for mass transit—all funded by capital sources interested in significant long-term returns.

Getting the "Configuration" Right: The Key to More Environmental Gain at Less Cost.

Successful infrastructure projects begin with far-sighted planners and designs. Investors and city planners should target their designs, and their money, to projects where the benefits are likely to be the greatest. While this principle seems obvious, the extent to which it is missed or ignored by the administrations, city planners, architects, real estate developers, and corporations in my research is not just surprising, but shocking.

As a first step in such a cost-benefit approach, it can be helpful to think in terms of a pyramid of project considerations and attributes like the one presented in Figure 2. This thinking applies to buildings, campuses, neighborhoods, and even cities. The higher (or farther from the base) that one moves in the pyramid, the worse the cost-benefit tradeoff becomes. In this pyramid, the width of the segment is greater when the benefit is greater; and the elevation of the segment is higher when the cost is higher. The benefit-cost tradeoff at the top is the least attractive.

The important message from the pyramid is that the configuration of buildings (and of cities) makes much more difference in energy and water efficiency than almost any other kind of intervention. And initiatives at the top of the pyramid, such as renewable energy and active systems, however popular, may well turn out to be net losers in cost-benefit terms. Just because something is high tech does not mean it's the best

5. Exploring this capitalization problem, my HBS colleagues Josh Lerner and Joe Lassiter have written extensively about the "valley of death" in clean-tech. This is not like investing venture capital in information technology or medical devices. In the energy space, the capital needs are too large for the typical venture capital investor. And the technology risks of alternative energy initiatives are too large for the kind of municipal finance that has funded large scale investment in coal, gas, and oil plants.

6. See Noble, Carmen and Lassiter, Joe, "Venture Capital's Disconnect with Clean Tech," Harvard Business School Working Knowledge, October 18, 2010 http://hbswk.hbs.edu/item/6499.html.

Figure 3

	Developed Economy	Emerging Economy
New Cities, Roads, Power, Buildings	Few new cities or towns (or buildings) being built in USA, Europe, or Japan	**(The *return on investment* is here).** High value, few legacy obstacles, new customers, ability to finance, ability to configure for the long run, ability to show both short term and long-term return on infrastructure and building investments.
Existing cities roads, power, buildings	**(The *need* is here).** Many physical and political obstacles. Entrenched interests. Difficult work-arounds. Little demonstrable return on investment in energy retrofit or rebuilt infrastructure.	Legacy cities are currently the innovation and financial hubs…but many are so choked with people and bad "third world" infrastructure that they will become uncompetitive 2nd and 3rd tier cities.

Source: Macomber.com

solution. The most cost-effective solutions—those involving configuration, layout, density, and adjacency—are often not the ones pursued by the market. Investors need pay attention to this mismatch in thinking where to place their money.[7]

At the city scale, there is a critical added advantage for agglomerations that are resource-efficient due to these kinds of choices in compactness, exposure, and transit: The configurations pursued in the name of environmental sustainability turn out to also be a source of economic competitiveness. To the extent this is so, cities with resource-efficient infrastructures should be both more *physically* attractive (in the sense of offering a higher quality of living) *and* more *economically* attractive, offering lower cost of operations for employers. This is a win-win and I believe that many forms of capital will be attracted to the cities that can accomplish this. They will get there through long-view effective infrastructure development and urban planning.

Developed/Emerging vs. New/Retrofit

The fourth part of my framework has to do with important investment differences between the development of new cities and the renovation of old ones. Cities in the developed world tend to have existing concrete, steel, and asphalt assets that are hard to move. They also tend to have slow population growth, and business, political, and social interest groups that resist change. By contrast, new cities in emerging economies tend to have no existing concrete, steel, or asphalt (although they may have existing informal housing). This means that the infrastructure can be built *now*, and it can be built for the long run. These cities also tend to have rapid population growth, which leads to increases in the velocity of money, if not growth in GDP. As a result, it's easier to fund and build up new than to move around in the old.

The converse of this argument is that infrastructure (and buildings) in mature cities tends to need retrofit and renovation. This is very hard to finance in most instances because there is generally little or no increase in tariffs or revenue associated with continuing to deliver a flat level of services. This in turn is likely to mean that governments will have to fund the work in the mature economies. There aren't going to be good opportunities for private investment, notwithstanding the growing discussion of public-private partnerships or infrastructure banks. New infrastructure is almost always cheaper to build than patching up old. For this reason, investors and entrepreneurs should think about constructing water and sewage pipes for Suzhou or Ho Chi Minh (which often opens up new revenue streams), or starting energy services companies or car-sharing businesses in Delhi or Dalian, before contemplating an investment in the re-piping of Washington, D.C. or Los Angeles.

A Tale of Three Cities

In what follows, I will lead you through three cities where I've spent a considerable amount of time researching the effectiveness (or lack thereof) of private capital in increasing long-term competitiveness and efficiency. The aim is threefold: First, to expand readers' awareness of these immense opportunities for growth; second, to illustrate how the framework above can be applied in practice; and third, to lay the groundwork for useful closing rules for investors and entrepreneurs about how to recognize a fertile climate for significant investment in new cities with sustainable infrastructures.

Our tour will start with Gurgaon, a largely unplanned city of about 3.5 million that has recently sprung up just southwest

7. Substantial work has been put into analysis of benefit-cost tradeoffs in buildings and in cities. One example is the "Cost Curve for Greenhouse Gas Reduction" (McKinsey Quarterly, September 2007). Another manifestation is in the mismatch in commercial real estate where landlords don't want to invest capital in insulation or equipment that will only benefit the tenant's cost equation. This is addressed for example in the New York City "Green Lease" program (nyc.gov April 11, 2011). These types of configuration savings, and mismatched incentives, are also explored in my HBS case study, "Design Creates Fortune: 2000 Tower Oaks Boulevard."

of New Delhi and hence near the federal region of India. The city has experienced remarkable economic activity and growth in the last decade and is now the location of country headquarters for many global 1000 firms. It's also home to many new Indian companies. But if Gurgaon is in one sense a success story of private sector investing, the city has also become choked by traffic, subjected to power blackouts and extreme water shortages, and continues to be interlaced with slums—and in this sense, it represents a failure of planning.

Then we move to South Saigon in Vietnam. The south part of Ho Chi Minh City consisted of swamp coconuts, abandoned Viet Cong tunnels, and other detritus of the American War of the 1960s and 1970s. Although also located near the nation's financial center, South Saigon was developed, in pointed contrast with Gurgaon, using private capital *in combination with* considerable input from government planners following a master plan. That plan anticipated a final population similar to that of Gurgaon, but with road, power, and water infrastructure built ahead. I believe that this kind of model—which combines a long-range development plan with private capital with a variety of timeframes and risk/reward expectations—will prove to be a useful model for future cities all over the world.

The third stop is Suzhou, China. Although an historic city with centuries of culture, art, agriculture, and fishing, Suzhou is also a modern metropolis that is far enough from Shanghai to be its own center. At the core of the modern city is the Suzhou Industrial Park, a joint venture involving the government of China, the government of Jiangsu Province, the government of Suzhou, and—interestingly enough—the government of Singapore. Using both the insights of Singapore's planners and capital from its sovereign investment funds, Suzhou has been transformed into a viable, competitive, and cost-effective major city.

From each of these three examples, there are lessons to be learned about access to capital, the desirability and limits of government involvement, and structures for disarming political resistance.

So now that I've outlined the itinerary, let's begin our tour.

Gurgaon

Gurgaon is a high-growth city that is a satellite of New Delhi, the capital of India. Currently in the range of 3.5 million people live in greater Gurgaon.

The city was developed essentially as a series of uncoordinated speculative real estate deals. Major Indian property companies like DLF and Unitech led this activity. Thanks to its proximity to a major airport and downtown Delhi, along with cheap and largely unregulated raw land, Gurgaon quickly attracted major employers, both multinationals and local firms. This in turn spawned some housing and retail—but also slums and street vendors.

A drive through Gurgaon today is frustrating at best. Major streets are unpaved, there are few signs and no sidewalks, and gleaming high-rises are surrounded by dusty fields populated with cows and goats. The city has constant power blackouts, leading major firms to supplement power with their own diesel generators—an expensive, and dirty form of electricity. The widest toll booth on earth, with 52 lanes, separates Gurgaon from Delhi, and funds a large build operate transfer (BOT) toll road between the two cities. But traffic is frequently stopped dead on both sides of the toll, while trying to squeeze into local roads that are completely ill-equipped to handle the high volume.

Along with traffic inefficiency and waste of power, Gurgaon has an incipient water problem. With its water table receding at the rate of about one meter per year, it will not be long before bore wells no longer reach the water.[8] And it does not rain a lot in Gurgaon; the source of groundwater is primarily from underground rivers fed from glacier melt in the Himalayas. The property industry is just now starting to reflect that potential problem in the prices of real estate transactions.

Insights from Gurgaon:

• The *motivation of property developers* is to earn high returns on investment, measured usually over the time it takes to develop, populate, and sell or refinance single buildings. This is typically in months or a few years—which match the maturities of most investment fund portfolios. Such investors generally have limited incentives to invest in roads, water, power, and sewers in the near term even if one could demonstrate a much higher long-term value to property. And so another capital source needs to be identified.

• *New cities that grow in this ad hoc way quickly become uncompetitive economically* (whether with shiny high-rises like Gurgaon or shacks like Tijuana) because the cost of travel and utilities is so high. (This is also now a major concern for not only Jakarta and São Paulo, but also for Beijing.) Jobs go where the costs are lower, and where the hard and soft infrastructure is conducive to doing business. In countries with high economic growth and high population growth, the people follow the jobs.

• Although Gurgaon has been an economic success story for its major developers, its proximity to the national capital, pro-development state government, and first-mover advantages are all highly unusual conditions, casting doubt on whether its *success will be possible to replicate* under more "normal" or representative circumstances. According to the McKinsey Global Institute, the urban population of India is likely explode in the next two decades, from about 350 million to about 500 million.[9] It is inconceivable that 50

8. "Gurgaon Hit by Water Crisis," *Times of India*, March 24, 2008.

9. McKinsey Global Institute, "India's Urban Awakening: Building Inclusive Cities, Sustaining Economic Growth," April 2010.

more Gurgaons could be created. This city meets none of the criteria of my proposed framework for repeat investing in sustainable cities.

South Saigon

Phu My Hung is a new city in South Saigon, Vietnam. It's a private development that was funded largely by Taiwanese industrialists in close cooperation with the government of Vietnam. With a footprint similar in size to that of Gurgaon and a final build-out of about the same number of inhabitants, this can also be viewed as a new city—or at least as a "satellite city," in planning parlance—and hence more than just a large real estate development.[10]

The promoters of Phu My Hung, prodded by the government, followed a number of steps that called for substantially more capital investment in the early stages than would piecemeal development. But such investment is expected to create a final city with much higher value, as well as a more competitive cost, amenity, and standard of living situations than an "ad hoc" approach would have allowed.

For example, the planners of Phu My Hung addressed power early. The promoters envisioned, arranged capital for, and constructed a large power plant, one that was able to grow to its design capacity of 1,000 MW through a series of modular additions that were anticipated at the start of the process. Although this facility was used partly to energize the first phase of Phu My Hung, it was planned from the start to have enough capacity so that early in its life, it was providing more than 75% of the power to Ho Chi Minh City (the "old Saigon") itself. Then, as Phu My Hung grew, HCMC was able to construct its own power to free the PMH plant for South Saigon.

At the same time, HCMC and PMH laid out the 18 kilometer main road that now serves all of the South Saigon new city. Envisioned as an eight-lane highway, the road started with a first stage that was just two lanes, but with a right of way prepared to accept future traffic lanes as well as a central strip available for future metro or bus rapid transit. Thanks to this foresight, South Saigon-PMH at full build out is likely to be one of the most competitive cities in Southeast Asia in terms of both transportation and power.

Like all real estate developers, PMH and HCMC started with a phase that produced early cash flow. In the case of PMH, this was a manufacturing zone with export and tax benefits, which in turn (1) attracted capital investment by other private investors and (2) created jobs. With this momentum, the next stages of the city plan were carried out, and new parts of the city were built and sold or refinanced, providing more capital for further development. Saved for last were premium lots, a city center, and a series of visually attractive areas along the water. The promoters will realize their major returns when these lots are sold or developed. When this happens, the promoters will prove to have been the catalyst for a new city of more than two million people. What's more, because the promoters have retained partial ownership in many of its infrastructure investments, the city continues to realize significant cash flow from them.

Insights from South Saigon

In what may come as a surprise to many, this project was driven by "industrial houses"—that is, financial firms with engineering capabilities—and not by real estate companies. Arguably, this allowed them to take the long view with respect to return on investment. They did not need to meet the short-term return requirement demanded by most real estate firms.

- Possibly driven by a *manufacturing and systems mentality*, the promoters committed early to long-term configuration of transit and density, and notably to effective infrastructure for power and water that would be competitive for decades.
- *The presence of a large, long-view promoter* allowed for numerous special purpose vehicles to be organized for financing purposes (see box inset for the basic configuration). The capital structure of a power plant is different from that used when financing a road, which is different from that used when developing raw land or constructing a building. A promoter using different SPVs can match different risk profiles, return preferences, and cash flow expectations.
- *Density and verticality are sources of efficiency*. Planners influenced by the Singapore experience were of course sympathetic to the investment and operating cost benefit of density, proximity, and vertical construction—all of which substantially reduce the use of energy both to operate buildings and also to get people to and from buildings. This model was largely continued.

Although the project was driven by private-sector financing, private investors focused early in the process on the supply of power, roads, and land. What's more, they were able to do so while thinking of the long view in terms of both modularity (of the power plant and the roads) and also of the long-term effectiveness and productive use of resources to get more benefit with the same input, again in power, roads, water, and sewer. Configuration was an essential part of a master plan that allows for compactness and density, while also preserving water and efficient movement. The low cost/high benefit end of the cost curve was addressed with energy efficient buildings and effective transit paths. Partly because this was new construction on an untouched site in a rapidly growing economy, it offered a chance for both high returns and, thanks to the way the project was planned and carried out, relatively low risk to investors.

10. www.phumyhung.com.vn.

Suzhou, China

Suzhou is an historic city on a series of lakes in the Yangtze River system between Nanjing and Shanghai. It's near enough to Shanghai to drive out and back in a long day, but too far to be a satellite like Gurgaon or South Saigon. For centuries, Suzhou has been a center of art, horticulture, fishing, and the silk industry (it is the host of the mulberry bushes that are the home of silkworms, and of the industries that spin, weave, and industrialize silk).

In the visitors' center at Suzhou Industrial Park is a large mural showing Deng Xiaoping, paramount leader of China, receiving Lee Kuan Yew, Prime Minister of Singapore, in the 1980s. Deng, who expressed great admiration for both the urban planning and government efficiency of the island nation, is said to have conducted a competition to determine which Chinese city would be the first model of Sino-Singapore collaboration. Suzhou was chosen, and both the expertise and capital of Singapore sovereign wealth funds were used when creating the new city. The administrative and investment vehicle is the China-Singapore Suzhou Industrial Park, or SIPAC.

This expertise is reflected in several attributes of this competitive and resource-efficient new city whose population today is in excess of seven million.[11] Power, water, and transit are largely available at a scale that allows industry and housing to flourish. Global corporates now commit tens and hundreds of millions of dollars to build new facilities in Suzhou,[12] and on land that is only leased by investors—and thus continues to be owned by the city, which receives both a ground lease payment and gets the land back, plus improvements, at the end of the lease.[13] This type of industrial interest also leads to super-linear scaling and benefits all tenants of the city.

Insights from Suzhou:

• *Master planning counts*. The promoters created a multi-decade, multi-city master plan including transit, other infrastructure, and the rollout of industrial and housing zones. This meant that some plots had early value and some were retained for later, as in any real estate project; but in this case, the allocation of current and future benefits could be channeled toward the long view.

• *Investment in upfront infrastructure pays off*. Suzhou not only raised the ground in some places (by trucking in gravel), but also took care to lay out road and to embed an electric and water and waste infrastructure that could scale. Although not all the new facilities were installed with the idea of a multi-decade build out, it was planned and sized so that the load could be accommodated. This takes very patient and very thoughtful capital, which, as already noted, is not necessarily typical of either the private or public sectors when working alone. In the long run, the capital invested by the Singapore sovereign funds and by Chinese sovereign funds will, at least in theory, be returned directly in the form of fees to the master developer and participation in subsequent smaller projects.[14]

• *Governance matters*. Decision-making in new cities led by substantial private capital can be very difficult since investors and administrators negotiate the terms of almost everything. The Suzhou Industrial Park is formally a fourth level of government in China, beneath federal, state, and city; and the Park's general manager is both an employee of the park and the head political administrator in this zone.[15] But thanks to a system of oversight and checks and balances, interests should be aligned. Another distinguishing feature of the "Singapore model" is accountability of public officials. As Suzhou evolved over the decades, this expectation is said to have led to the removal of many administrators in modern Suzhou. The style of government may not have been democratic, but the political leaders expected a high level of competence and transparency from the other functionaries.

Suzhou also matches the proposed frameworks in many ways, with particular emphasis on outside capital (in this case from the Singapore sovereign wealth fund), and not all from the local government; and even the Chinese and Shanghai government's capital has been promised an equity-like return, thanks to rights in follow-on projects and land sales that were retained as part of the security for the infrastructure investment. The configuration of the city makes sense for corporations and commuters. While not outstandingly green, Suzhou Industrial Park still uses resources effectively with district scale power, water, and cooling as well as comprehensive and long-term water and waste water infrastructure. This development around an ancient city was accomplished on former farmland, providing, a highly beneficial opportunity to invest in new infrastructure in an emerging market.

Best Practices for Finance and Investment in Developing Sustainable Cities

Having finished our tour of three cities, what can investors conclude with respect to applying the frameworks? I offer the following four guidelines to help identify the target cities for

11. The SIP covers a total jurisdiction of 288 km^2, or about 110 square miles or 70,000 acres. (The total area of Manhattan is about 33 square miles and the five boroughs of New York are about 320 square miles).

12. For example, foreign companies now invest very large amounts of their own capital in assets in SIP. "Samsung Suzhou LCD (SSL), a joint venture of Samsung Electronics, Suzhou Industrial Park State-Owned Assets Holding Co., Ltd., and TCL Group, held a ground-breaking ceremony on May 30. The initial investment of the country's first LCD project with a foreign company as the controlling shareholder is three billion U.S. dollars. The plant with monthly capacity of 100,000 panels is expected to start production in January 2013 and the main product is TV panels bigger than 40 inches, which makes it the biggest South Korean project in China." http://www.sipac.gov.cn/english/categoryreport/IndustriesAndEnterprises/201105/t20110531_91018.htm.

13. Ref: interviews on site June 2011.

14. Recent accomplishments for the SIP are measured in hundreds: Four "Hundreds of Billions" achievements: RMB 133 billion of GDP [about $20 billion USD], RMB 165 billion of accumulated taxes (about $25 billion USD), USD 18.9 billion of accumulated utilized foreign capital and RMB 197.2 billion of accumulated registered domestic capital. http://www.sipac.gov.cn.

15. Suzhou Industrial Park Investment Guide, "Organization of China-Singapore Joint Steering Council," http://www.sipac.gov.cn/english/InvestmentGuide/SinoSingaporeCooperation.

investment, the kinds of assets to invest in, and the optimal structure to enable such investments to achieve the highest risk adjusted return on investment—all within the framework of major private sector investment in infrastructure that seeks to use finite "public good" resources more productively. This has to happen in order to get trillions of dollars of investment put to good use in creating hundreds of new cities for billions of new urban dwellers.

1. Capital is not stupid. Many cities and countries seem to think that "public private partnerships" are a panacea for all their infrastructure woes. This is clearly not true: although the best PPP investors have value-adding capabilities, access to "dumb capital" by itself is not likely to provide a solution. The best PPP projects seem to arise when the privatizer also has significant operating experience with the asset and where there is a clear benefit to the capabilities, speed, and transparency that a proper PPP can bring. Obviously, the PPP investor, or the infrastructure investor, or the mezzanine lender, or the special purpose vehicle (SPV) partner needs to see a path to repayment. Money flows to efficient use and lower risk. Efficient infrastructure in competitive cities *enhances* the chances of repayment and, in so doing, reduces the risk of the investment and *lowers* the coupon. Money will flow to this definition of smart cities.

2. Configuration matters. Density of occupancy and proximity of uses means less energy, less water, and less wasted time. From a planning and design point of view, configuration and massing are also what lead to variety, air, sunlight, open space, and vibrant public places. These factors make new cities attractive to the knowledge workers who create disproportionately high value—and also attract more jobs. Configuration also helps to answer the aesthetic part of the question already addressed above by the economics: who would want to live here? Invest in cities whose design works with this rule, not cities that have to fight against it.

3. Sharing matters. Verticality, mass transit, a shared water plant, and district cooling are all examples of sharing fundamental mechanisms that have economies of scale. This is how effective cities achieve super-linear scaling. An effectively designed city, for example, can accommodate twice as many people and jobs without needing twice the roads, metros, stores, government offices, or bus lines. Similarly, techniques like "smart grid" or at least effective sensors, coupled with contracts to encourage optimization, can lead to major savings in both the variable cost of electricity and in capital costs by avoiding the need to build inefficient "peaking capacity." That is, through effective use of concepts like load leveling, peak-load sharing, and planning for trading of energy needs and contracts, cities can avoid replication of capacity that often stands idle.

4. Financial Engineering adds liquidity. There are many layers of investment securities that can and have been used in funding the development of new cities. Governments and promoters can use simple financial engineering to create tranches of investment that reflect more than just priority in repayment, but also build different vehicles with different returns. These vehicles can attract different—or overlapping—investors to build heavy infrastructure like dams and power plants as well as light infrastructure like roads and sewers. They can also attract investors interested in land and property development, and in owning equipment, property development. One insight of financial engineering is that each of these investments may have significant differences in risk and payoff profiles, which could in turn require differences in coupons, maturities, and priorities. Sustainable cities take advantage of these different preferences. (See Appendix).

Conclusion: Using Finance to Build Sustainable Cities

Rapid urbanization, resource scarcity, and lack of government funding are three major global themes of our time. Thoughtful entrepreneurs, investors, and planners can use the tools of business and investing to shape hundreds of better cities and millions of better lives—while earning high returns in the process.

There is an abundance of private sector opportunity for investing in resource productivity that extends capacity in making, moving, or sharing goods and services. The tools of urban planning, finance, and entrepreneurship can and should be combined to develop companies that enrich their owners by using every gram or kilowatt of resources more effectively. To the extent they succeed, they will grow cities that compete both environmentally and economically because the cost of doing business also goes down with efficient use of transit, building massing, and energy.

To realize these opportunities, action will be needed on all fronts—not only by governments but with the help of the private sector—and not only in adding new supply, but in extending resources so as to reduce demand in new cities, in old cities, in new construction, and in retrofit and revitalizing. This development is happening fast, it's happening now, and it's often happening without a plan. Business (and finance) cannot solve the world's problems on its own. But none of the world's problems will be solved without their help. This article has tried to identify some of the lenses to consider when looking at investments—and some of the action steps to create value in sustainable cities.

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Figure A-1 **Baseline**

Investing in Sustainable Cities																				
Pro Forma Model for Master Development Discussion					**Scenario:**	**Baseline: NO Investment in Resource Productivity**														
	Total		**Total Built SF 000,000's**	**Non-"Eco" Cost/ Acre**	**Eco-Premium**	**Cost/**	**Total**	**Year**												000,000's
Outflows (Aggregated from all parties)	Acres	FAR	43,560	000,000's	(what-if)	Built SF	000,000's	0	1	2	3	4	5	6	7	8	9	10		Total
Land Acquisition Cost	7,150			$1.00	0.0%		7,150	3,000	2,000	2,000	150									7,150
Cap Ex Major Infrastructure (see list)	7,150			$0.50	0.0%		3,575		1,192	1,192	1,192									3,575
Prepare Lots and Sites for Sale	4,290	1.00	186.9	$0.10	0.0%		429			86	86	86	86	86						429
Build Commercial and Res Bldgs for Sale	2,860	1.00	124.6			250	31,145				4,449	4,449	4,449	4,449	4,449	4,449	4,449			31,145
			311.5				**42,299**	3,000	3,192	3,277	5,877	4,535	4,535	4,535	4,449	4,449	4,449			42,299
Inflows (Aggregated to all parties)																				
Property Tax				5%	0.0%				0	0	0	0	334	667	1,001	1,335	1,669	2,002		7,008
Infrastructure Use Fees (Net of Cost to Provide)				4%	0.0%				0	0	0	0	267	534	801	1,068	1,335	1,602		5,606
Sale of Lots and Sites At Margin of =				100%	0.0%				0	0	172	172	172	172	172	0	0	0		858
Sale of Commercial and Res Bldgs at Margin =				50%	0.0%				0	0	0	6,674	6,674	6,674	6,674	6,674	6,674	6,674		46,718
								0	0	0	172	6,846	7,113	7,380	7,646	7,742	8,009	8,276		53,182
Measures of Profitability (Allocated to different securities)					**Disc Rate**															
Land Acquisition Cost (no matching inflow)								(3,000)												
Infrastructure Net Inflows less Outflows								0	(1,192)	(1,192)	(1,192)	0	267	534	801	1,068	1,335	1,602		2,031
Discount Rate =					5%	NPV =	**474.4**													
Lots and Sites Net Inflows less Outflows								0	0	(86)	86	86	86	86	172	0	0	0		429
Discount Rate =					10%	NPV =	**219.9**													
Commercial and Res Bldgs Net Inflows less Outflows								0	0	0	(4,449)	2,225	2,225	2,225	2,225	2,225	2,225	6,674		15,573
Discount Rate =					20%	NPV =	**2,320.3**													
Aggregate Net All Outflows and Inflows								(3,000)	(1,192)	(1,277)	(5,555)	2,310	2,577	2,844	3,197	3,293	3,559	8,276		15,033
						IRR =	**16.20%**													
Other Indicators of Economic Activity:																				
Jobs/1000 SF of total built SF					2	=	**622,908**	jobs												
Annual contribution to GDP per Job					$50,000		**$31,145**	million in contribution to GDP per year												

Notes: Assumes sponsor funds 100% of infrastructure and either sells lots/sites or constructs and sells finished buildings. Assumes some entity can measure and track total "GDP" or value of other economic activity. No inflation is modeled. No debt is modeled. Assumes all buildings are sold as completed so there is no "terminal value" from rental revenue in this model (although infrastructure fees would be a plausible candidate).

Appendix: City Scale Investment and Cash Flow

The private sector has tremendous influence on the design and finance and execution of projects at the serious city scale—projects intended for well over a million residents. No government in the world has the financial capacity to build ahead for enough cities to accommodate three billion people. Governments need to turn to the private sector for funds, expertise, and manpower. And as readers of these pages know, there is a large amount of capital seeking "bond-like" or "muni-like" or "infrastructure" returns. The art of freeing up this money at reasonable rates is not, of course, in increasing the coupon, but in taking risk out of the investment. My research with firms like IDFC India,[16] the Sino-Singapore Tianjin (China) Eco-City, and King Abdullah Economic City in Saudi Arabia all suggest that there are three or four distinct stages, time frames, and risk factors for investment:

1) Build the basic infrastructure (one shot or in phases)

2) Prepare land for sale (large parcels or small); decide when to sell

3) Improve the land (build structures); monetize through sale or rent (by the promoter or by others)

4) Identify all of the non-real estate follow-on benefits of jobs, manufacturing and services output, retail, housing; what investment, what revenues? (This last is so difficult to model that most government and quasi-government entities proceed on the assumption that if they do 1-3 well, then 4

16. My Harvard Business School case study, "IDFC India: Infrastructure Investment Intermediaries," describes the ways in which this quasi-government "think tank" helped to free up the market for private capital in public infrastructure in India. IDFC both rethought the guidelines for competition and for concession agreements, and also organized its own capital and funds from investors to take at-risk positions in early infrastructure deals in India.

Figure A-2 **Illustration with Investment in Resource Productivity, with Related Assumptions Around Costs and Revenues**

Investing in Sustainable Cities																				
Pro Forma Model for Master Development Discussion					**Scenario:**	**Comparison: WITH Investment in Resource Productivity**														
	Total		**Total Built SF 000,000's**	**Non-"Eco" Cost/ Acre**	**Eco-Premium**	**Cost/**	**Total**	**Year**												000,000's
Outflows (Aggregated from all parties)	Acres	FAR	43,560	000,000's	(what-if)	Built SF	000,000's	0	1	2	3	4	5	6	7	8	9	10		Total
Land Acquisition Cost	7,150			$1.00	0.0%		7,150	3,000	2,000	2,000	150									7,150
Cap Ex Major Infrastructure (see list)	7,150			$0.50	15.0%		4,111		1,370	1,370	1,370									4,111
Prepare Lots and Sites for Sale	4,290	1.20	224.2	$0.10	0.0%		429			86	86	86	86	86						429
Build Commercial and Res Bldgs for Sale	2,860	1.20	149.5			250	37,374				5,339	5,339	5,339	5,339	5,339	5,339	5,339			37,374
			373.7				**49,065**	3,000	3,370	3,456	6,945	5,425	5,425	5,425	5,339	5,339	5,339			49,065
Inflows (Aggregated to all parties)																				
Property Tax				5%	0.0%				0	0	0	0	440	881	1,321	1,762	2,202	2,643		9,250
Infrastructure Use Fees (Net of Cost to Provide)				4%	25.0%				0	0	0	0	440	881	1,321	1,762	2,202	2,643		9,250
Sale of Lots and Sites At Margin of =				100%	10.0%				0	0	189	189	189	189	189	0	0	0		944
Sale of Commercial and Res Bldgs at Margin =				50%	10.0%				0	0	0	8,810	8,810	8,810	8,810	8,810	8,810	8,810		61,668
								0	0	0	189	8,998	9,439	9,879	10,320	10,572	11,012	11,453		71,862
Measures of Profitability (Allocated to different securities)					**Disc Rate**															
Land Acquisition Cost (no matching inflow)								(3,000)												
Infrastructure Net Inflows less Outflows								0	(1,370)	(1,370)	(1,370)	0	440	881	1,321	1,762	2,202	2,643		5,139
Discount Rate =					5%	NPV =	**2,328.0**													
Lots and Sites Net Inflows less Outflows								0	0	(86)	103	103	103	103	189	0	0	0		515
Discount Rate =					10%	NPV =	**268.8**													
Commercial and Res Bldgs Net Inflows less Outflows								0	0	0	(5,339)	3,470	3,470	3,470	3,470	3,470	3,470	8,810		24,293
Discount Rate =					20%	NPV =	**4,176.6**													
Aggregate Net All Outflows and Inflows								(3,000)	(1,370)	(1,456)	(6,607)	3,573	4,014	4,454	4,981	5,232	5,673	11,453		26,947
						IRR =	**23.38%**													
Other Indicators of Economic Activity:																				
Jobs/1000 SF of total built SF					2	=	**747,490**	jobs												
Annual contribution to GDP per Job					$50,000		**$37,374**	million in contribution to GDP per year												

Notes: Assumes sponsor funds 100% of infrastructure and either sells lots/sites or constructs and sells finished buildings. Assumes some entity can measure and track total "GDP" or value of other economic activity. No inflation is modeled. No debt is modeled. Assumes all buildings are sold as completed so there is no "terminal value" from rental revenue in this model (although infrastructure fees would be a plausible candidate).

will happen.) In practice, all of the follow-on benefits depend on job growth, and only indirectly on land development. The best in class new urban agglomerations, whether led by government or private sector, reflect this reality.

The pro forma template in Figure A-2 is meant to be representative of the sources and uses of funds in such investments, and of their eventual returns. The promoters (in this case a quasi-government body) lay out funds toward ends like land purchase, road building, and water plants; and they anticipate the long-term return of capital through land sales, water charges, railway operations, and property tax. For illustrative purposes, this model at a very gross level includes some measure of jobs created by the infrastructure investment, and extrapolates other additions to the economic region of the project (the equivalent of local GDP) that are expected to be catalyzed by it.[17]

Two factors are being modeled. One is the added cost of building "eco-friendly" infrastructure, raw lots, and finished buildings—which is matched against the expected "eco-premium" that is created and will be realized in rents, lot sales, and building rentals. The other factor is the separation of layers of investment by infrastructure development, sales of lots and sites, and sale of commercial buildings. In this model, the investors are assumed to have a wide variety of costs of capital; all of the projects have positive NPV with those variable discount rates; and risk and return volatility

17. This pro forma is derived primarily from my HBS Case Study, "Masdar and Tianjin: Eco-Cities" and secondarily with insights from the Draft Development Plan for DISIRDA, the Dholera Special Investment Regional Development Authority, Gandhinagar, Gujarat, India – 5 January, 2011.

Figure A-3 **"Productive" Pro Forma vs. "Baseline" Pro Forma**

	Productive	Baseline	Differ-ence	(000,000)	Pct Diff
Total Cost	$49,065	$42,299	$6,765		16.0%
CapEx Major Infra	$4,111	$3,575	$536		15.0%
Total Built SF	373.7	311.5	62		20.0%
Annual Inflows Yr 10	$11,453	$8,276	$3,177		38.4%
Aggregate IRR	23.38%	16.20%	718	BPs of IRR	44.3%
Infra NPV	$2,328	$474	$1,854		
Lots NPV	$269	$220	$49		
Commercial NPV	$4,177	$2,320	$1,856		
Total Jobs	747,490	622,908	124,582	Jobs	**20.0%**
GDP as function of Jobs	$37,374	$31,145	$6,229		**20.0%**

are spread away from the long-term infrastructure notes and into the shorter- term property development activity.

In Figure A-3 one can see the major differences between the "productive" pro forma and the "baseline" pro forma. It's easy to see a substantial benefit to aggregate IRR and to annual inflows in Year 10. As with most incremental investments, more money has to be spent up-front in order to reap the returns down the road.

The difficulty in implementing this kind of "whole system view" in cities is that there is usually no financial mechanism for the consideration of aggregate benefit to the whole. All of the actors are usually independent and making segregated investment decision. Additionally, in this illustration the added six billion dollars of investment by one party might lead to benefits enjoyed by others parties, unless the gaps in the urban finance problem can be overcome.

To address this gap in the examples of both Suzhou and Phu My Hung, the early-stage capital also participated in the late stage investments by retaining infrastructure and taxing privileges, by being allowed to invest as equity holders in later-stage investments, or by holding out land. Symmetrically, in some situations my research indicates that for entrepreneurs to be considered for later-stage investments, they must have participated in funding of the early-stage work. This is a growing aspect of municipal finance in emerging economies where the political environment is amenable to these kinds of requirements of capital. When applied well, the outcome is better for the whole system. From a negotiating point of view, the parties figure out how to create more value; then via the deal structure for each of these layers of investment, they determine how the total value created by the project gets divided among the different investors.

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