

Rethinking Infrastructure: Voices from the Global Infrastructure Initiative

May 2014



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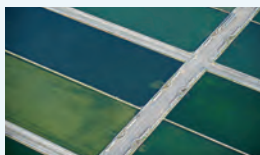
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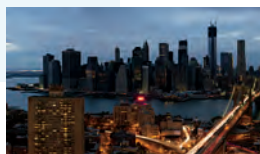
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Introduction

The Global Infrastructure Initiative (GII) exists to bring together the most important leaders and thinkers from all disciplines in the sector worldwide to rethink infrastructure and to challenge and inspire us to meet the needs of a growing, urbanizing global population.

When the GII first met in 2012, we presented the initial findings of our report *Infrastructure productivity: How to save \$1 trillion a year*. We pointed out that \$57 trillion in global infrastructure investment would be needed between 2013 and 2030 just to keep up with growth—and that there are substantial barriers to delivering it. In Europe, it takes an average of four years to obtain a permit for power infrastructure. Seventy percent of water in Nigeria is unmetered or stolen. There has been no gain in construction-sector labor productivity over the past 20 years in Germany, Japan, and the United States. Every region and every type of infrastructure faces issues.

But we also suggested a path to gains in infrastructure productivity, which could total \$1 trillion a year in savings. Governments can provide greater clarity about roles and priorities, delivery can be streamlined, operations can be improved, and data can increasingly be collected and harnessed to improve productivity.

Over two and a half days in Istanbul, a unique gathering of presidents, ministers, mayors, CEOs, financiers, architects, engineers, construction executives, and advisers debated and shared ideas in the field of infrastructure. The program centered on dialogue, rather than one-way presentations,

and at its conclusion participants were clear in requesting that the conversation continue.

Today, as we launch the 2014 GII, we are delighted to present *Rethinking Infrastructure: Voices from the Global Infrastructure Initiative*. This volume contains 11 provocative “thought starters” from leaders in their field. Each explores the challenges of new infrastructure from an individual perspective and points to different issues and solutions (the views expressed are those of the authors and not necessarily of McKinsey & Company). Unifying them, and a theme of this year’s conference, is an emphasis on pragmatic solutions that can be rapidly executed to address the global infrastructure challenge.

This publication deepens and extends our conversation. Over the course of our time together, we will add ideas, debate them, and refine them. Additional discussions in Rio de Janeiro will cover operations, the details of planning and financing, and other issues. In the autumn, we will produce a companion collection of essays and reflections, drawing on our ongoing debate and covering new issues.

The collection explores four themes:

- [Winning public consent](#) explores the role of public opinion on infrastructure policies and how infrastructure leaders can learn from the agility and customer focus of consumer-goods companies.
- [Financing and ownership](#) tackles the challenge of matching projects with institutional investors,

public–private partnerships (PPPs), the Hong Kong rail-plus-property model, and alternatives to direct sales as ways of increasing revenue.

- **Improvements in design** investigates the benefits of building resilience into infrastructure projects, “inspired” and future-proof architecture, and the prefabricated and energy-efficient designs of the Broad Group.
- Finally, **new infrastructure in emerging economies** offers two reflections on the challenge and change needed in China’s remarkable infrastructure effort, as well as a look at the opportunities for energy infrastructure.

Chapter 1: Winning public consent

The challenge of winning public support kicks off our volume in “Making the consumer case for major infrastructure,” by Dominic Maxwell, Julian Mills, and Stuart Shilson, who have led much of McKinsey’s recent transport and infrastructure work in the United Kingdom. They point out that decisions are ultimately won not just with technical arguments to elite decision makers but with hearts-and-minds appeals to the public. Infrastructure planners, project proponents, and other leaders, they argue, should learn from the customer-focused world of consumer goods. In particular, infrastructure leaders can learn to think positive in developing brand personalities for their projects, to think big by quantifying infrastructure’s broad catalytic benefits, and to keep talking via customer research and social media.

Chapters 2–5: Financing and ownership

As infrastructure proposals win public consent, they must resolve financing and ownership issues. Four articles explore the challenges involved.

In chapter 2, “Making a better match between institutional investors and infrastructure investments,” Frédéric Blanc-Brude probes why it is so difficult to match long-term money with long-term investment projects. As research director of the EDHEC-Risk Institute, his experience in infrastructure finance spans ten years, including active involvement in transactions with a cumulative value of more than \$6 billion across Asia, Europe, and the Middle East. A “knowledge deficit,” he says, plagues asset definitions, performance, and benchmarks. Two requirements would better match investors and projects: preserving the benefits of delegation to a specialist manager, who can act on behalf of an active asset owner, and making it easier to hold a passive investment stance through improved long-term performance monitoring and benchmarking.

One example of successful matching of projects and investors is the greenfield PPP explored in chapter 3, “Using PPPs to fund critical greenfield infrastructure projects.” Author Thierry Déau founded the greenfield-focused investor and asset-management company Meridiam in 2005. He now serves as chair and chief executive, with €2.8 billion in assets under management, invested in 25 projects worth €24 billion. He argues that well-structured PPPs can help governments ensure that greenfield projects are delivered on time and within budget. For investors that enter a project in its early stages, meanwhile, there can be a premium of several percentage points. To capture this, they must manage risk properly, with the right contract framework and political risk assessment and management. He calls on governments to develop a clear pipeline of opportunities, investment predictability, regulations that encourage economic stability, and roles as facilitators and guarantors.



An alternative approach is Hong Kong's rail-plus-property model, described in chapter 4, "Keeping 21st-century cities on the move." Author Jay H. Walder is CEO of Hong Kong's MTR Corporation, which carries an average of five million passengers every weekday across its services. In Hong Kong, new rail lines are financed over the long term by providing the rail operator with land-development rights along the line: it is able to pay the government the value the land would have been worth in the absence of the railway. MTR builds integrated communities along the line and so is able to provide a world-class public railway with minimal government investment.

Other governments looking to raise funds for new infrastructure investments and other causes often look to privatizations and asset sales. In chapter 5, "Maximizing revenue from government-owned assets," Robert Palter, global leader of the infrastructure practice at McKinsey, and Stuart Shilson, a fellow McKinsey director, lay out why privatization is just one of many options to explore. Alternative approaches can also monetize substantial value, along with actual sales. To master the full range of options, governments must be clear on their own motivations, conduct a thorough "scan and sift" of potential assets, identify opportunities, and execute carefully.

Chapters 6–8: Improvements in design

Uwe Krueger is the CEO of Atkins, one of the world's leading design, engineering, and project-management consultancies. In chapter 6, "Inspired infrastructure," he explains that

for infrastructure to meet the globe's growing, urbanizing population it must do the following:

- fulfill multiple objectives, as illustrated by Malaysia's new Asia Aerospace City
- be built from a coordinated, long-term approach, with governments and industry supporting each other, as with Qatar's National Development Strategy
- break away from a silo mind-set and draw on the expertise of many, as shown by London's Crossrail
- be sustainable and "future proof," delivering sustainability in all projects

Judith Rodin, president of the Rockefeller Foundation and cochair of the New York State 2100 Commission on long-term resilience, picks up the sustainability theme. In chapter 7, "Infrastructure and the resilience dividend," she details the story of Arverne by the Sea, a seaside housing development in New York City that bore the brunt of Superstorm Sandy largely unscathed. This was thanks not just to planning for storm damage but to a form of resilience that, rather than trying to keep all bad things out, anticipates unpredictable events and incorporates the ability to "fail safely." Government and the private sector have a role to play in promoting this form of resilience, Rodin argues, to permit cities to enjoy a "resilience dividend."

Some of the world's most extraordinary breakthroughs in design and construction in recent years have come from the Broad Group, whose CEO, Zhang Yue, talks with McKinsey director David Xu in chapter 8, "Rethinking conventional construction." Through design improvements and off-site prefabrication, Broad Group completed a 30-story structure in 15 days. It is now building the 200-plus-story Sky City, with 90 percent of workload off-site and new standards in energy efficiency.

Chapters 9–11: New infrastructure in emerging economies

Given its unique role in building the infrastructure of the future, China is the subject of intense focus in the infrastructure universe. By 2020, China aims to integrate 100 million rural migrant workers into urban life, revamp shantytowns of 100 million people, and urbanize 100 million people in China's central and western regions.

The scale of the undertaking is laid out in chapter 9, "Infrastructure's central role in China's 'new urbanization,'" by Xiaodong Ming, deputy director of the planning department of China's National Development and Reform Commission. The overarching goal, he explains, has now shifted to quality and efficiency. Transport will be a key priority, including integrated transport, high-speed rail among major clusters, and connecting small and midsize cities to hubs. Investment will come from local-government bonds, franchises, central-government bonds, private finance, and innovative mechanisms.

Zuo Kun, executive vice president of China Development Bank Capital, explores the

challenges ahead in chapter 10, "Critical issues in the next decade of China's infrastructure effort." He argues that future urbanization and infrastructure construction will have to meet higher quality requirements and financing models and must move away from a single-source approach toward a greater reliance on the market. In addition, he highlights the need for Chinese construction companies to globalize the "made in China" brand and to expand internationally.

Arif Naqvi, group chief executive of the Abraaj Group, wraps up our volume with "Energy infrastructure: Seizing the opportunity in growth markets." He points out that over 35 million Kenyans, 80 million Nigerians, and millions of Ghanaians live without electricity. Investors in energy-infrastructure projects should view the risks of countries individually, recognizing the exemplary history of Kenya and opportunities in Nigeria, rather than applying a blanket risk premium.



As these authors detail, the infrastructure world must respond to some of the most significant, transformative challenges on the planet: urbanization, development, growing populations, and the threat of climate change. In doing so, the industry faces challenges of its own—around public consent, financing and ownership, improvements to design, and other issues. These 11 thought-provoking articles, from some of the leaders of the field, demonstrate the appetite of the industry to engage with the challenge and solve the most pressing issues together. The Global Infrastructure Initiative will continue to remain at the heart of that conversation. ○



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Making the consumer case for major infrastructure

Infrastructure leaders who are looking to win public support for new projects can learn from industries that understand their customers.

**Dominic Maxwell,
Julian Mills,
and Stuart Shilson,**
McKinsey & Company

In the world of Twitter and citizen campaigns, of strained budgets and competing needs, infrastructure decisions will always be hard fought. But how are they won, and how should they be decided? Not just with technical arguments to the elite but with hearts-and-minds appeals to the public and a deep understanding of citizens' and customers' needs.

Infrastructure leaders who are considering new investments and looking to win public support can learn from their peers in consumer-focused industries, companies that define themselves—and live or die—by their ability to understand customers and to adapt quickly and precisely to emerging trends and preferences.

Incumbent operators, too, can apply these techniques. Holding a monopoly position, as they often do, makes it easy to pay little attention to the consumer. We are in an industry of hard hats and operational focus more than focus groups and customer segmentation.

But in the long term, returns from infrastructure always depend on the end customer who pays the bills. True, there will be regulation and political context, but ultimately, the best strategy for regulation and for stakeholder management, and the right strategy for the country, is a strategy centered on meeting the needs of consumers and citizens.

For example, Thames Water, a UK private utility company that provides water and waste treatment for 15 million customers in London and the Thames Valley, has prices strictly set by an independent, technical regulator. Its formally stated vision, though, is that “if customers had a choice, they would choose Thames Water.”

A strong focus on the customer does not mean every investment should go ahead, and the counterarguments on cost or local impact should sometimes be decisive. It does, though, mean that infrastructure planners and proponents should prepare the right facts and conduct the right research.

How can we refocus on the customer? From serving some of the largest companies in consumer goods and infrastructure, we suggest three steps:

- **First, think positive.** The best consumer companies are focused and disciplined about their brands’ positive value proposition and core emotional appeal, but the same is not always true for those making the case for infrastructure.
- **Second, think big by considering “catalytic” benefits to the economy.** Catalytic benefits are part of the standard framework of economic assessment and include broad impact on trade, investment, and industrial clusters. They are also part of a hearts-and-minds strategy that appeals to a far wider contingent. By speaking to the core of what a benefit does and feels like, they speak to issues of identity and pride.
- **Third, keep talking.** Consumer and retail companies make use of constant feedback from

their consumers through purchases, but the insights from systematic analysis of social media and “generated data” such as Google searches are valuable, and are also continuing to increase. To understand the conversation that they are in the midst of, infrastructure companies and planners should mine these insights.

Think positive

As mentioned, the first step for infrastructure companies is to think positive, learning from customer research in consumer-goods companies to deeply understand the specific, positive, and emotionally resonant appeal of their project. In many ways, consumer-goods companies have always known how to do this. Coca-Cola’s “brand emotion” is happiness and moments together, and each advertisement and brand presentation offers a variation on that theme. Its 2010 World Cup theme song, “Wavin’ Flag,” had more than 20 different variations appealing to different regions, but all played on the brand’s core emotion, happiness.

Similarly, stories of national progress and development, as well as the broader national narrative, are rife in advertisements for consumer goods in much of the developed world. Recurrent themes include unstoppable modernism (“now is our time”) and national destiny.

Beyond consumer-goods companies, research and writing on the power of emotion in thinking has exploded in recent years. Neuroscientists such as Antonio Damasio have helped us understand that emotion underlies, rather than opposes, reason. In politics, Drew Westen’s *The Political Brain* (PublicAffairs, 2007) popularized the argument that emotion, not reason, dictates individuals’ political decisions. From behavioral

economics, Daniel Kahneman's *Thinking, Fast and Slow* (Farrar, Straus and Giroux, 2011) argued that we are governed by a “fast and intuitive” system of thinking as well as a deliberative, logical system.

Those who believe that new transport and other infrastructure investments are crucial for a country's long-term future should be equally clear about their projects' positive value proposition and emotional brand.

The key to doing so is to ruthlessly prioritize and clarify which emotion is at stake. Is it national pride, national competitiveness, hope for the future, family and security, or something else? No retail proposition can win on every dimension—on price, quality, and convenience—and successful retail companies typically excel on just one or two dimensions of the “retail pentagon” (comprising price, range, service, experience, and convenience) and carefully map their strengths against competitors. Similarly, no infrastructure proposition can win on all points. With no message discipline, there is no message.

Beyond this, though, foundational research on the “motivation hygiene” theory or “dual factor” theory has long shown that while many preferences, often including avoidance of irritations, must meet a “hygiene” level, or minimum bar, they have no further energizing power once met. Motivating factors have continuing force.¹ Finding and emphasizing them is vital for success.

Think big

Building an emotionally compelling story around infrastructure is possible. In fact, it is common for politicians, who build their case from words rather than numbers.

When Governor Arnold Schwarzenegger made the case for high-speed rail in California, he said, “The faster we move economic goods—that's economic power, and this is why all over the world they are building high-speed rail”—appealing in one sentence to catalytic benefits, regional pride in economic power, and competitiveness with the rest of the world.² And when Russian President Vladimir Putin made the case for high-speed rail from Moscow to Kazan and Yekaterinburg, he said, “[Our funds] should be directed to projects that will change the face of the country and open up new prospects for development.”³

To do the same, to move from time savings or convenience to local and national pride, infrastructure leaders need to think big—and count big, quantifying the benefits that make this case.

There is a standard framework for cost-benefit analysis of major infrastructure investments, used by most major governments. It starts with the direct benefits for users and producers, including the monetary value of time savings and convenience. It then moves on to the multiplier effects, as money cascades from till to till, creating additional wealth. Finally, it tallies the catalytic impacts on underlying productivity.

But the theory almost invariably exceeds the practice, and the catalytic benefits are often ignored. Finding ways to expand the conversation and the measurements beyond the direct and multiplier effects to include the catalytic impacts is crucial to counting the full benefits of infrastructure.

For example, when the UK government quantified the case for expanding Heathrow Airport in 2009, catalytic benefits were simply excluded.

The official assessment included a long list of potential catalytic benefits for “firms...enjoying the same broad location,” for “deeper markets,” for firms “reliant on air transport,” and for “the UK’s ability to compete in international markets.” At the end of this list, though, came the anti-climactic line that “it might be very difficult to quantify such benefits....[h]ence no estimate of wider economic benefits is included.”⁴

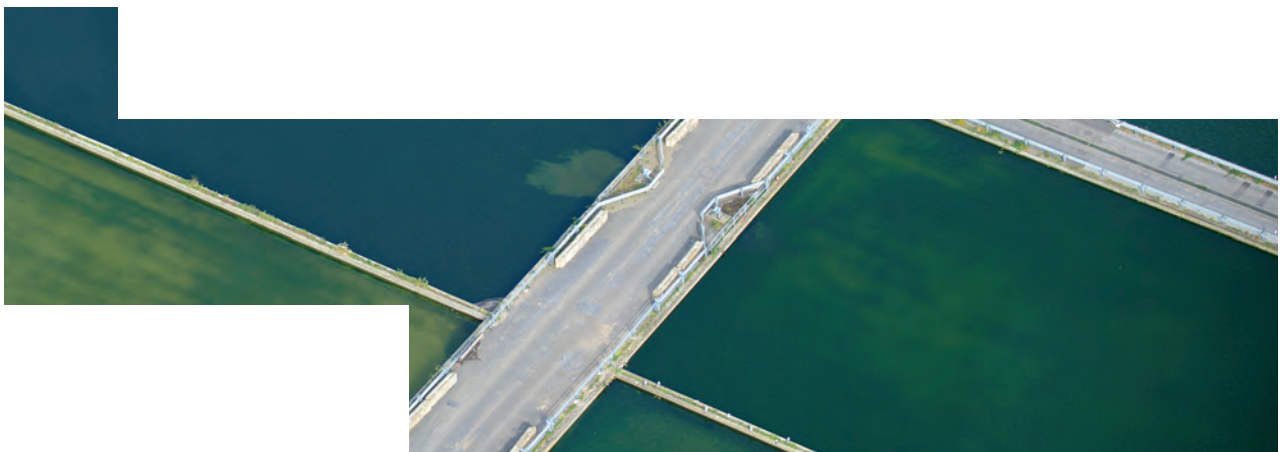
Similarly, there are few, if any, quantitative assessments of the catalytic benefits of some of the world’s biggest infrastructure projects, including the recently discussed California high-speed rail and Moscow–Yekaterinburg high-speed rail, and the EastLink toll road in Melbourne, Australia.

It is easy to see why. Many of the impacts are highly specific to context, prone to complicated feedback loops and tipping points, and unpredictable. As the evaluation of the United Kingdom’s high-speed rail conceded, “there is no ‘off the shelf’ methodology that is widely used in UK transport appraisal to assess the complex issues of productivity, trade, and regional economic competitiveness.”⁵

And yet the catalytic impacts—the wider economic benefits—can be enormous, changing the outcomes of cost-benefit analyses and transforming the prospects for hearts and minds. With one major piece of infrastructure on which we worked, the catalytic benefits were as big as the direct and multiplier effects combined. Intuitively, that makes sense: What would the economy of New York be without its subway system, or Memphis without its airport? An existing infrastructure asset can be fundamental to a regional economy, and a new infrastructure asset can transform one.

Infrastructure leaders can succeed at thinking big—at bringing to debates and analyses the full benefits of their project, including the catalytic ones, in three ways:

- **First, by pinning down causation with enough precision to be persuasive.** Would an airport increase exports? Prove it. The standard of evidence is constantly rising, and simple comparisons on cross-tabulations are no longer enough when sophisticated econometrics can answer the question more convincingly.



To move from time savings or convenience to local and national pride, infrastructure leaders need to think big—and count big, quantifying the benefits that make this case.

- **Second, by paying proper attention to space.** Infrastructure is intrinsically place-specific, so analysis has to escape from the national, regional, or local to the level of individual business clusters and even individual companies. Thanks to the proliferation of data, clusters can now be mapped at a company-by-company, industry-by-industry, and street-by-street level. Doing so allows the benefits of infrastructure to be pinned down and quantified, allows those clusters to be mobilized as allies, and brings the argument alive for citizens. For example, Heathrow Airport identified the aviation-using clusters in its region, including IT, and secured endorsements from Microsoft, BlackBerry, FM Global, and Electronic Arts.⁶
- **Third, by paying proper attention to time, with rigorous benchmarks.** Opponents of infrastructure projects will often suggest an alternative plan or location. Finding the nearest equivalent projects that match along the dimensions of geography, assets, and political context can be illuminating. Heathrow expansion, again, faced alternative proposals for a new airport in the Thames Estuary, with discussions of Heathrow's closure and redevelopment as a contribution

to the cost and source of alternative employment. They were able to point out that the old Hong Kong International Airport, with skyscrapers lined up to the airport fence, has been empty more than 15 years and is still undeveloped, and Denver International Airport took 22 years to complete; that Battersea Power Station, on the bank of the River Thames and moments from superprime real estate in London's Chelsea neighborhood, has taken more than 33 years to develop; and that Bankside Power Station took 19 years to be reopened as the Tate Modern.⁷ These projects helped change the perception about what the closure of Heathrow would mean for the local area.

Once identified and quantified, the catalytic benefits also need to be expressed in a way that means something to the ordinary user and citizen—translating it, in effect, from net present values and monetized equivalents to jobs, house prices, foreign investments, and industrial clusters, to create a compelling and tangible vision.

Keep talking

The third lesson for infrastructure leaders is to keep talking to consumers, as consumer companies do—developing a constant dialogue

beyond mere purchases. Once the message is developed and the appeal is pitched with suitable resonance, it needs to be continually fine-tuned and adjusted. The “brand personality” of the infrastructure project is often attacked and needs to be monitored and defended; continual conversation allows the infrastructure company to provide better service to users, ameliorate local impact, and generate greater loyalty.

And, as with consumer companies, infrastructure companies can increasingly draw more information from social media—from blogs, Twitter feeds, Facebook feeds, and search data. Buzz volume, for example, shows which arguments are “winning” and when conversation spikes, based on the number of messages, tweets, and blog posts. Sentiment analyses use algorithms to determine if social-media postings are positive, negative, or neutral. Accuracy is greater than 70 percent, and with smaller samples or more resources can be combined with manual analysis. “Word clouds” show relative prominence of ideas, measuring the frequency of occurrence of particular words. And detailed, systematic (and human) reviews of material can reveal a gap between the arguments that motivate social-media users

and how local or other groups express them to policy makers. Making full use of tools such as these, infrastructure leaders can start to understand more directly what the public may object to and how to address it.



Infrastructure investments can transform lives, regions, and nations. Without public support and a clear consensus audible from the cacophony of claims, interests, and beliefs, new investment is impossible. By thinking positive, thinking big, and continuing to talk, those interested in new infrastructure can stay focused on the needs of consumers, and win and keep public support. ○

¹ See Frederick Herzberg, “The motivation-hygiene concept and problems of manpower,” *Personnel Administrator*, January–February, 1964.

² “California Governor Arnold Schwarzenegger addresses our HSR conference,” US High Speed Rail Association, November 15, 2010, ushsr.com.

³ “JSC High-Speed Rail Lines,” 2014, eng.hsrail.ru.

⁴ *Adding Capacity at Heathrow Airport: Impact Assessment*, UK Department for Transport, January 15, 2009, nationalarchives.gov.uk.

⁵ *High Speed Two (HS2) Limited: HS2 Regional Economic Impacts*, UK Department for Transport, September 2013, kpmg.com.

⁶ *Heathrow: best placed for Britain*, Heathrow Airport, June 2013, heathrowairport.com.

⁷ Ibid.



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Making a better match between institutional investors and infrastructure investments

Matching up infrastructure projects and institutional investors is difficult. Better knowledge of how infrastructure assets will behave and new ways to monitor performance can help.

Frédéric Blanc-Brude,
research director,
EDHEC-Risk Institute

Why is it so difficult to match long-term money with long-term investment projects such as new infrastructure? Policy makers have certainly made a priority of the search for new ways to finance long-term growth.¹ At the same time, institutional investors have recognized the need for alternative long-term instruments to help meet long-term commitments such as pension payouts or insurance policies. Yet matching investment demand (for new infrastructure) and supply (from institutional investors) remains elusive.

Simply put, better matchmaking requires creating new knowledge about the expected behavior of underlying infrastructure assets and portfolios. Infrastructure investing today is not yet a relevant

asset-allocation question for institutional investors, and until it becomes one, the relative size of their investment in infrastructure will remain marginal.

There are several reasons why matching up institutional investors and infrastructure projects is difficult:

- The *first generation of infrastructure-investment products* was not well suited to long-term investors' needs and has prompted a backlash among the largest investors.
- More important, a *knowledge deficit* about what "investing in infrastructure" actually means prevents investors from examining such long-term investment decisions at the relevant strategic asset-allocation level.² This gap also

tends to reinforce the view among regulators that infrastructure investment is highly risky.

- Needed *performance monitoring* is lacking. In fact, long-term investment in unlisted and highly illiquid assets like infrastructure projects significantly increases investors' demand for performance monitoring in ways that the private-equity and debt sectors have been unable to respond to so far. The task is to overcome a substantial collective-action problem to standardize reporting and improve benchmarking.

The infrastructure story so far

Investing long term in illiquid infrastructure assets is a strategic asset-allocation decision. Ideally, investors should make it based on an investment benchmark that allows them to take a robust view on the expected performance of such investments. However, such benchmarks do not exist for infrastructure assets. The paucity of relevant data and the absence of a clear definition of what is meant by “infrastructure” mean that only remote proxies can be used as benchmarks. Moreover, the kind of reporting that private-equity managers typically use, focusing on internal rates of return and investment multiples, is fundamentally inadequate for the purpose of benchmarking investments in an asset-allocation context.

In the absence of adequate investment benchmarks, investors' growing interest in infrastructure assets stems from what we call the “infrastructure-investment narrative.”³ The notion is that infrastructure assets uniquely combine the following characteristics:

- low price elasticity of demand, therefore low correlation with the business cycle
- monopoly power, hence pricing power, hence an inflation hedge

- predictable and substantial free cash flow
- attractive risk-adjusted cash yield, available over long periods
- the opportunity to invest in unlisted assets

In other words, infrastructure investment *implies*:

- improved diversification
- better liability hedging
- less volatility than capital-market valuations

The narrative is itself a model in that it describes the characteristics of the average infrastructure project. It is also a benchmark (albeit one that does not rely on any empirical observations) upon which investors must rely to form their expectations about such investments, and thus make allocation decisions.

However, this infrastructure-investment story has not so far proved easy to buy. First, most free cash flow in infrastructure projects goes to debt instruments (predictable cash flows tend to lead to significant balance-sheet leverage), and few infrastructure-debt investment solutions existed until very recently.

Another reason is that gaining exposure to infrastructure equity has been mostly limited to two routes: the so-called listed infrastructure and unlisted private-equity funds, or “infrastructure funds,” the immense majority of which are clones of leveraged-buyout funds with similar investment time frames, fee structures, and use of fund-level leverage. As we at EDHEC have pointed out,⁴ in our opinion, neither listed nor unlisted infrastructure-equity products have delivered the “narrative” suggested above (exhibit).

A knowledge deficit

It should surprise no one that the disconnect between the investment narrative and the

Exhibit

Research findings about the performance of infrastructure equity show listed and unlisted products have not followed the narrative.

Expected behavior	Listed infrastructure	Unlisted infrastructure private-equity funds
Low risk	No	No
Low correlation with business cycle	No	No
Long term	No	Exits after 5–7 years
Excess returns	No	Yes, but fund-level leverage
Limited drawdown	No	No (credit cycle)
Inflation protection	No	No

Source: Frédéric Blanc-Brude, *Towards Efficient Benchmarks for Infrastructure Equity Investments*, EDHEC-Risk Institute, Jan 2013, edhec-risk.com

observed performance of available investment products occurs because there is little clarity about what “infrastructure investment” means in the first place. The definition of the underlying asset often remains vague and is subject to considerations about “real” assets and assumptions about the characteristics of firms in certain sectors. As a result, descriptions of the infrastructure sector often employ a series of industrial classifications such as utilities, transport, energy, water, public buildings, and so on, but no widely agreed-on definition. Observers and practitioners alike rely on the proverbial wisdom that they shall know it when they see it.

Lacking a clear definition of what “infrastructure” actually is, it’s also not surprising that no clear picture emerges from the evidence on the performance of existing infrastructure-related investments. These strategies do not stem from well-identified mechanisms at the underlying level corresponding to remunerated risk factors.

They are simply ad hoc asset-selection schemes in the listed and unlisted spaces.

Since investors remain largely ignorant about how infrastructure equity and debt portfolios might behave, it is virtually impossible to understand infrastructure investment from a strategic asset-allocation standpoint. Assembling the necessary ingredients to take a long-term view on infrastructure investing requires the ability to document expected returns, risk measures, and correlations. That can only start with a clear and well-accepted definition of underlying assets and a transparent proposal about the investment strategy, including the use of leverage and the effective number of bets that a portfolio of infrastructure assets can be expected to correspond to.⁵

In effect, meeting investors’ needs for better knowledge of the performance of infrastructure assets and investment strategies determines the

extent to which they are able to invest in such assets. Moreover, the absence of knowledge about performance also leads to a regulatory dead end: when faced with unknown quantities, prudential regulation penalizes long-term unlisted bets, further distorting allocation decisions.⁶

Of course, this lack of knowledge about the performance of infrastructure assets is not new. It was also not a particular problem as long as investing in long-term unlisted assets played a minor role in the (relatively small) alternative investment allocations that large institutional investors made. Until recently, most of them did not invest in alternatives at all.

However, once investors consider making substantial allocations to infrastructure investment, ranging from a few percentage points to almost a fifth of their assets in some cases, the absence of better knowledge about long-term unlisted investments becomes an impediment to new investment. This partly explains why investors have remained mostly on the sidelines rather than making greater forays into the infrastructure sector.⁷

Wanted: Long-term performance monitoring

What we know about the long-term behavior of illiquid assets is likely to evolve and improve. As a result, long-term investors need more than just a benchmark to make their initial asset-allocation decisions; they also need to be able to monitor performance in order to continuously update and enhance their knowledge. Long-term

investors tend to be more active shareholders and require greater monitoring. However, in the case of infrastructure investment, the failure to deliver adequate performance measurement and monitoring has led to an unfortunate retreat from the delegated-investment model.

Wide-ranging academic research documents how investors' demand for firm monitoring is an increasing function of their investment horizon.⁸ But if long-term equity investors tend to be active shareholders, they are also passive investors whose asset-allocation decisions require forming long-term expectations about risk and returns—that is, investment benchmarks. In the case of frequently traded assets, market prices provide the basis for forming these expectations. In effect, private monitoring efforts by large block holders contribute to market efficiency, since these efforts also benefit other stockholders. In turn, the market also provides monitoring benefits to long-term investors by processing information that is not available privately.⁹

Likewise, investing in infrequently traded assets requires a long investment horizon. But without the feedback of market prices, forming long-term expectations about risk and returns is less straightforward. It follows that investing in unlisted equities like infrastructure further increases investors' demand for monitoring. As with listed firms, a long-term investment horizon creates incentives to monitor performance to preserve or improve shareholder value, but the illiquid nature of unlisted firms creates a second motive for monitoring: investment benchmarking.



Investing in unlisted, illiquid firms with a long-term horizon also requires specialist knowledge and should typically lead investors to delegate this process to investment managers. Unfortunately, the current delegated model of private-equity investment mostly fails to respond to investors' monitoring needs. This is most apparent with the kind of performance reporting offered by private-equity managers.

For example, two associate professors at the Saïd Business School in Oxford and HEC Paris, respectively, propose a comprehensive critique of the performance monitoring of typical private-equity funds.¹⁰ They show that pooling individual investments and internal rates of return (IRRs) for funds creates misleading results, because IRRs cannot be averaged; IRRs are grossly inadequate for the purpose of asset allocation.

With private-equity managers unable to deliver satisfactory performance measurement and monitoring, a number of large institutional investors have ceased to delegate their investments in unlisted firms. Instead, they have brought in-house the function of acquiring and managing infrequently traded assets such as infrastructure. Canadian pension funds, a few large European pension funds, and sovereign-wealth funds are leading this trend of investing directly in illiquid assets.

Bringing investment and monitoring functions in-house is not necessarily an improvement, however. Delegating monitoring tasks to a specialist agent should boost efficiency. But a number of large investors have decided to exit delegated private equity altogether because information asymmetries between investors and managers can be so large that the benefits

of delegation go unrealized. Nevertheless, bringing the function in-house creates other costs. In particular, it can be difficult to create a well-diversified portfolio of large illiquid assets such as infrastructure-project equity.¹¹ Investors are now engaged in individual project selection even though they still haven't answered the asset-allocation question. Moreover, this approach is only available to very large investors that can bear the full cost of deal sourcing and the ongoing management of their portfolio companies.

Faced with a retreat by such large accounts as the Canadian pension industry, why are private-equity managers not offering to improve their monitoring and reporting so that investors can benefit from delegation while making well-informed asset-allocation choices? In effect, some managers are already evolving toward new private-equity models that allow investors to gain the kind of longer-term exposure they require. Moreover, the tendency for institutional investors to create large or very large unlisted equity allocations is a recent development; the need to monitor and benchmark performance has only recently become more pressing.

The failure of the private-equity industry to provide satisfactory monitoring for large investors is also a problem of collective action. Most of the necessary information is private. Dissemination and data collection, when it exists, is ad hoc and relies on existing practices instead of promoting data collection according to the requirements of robust asset-pricing methods. Private-equity managers could be more transparent and aim to provide performance measures that are more relevant to long-term investors. Taken individually, however, not one has access to enough information to answer the private-equity asset-allocation question.

Direct investment in infrastructure projects is not a panacea for institutional investors, even large ones.

Clearly, there is a role to play for policy makers and academics in overcoming this collective-action problem and supporting the standardization of data collection and the creation of adequate investment benchmarks for the purposes of long-term investing in unlisted assets. Without such improvements, it will remain considerably more difficult for long-term investors to make allocations to infrastructure-related products.

The way forward

Effectively and efficiently matching up long-term institutional investors with long-term illiquid infrastructure assets will require two actions that must work in concert: preserving the benefits of delegation to a specialist manager who can act on behalf of an active asset owner, and enforcing sufficient long-term performance monitoring and benchmarking to allow a passive investment stance, which can be justified as a strategic asset allocation.

Direct investment in infrastructure projects is not a panacea for institutional investors, even large ones. Instead, the benefits of delegation should prove significant if the information asymmetry between investors and managers can be reduced by creating new knowledge to inform investors' asset-allocation decisions.

We propose a step-by-step road map to help resolve the question of how relevant to investors infrastructure investment can be. Our approach requires a multistakeholder effort to reveal the characteristics of infrastructure assets at the underlying and portfolio levels and reduce existing information asymmetries between investors and managers. This road map has eight elements:

1. Definition. The first step on the road to relevant infrastructure-investment solutions for institutional investors is an unambiguous definition of the underlying instrument, as a financial asset.

2. Valuation and risk-measurement methodology. With a clear and well-accepted definition of underlying instruments, it is possible to develop adequate valuation and risk-measurement methodologies that take into account infrequent trading. By "adequate" we mean that such methodologies should rely on the rigorous use of asset-pricing theory and statistical techniques to derive the necessary input data, while also aiming for parsimony and realism when it comes to data collection. The proposed methodologies should lead to the definition of the minimum data requirement, which is necessary to derive robust return and risk estimates.



3. Data-collection requirements. While ensuring theoretical robustness is paramount to the reliability of performance measurement, a trade-off exists with the requirement to collect real-world data from market participants. In particular, proposed methodologies should aim to minimize the number of inputs in order to limit the number of parameter-estimation errors. Adequate models should also focus on using known data points that are already collected and monitored or could be collected easily. In all cases, data requirements should be derived from the theoretical framework, not the other way around. In turn, whether the necessary data already exist or not, this process will also inform the standardization of investment-data collection and reporting.

4. Reporting standards. Standardizing infrastructure-investment data collection should enable the emergence of an industry-wide reporting standard that investors and regulators alike can recognize. Such a reporting standard would increase transparency between investors and managers, who would now be mandated to invest in a well-defined type of instrument and commit to report enough relevant data for investors to benefit from their specialized monitoring.

5. Investment benchmarks. The investment profile of the underlying assets spans expected returns, risk, and market correlations. Once these have

been documented as well as the existing data allow, it is possible to design investment benchmarks to reflect the performance of a given strategy (for example, maximum Sharpe Ratio) for a given investment horizon.

6. Investment solutions. These investment benchmarks can serve as the basis for the development of various standard or tailored investment solutions by the industry, including different types of funds with explicit horizons and risk profiles.

7. Regulation. The robust performance benchmarking of unlisted infrastructure equity portfolios also has direct regulatory implications for risk-based prudential frameworks like Solvency II, the directive codifying EU insurance regulation. For example, the benchmarking should permit calibrating a dedicated unlisted infrastructure submodule in the context of the Solvency II standard formula, or usefully informing investors' internal risk models.

8. Public procurement. Finally, documenting the financial performance of unlisted infrastructure is relevant for the design of public-infrastructure tenders and contracts. It is the opportunity for the public sector to involve investors early in the design of public-infrastructure contracts with a measure of investment performance that has been validated academically and recognized by industry.

At EDHEC, we have begun following this road map. In our publications, both recent and upcoming, we propose a number of solutions to make infrastructure investment more relevant to institutional investors. As a first step, we suggest that well-defined underlying instruments can be found in project-finance debt and equity, which embody many of the aspects of the infrastructure-investment narrative and can be modeled and calibrated.¹² We also develop valuation and risk-measurement

methodologies for project-finance equity and debt that are consistent with modern asset-pricing theory, while relying on standardized data inputs that are as succinct as possible and that can be easily collected.¹³

The EDHEC-Risk Institute will continue to implement these steps with its partners over the coming years, including the creation of infrastructure debt and equity investment benchmarks. ◯

¹ Long-term investment in infrastructure was a key topic during the 2013 Russian presidency of the G20 and remains high on the agenda of the 2014 Australian presidency.

² Numerous research papers have demonstrated the primacy of asset allocation in investment management. Asset-allocation decisions explain most of the variability of investment outcomes. See William F. Sharpe, "Asset allocation: Management style and performance measurement," *Journal of Portfolio Management*, 1992, pp. 7–19; Michael J. Brennan, Ronald Lagnado, and Eduardo S. Schwartz, "Strategic asset allocation," *Journal of Economic Dynamics and Control*, 1997, Volume 21, pp. 1377–1403; and Roger G. Ibbotson and Paul D. Kaplan, "Does asset-allocation policy explain 40, 90, or 100 percent of performance? Authors' response," *Financial Analysts Journal*, 2000, Volume 56, pp. 16–19.

³ See Frédéric Blanc-Brude, *Towards Efficient Benchmarks for Infrastructure Equity Investments*, EDHEC-Risk Institute, January 2013, edhec-risk.com.

⁴ Ibid.

⁵ See Noël Amenc, Felix Goltz, and Ashish Lodh, *Alternative Equity Beta Benchmarks*, EDHEC-Risk Institute, August 2012, edhec-risk.com.

⁶ The current debate about the role of long-term investment in Solvency II, the directive that codifies EU insurance regulation, illustrates this point. See Frédéric Blanc-Brude and Omneia R. H. Ismail, *Response to EIOPA's Consultation on Standard Formula Design and Calibration for Certain Long Term Investments*, EDHEC-Risk Institute, 2013, edhec-risk.com.

⁷ For example, Australia may be a pioneering market for infrastructure investment, but Australian super funds only invest 3 percent of their assets in infrastructure.

⁸ See Andrei Shleifer and Robert W. Vishny, "Large shareholders and corporate control," *Journal of Political Economy*, 1986, pp. 461–88; Nemmara K. Chidambaram and Kose John, "Relationship investing: Large shareholder monitoring with managerial cooperation," New York University working paper, NYU Stern School of Business Research Paper Series, FIN-98-044, November 1998, stern.nyu.edu; Xia Chen, Jarrad Harford, and Kai Li, "Monitoring: Which institutions matter?," *Journal of Financial Economics*, 2007, Volume 86, pp. 279–305; Elyas Elyasiani and Jingyi Jia, "Institutional ownership stability and BHC performance," *Journal of Banking & Finance*, 2008, Volume 32, pp. 1767–81, and "Distribution of institutional ownership and corporate firm performance," *Journal of Banking & Finance*, 2010, Volume 32, pp. 606–20; and Najah Attig et al., "Institutional investment horizon and investment–cash flow sensitivity," *Journal of Banking & Finance*, 2012, Volume 36, pp. 1164–80, edhec-risk.com.

⁹ See Bengt Holmström and Jean Tirole, "Market liquidity and performance monitoring," *Journal of Political Economy*, 1993, pp. 678–709.

¹⁰ See Oliver Gottschalg and Ludovic Phalippou, "The performance of private-equity funds," *Review of Financial Studies*, 2009, Volume 22, pp. 1747–76.

¹¹ See Blanc-Brude, *Towards Efficient Benchmarks*.

¹² See Frédéric Blanc-Brude and Omneia R. H. Ismail, *Who is Afraid of Construction Risk? Portfolio Construction with Infrastructure Debt*, EDHEC-Risk Institute, 2013, edhec-risk.com, and Blanc-Brude, *Towards Efficient Benchmarks*.

¹³ See Frédéric Blanc-Brude and Omneia R. H. Ismail, *Valuation and Risk Measurement of Unlisted Infrastructure Equity Investments and Valuation and Credit Risk of Illiquid Infrastructure Debt Instruments*, EDHEC-Risk Institute, 2014, edhec-risk.com.



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Using PPPs to fund critical greenfield infrastructure projects

For institutional investors and government agencies, greenfield infrastructure projects are ripe with opportunity. By structuring them as public-private partnerships, both parties have a better chance of meeting their individual goals.

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corporate-development
director and investment
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The global infrastructure funding gap is now widely acknowledged: approximately \$57 trillion must be invested in infrastructure to maintain GDP growth through 2030, according to the McKinsey Global Institute.¹ The World Bank Group has offered similar estimates.² Given the long life span of most infrastructure assets—from 15 to more than 100 years—a higher share of global savings will have to be allocated to infrastructure in coming years. The fast-growing savings managed by institutional investors—estimated at \$75.1 trillion in 2011 by the Organisation for Economic Co-operation and Development—must play a central role.

Funding for infrastructure projects can take a number of forms, including non-infrastructure

financial products (such as government bonds, infrastructure-related corporate equity, or debt products) and dedicated *pure* infrastructure financial products. The focus of this article is the latter. Dedicated infrastructure financial products include unlisted equity investment in infrastructure and infrastructure project debt. To date, these products represent a limited share of institutional investors' asset allocation—less than 5 percent on average, but more than 10 percent for large investors, such as Canadian and Australian pension funds. However, this share is growing, and this asset class is becoming more noteworthy to investors and, subsequently, to regulators.

A particularly interesting area is so-called greenfield infrastructure—or new infrastructure—

projects, which are developed as public–private partnerships (PPPs). While PPPs represent a limited share of total infrastructure investments, they are gaining speed. In the United Kingdom, the new framework to fund low-carbon energy-generation projects, the so-called Contract for Difference scheme, strongly resembles a traditional PPP. Also, PPP schemes are becoming more popular in mature economies like the United States and are expected to play a major role in addressing the infrastructure challenges of fast-growing economies like Africa's.

Why greenfield infrastructure is attractive to institutional investors

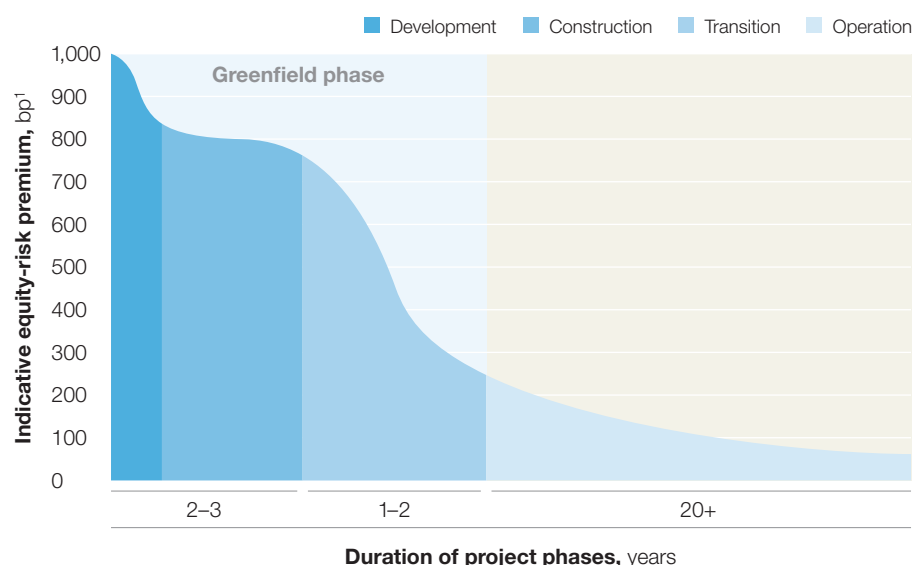
Traditional infrastructure-market players, such as governments and utilities, are under financial

pressure, and their budgets are strained. They are increasingly looking to private investment to fund infrastructure projects. PPPs can offer a number of benefits, including a whole-life costing approach that optimizes construction, operation, and maintenance costs, better risk management, and efficient project delivery. Well-structured PPPs can help ensure that greenfield projects are delivered on time and within budget and at the same time generate attractive risk-adjusted returns for investors.

Investors that enter a project in its early stages can capture a premium of several percentage points. Such a return usually takes the form of patient capital, or long-term capital. Investors must wait for the end of the construction period before

Exhibit 1

The indicative risk premium and timeline for an infrastructure investment varies by project phase.



¹Basis points.

they can expect a project to begin generating yield. Depending on the complexity of the project, this can take five years or longer (Exhibit 1); for instance, high-speed rail projects are known to be on the longer end of this timeline. However, investors in patient capital are willing to forgo quick returns for greater long-term returns. Typically, while investors in patient capital expect a return, they also value the economic and social benefits of a project.

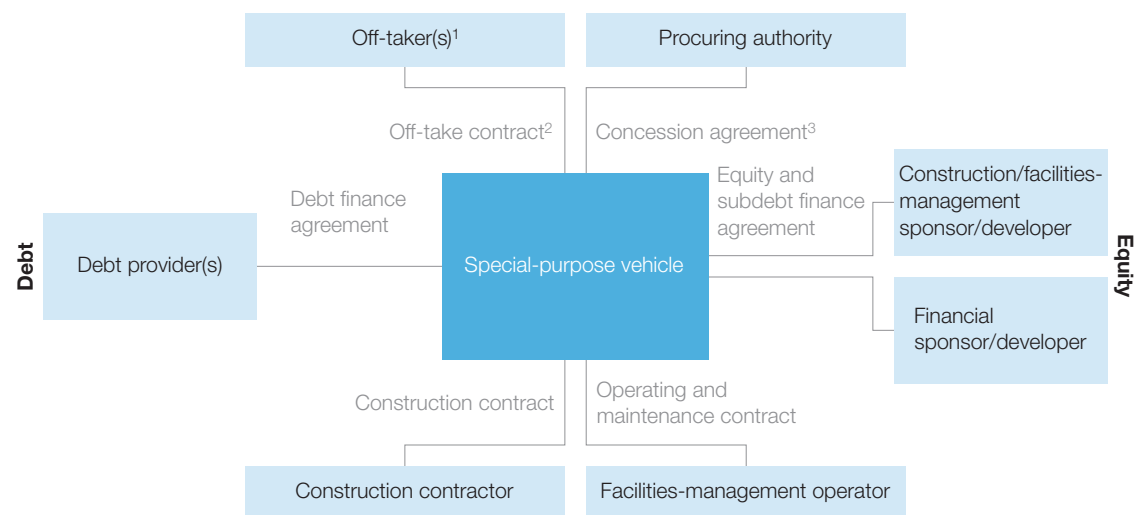
To secure this premium, investors must ensure that the risks associated with a project are properly managed. Greenfield projects usually begin with a clearly defined contractual framework that allocates risks to the most natural owners. Exhibit 2 illustrates a generic,

multicontract framework that will be familiar to project-finance professionals.

Contract frameworks bring structure and discipline to the execution of greenfield infrastructure projects. For example, the construction risk associated with greenfield projects is typically greater than brownfield projects. By transferring construction risk to experienced contractors and by establishing fixed prices and specific design and build deadlines, project managers and investors can protect against the delays and cost overruns that can plague infrastructure projects. The impact of such rigor can be significant: according to experts, the average cost overrun is below 3.5 percent for project-finance schemes—

Exhibit 2

A project-finance structure identifies parties and agreements.



¹ The off-taker is the party buying the service or product that the project produces.

² An off-take contract specifies the price and volume of the future product and helps ensure a market for it.

³ A concession agreement concedes the use of a public infrastructure asset to the project company for a specified period of time.



in particular PPPs—and close to 27 percent for a traditionally procured project.³

For investors to secure long-term returns, contracts must address the key risks inherent to all infrastructure projects, not only greenfield projects. Examples include revenue and volume risk, which relate to the effective use of the infrastructure at expected tariff levels (for instance, road traffic), or the availability and affordability of a critical input (for example, gas supply to a gas-fired power plant). These risks can be managed through risk-sharing mechanisms like minimum traffic guarantees from public authorities and long-term off-take agreements.

Political risk assessment and management is also essential over the long term. An infrastructure asset is captive by essence, and its performance relies on the willingness of local counterparties to respect the commitments made at inception. Managing this risk over the long term typically involves focusing on critical assets with proven added value (for example, a strategic urban-transportation project or a power plant essential to national energy supply), negotiating robust contractual agreements, and fully addressing the environmental, social, and governance aspects of all infrastructure projects. Project participants

that do this are more likely to secure and sustain support from key government stakeholders and simultaneously protect their investment over the long term.

What government can do to encourage investment

As investment in infrastructure is based on specific assumptions regarding the stability of legal frameworks and public policy over a projected investment period, government agencies can take several steps to encourage PPPs. One, governments are more likely to attract long-term investment if they can provide a clear pipeline of investment opportunities. Investors will only develop internal knowledge and skills in a specific sector, such as infrastructure, if concrete investment opportunities exist. Similarly, government agencies must establish clear guidelines and reasonable timelines from project announcement to award in order to convince investors to develop their internal skills. Put another way, to make development risk manageable for investors, procurement agencies must avoid any “stop and go” when launching infrastructure projects. This will be instrumental to building credible pipelines of investable opportunities and enabling institutional investors to actually engage.

Two, long-term investment requires visibility into cash flow. PPP frameworks, and in particular contracted cash flows, provide this visibility and also ensure predictability. Predictability, in addition to the natural correlation of cash flows to inflation, contributes to the attractiveness of PPP projects for institutional investors seeking assets that match their long-term goals. Still, some industries that are of great importance to the public sector suffer from a lack of investment predictability. The power sector in Europe offers a case in point. Securing funding for critical facilities such as thermal power plants is proving more difficult when revenues are derived from European deregulated wholesale markets. In the United Kingdom, where merchant and regulated energy assets did not typically benefit from the visibility that private-finance-initiative assets could provide—specifically with regard to appropriate mitigation of a change in law or public policy, force majeure, or hardship risks—low-carbon facilities may be an inflection point.

This is also the case in the rest of Europe, where regulated power transmission and distribution networks are better suited to short- or medium-term private-equity strategies, because visibility on tariffs is typically limited to five years.⁴ In contrast, the power sector in Africa, which is dominated by PPP-like independent-power-producer projects, can be considered more predictable by long-term investors. By providing greater and enduring visibility to investors, typically under contractual arrangements akin to PPPs, European governments could attract long-term investors in the power sector.

Three, financial regulations help ensure economic and financial stability. They also affect long-term investment. Government agencies must think strategically about how regulations can encourage long-term investment in infrastructure projects and whether they reflect the risk-reward equation of these nuanced investments. For instance, it will be interesting to see how Europe's forthcoming



Solvency II framework evolves and potentially affects infrastructure investment. Regulations should also be built on hard data. For example, an academically validated index for equity investment in infrastructure projects will be instrumental to ensuring that all parties are aware of the financial realities associated with greenfield infrastructure.

Finally, government agencies can play a key role in addressing market failures, either directly or through public development banks. They can act as facilitators and provide credibility to infrastructure projects. By funding transactions or supporting active market players, development banks provide a powerful signal to the private sector. Their presence suggests political support and stability over the long term. In addition, dedicated financial instruments—such as guarantee instruments, long-term funding, seed investment, and early-development stage facilities—can encourage long-term investment.

Channeling wealth and savings into productive investments, including greenfield infrastructure, will be essential for the global economy to grow. This is a historic opportunity for institutional investors and governments around the globe to secure both financial stability and performance and at the same time contribute to long-term growth fueled by efficiently managed infrastructure. ○

¹ For more, see *Infrastructure productivity: How to save \$1 trillion a year*, McKinsey Global Institute, January 2013, on mckinsey.com.

² *Capital for the Future: Saving and Investment in an Interdependent World*, The World Bank Group, 2013, econ.worldbank.org.

³ See Frédéric Blanc-Brude and Dejan Makovsek, “Construction risk in infrastructure project finance,” EDHEC Business School working paper, February 2013, edhec.com.

⁴ In Belgium, Italy, and Spain, the current regulatory period for electricity-transmission activities is four years; in Germany, it is five years. The only exception is the United Kingdom, where the Office of Gas and Electricity Markets now offers eight-year visibility on tariffs.





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Keeping 21st-century cities on the move

Effective public-transit networks are an essential element for burgeoning urban centers to deliver economic growth and improve quality of life.

Jay H. Walder,
CEO, MTR Corporation

The rapid urbanization of our planet now under way is among the most seismic changes the world has ever seen. According to the World Bank Group, 2 billion people lived in developing-country cities in 2000; by 2050, that number will grow to 5.5 billion. In many ways, this urbanization is terrific news, even in the developed world, where populations of major cities are also increasing rapidly. The population density of cities is vital for the environment, innovation, economic development, and so much more. But how do we accommodate this level of growth? How do we absorb millions of new residents into our cities without compromising our quality of life?

These are critical questions for our generation. The answers lie in providing the necessary infrastructure to build stronger foundations for our cities and the surrounding regions. “Infrastructure matters because it is the magic ingredient in so much of modern life,” UK Prime Minister David Cameron said in a speech. “Its value lies in its ability to make things possible tomorrow that we cannot even imagine today.”

If we are to build the cities we need for the rest of the 21st century, we need to start with a clear vision. The challenge before us is to not only provide the essential infrastructure our cities

require but to do so in ways that are sustainable—financially and environmentally—and to maintain quality infrastructure for the long term.

Effective public-transport networks are among the most essential infrastructure requirements for the cities of today and the even larger cities we envisage. Statistics tell the story. In 2012, members of the Community of Metros, or CoMET, a group that brings together 15 of the largest metro systems, carried 17 billion passengers—or about two and a half times the world’s population. And if we look at the largest metros in China—Beijing, Shanghai, and Guangzhou—they alone carried 6.5 billion passengers.

China is on the cutting edge of this great urban transformation. It clearly recognizes that the only way to provide the mobility essential to supporting the way we want to live our daily lives is to build bigger and better transit systems. Today there are metros in 19 mainland cities, and just last year the National Development and Reform Commission approved 25 new metro projects in 19 cities.

Transportation is at the top of the agenda in developed-world cities as well. From Singapore to Sydney to Stockholm, new railway lines are being built or are in advanced stages of planning. In every case, urban leaders know that they cannot keep their cities moving without more and better public transport. All of them are looking for ways to make these systems sustainable in the long term.

Last year, in a lecture at Harvard’s Kennedy School of Government, I shared stories about sustainable models from each of the cities where I have had the good fortune to live and

work—New York, London, and now Hong Kong. I was struck by the interest of professors and students, local citizens, and people from around the world in the rail-plus-property model that has transformed Hong Kong.

Hong Kong’s metro, the MTR, started train service in 1979 along an initial stretch of track that was eight kilometers long and served 280,000 passengers on its opening day. Over the past 35 years, it has expanded across the city and now carries 5.2 million passengers a day, with 99.9 percent on-time performance. How the MTR performs at such a high standard and has contributed so much to Hong Kong’s development can be traced to a key decision made by the city’s government when the railway was established: the requirement that the new railway operate on prudent commercial principles.

The rail-plus-property model that evolved is a system that is sustainable in every sense of the word. New rail lines are financed over the long term by providing the rail operator with land-development rights along the rail’s path. These are rights, not free land, which means the company has to pay the government for the value of the land based on what it would have been worth if the railway was not there.

MTR builds integrated communities along the rail line. The company benefits from the appreciation in land value once the line is built. By capturing the additional land value, we can ensure, subject to normal business risks, that the rail line will have proper resources not just for construction but also for long-term operation and maintenance of the assets. This model provides Hong Kong with a world-class railway with minimal government investment. It also



provides outstanding connectivity for the whole city. Who would have imagined 35 years ago that Hong Kong would today lead the world in urban mobility? Ninety percent of Hong Kong's journeys take place on public transport, the highest of any major city, and the railway serves as the low-carbon backbone of the whole system. It's a great example of how infrastructure can transform a city.

What Hong Kong has identified is a way to support its urbanization and density by sharing the benefits of the economic activity it creates. This is relevant to cities around the world that are experiencing unprecedented growth. Every growing city on the planet is going to have to grapple with this phenomenon in its own way, but the consistent theme is that to support growth we need to keep reinventing and embracing new ideas.

The cities of the future demand that we be able to serve millions of people. But by focusing on initiatives of such massive scale, there's a

danger that we might lose sight of the individual experience. We can't forget that cities are still made up of individuals and that, more than ever, people want personalized service customized to their individual needs and desires. Mass urbanization won't work if the quality of the product provided isn't good enough; it will only succeed if we maintain and improve the personalized experience.

It starts with delivering excellent, reliable services—public transport, medical care, education, or any other public work that's vital to cities. But as our cities get bigger and bigger, we also need to cater to each of our customers. The exciting prospect is that as we serve more people, advances in technology are allowing us to reach out to more of them on an individual basis.

If we can bring this personalized approach to how we manage 21st-century cities, along with innovative, sustainable financial models, we have every reason to be optimistic about our urban future. ○



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Maximizing revenue from government-owned assets

Privatizing government assets is just one way to improve fiscal health or invest in new infrastructure. To create value for the public, all options should be considered.

**Robert Palter and
Stuart Shilson,**
McKinsey & Company

Selling public assets can be an effective way to improve fiscal health but can also be unpopular, slow, and risky. It is also just one of many available options. From real estate and roads to state-owned agencies and monopolies, there are multiple approaches to create new sources of general revenue that governments can use to improve finances or invest in new infrastructure and other key priorities.

As financial deficits remain high in much of the developed world and spending needs continue to rise, full asset sales will be an important option for meeting these needs. In the United Kingdom, for example, the government has announced a £20 billion (US \$33 billion) target for asset sales.¹

The Australian government announced plans to raise up to AU \$130 billion (US \$120 billion) from asset sales.² And there is substantial scope for such sales: eurozone governments hold €4 trillion of fixed assets, and the US government owns an estimated 45,000 underused or underutilized buildings.³

But privatizations are only one way to raise funds from government-owned assets. Our work with infrastructure and other assets of regional and national governments suggests there is a substantial ability to monetize value short of an actual sale—in one case, 60 percent of asset value was realized through sales, and 40 percent, totaling multiple billions of dollars, was better

Subtlety matters—different objectives point to different assets and to different strategies for monetization.

realized through other means, such as making operational improvements and restructuring the financial model. Often, these types of changes can be easy, quick, and ultimately have the potential to create substantial value for the public.

Four steps, which we explore further in the sections below, are needed to make any approach to monetizing government assets a success:

- First, understand the motivations and policy concerns of the current government. Subtlety matters—different objectives point to different assets and to different strategies for monetization.
- Second, scan and sift. A full and detailed scan of assets is needed, tracking data to the most detailed operational and financial level possible. These data stimulate ideas for value creation at an asset level that go beyond outright sale.
- Third, identify the opportunities. Rapid diagnosis of the current and future operating and financial potential, asset by asset, with fine-grained benchmarking and interviews, can often reveal substantial opportunities to unlock value, including cost-reduction programs and partial equity sale, sale-and-leaseback, contracting for operations, and obtaining a credit rating.

- Fourth, execute with care; carefully manage stakeholder, legislative, accounting, policy, and other barriers.

Understand motivations

The first step is to understand the motivation: governments' need for extra resources is simple, but their specific requirements may be more varied and can strongly shape the way assets should be monetized.

Is the government looking for a simple fiscal impact? In such cases, governments should bear in mind that public-sector accounting rules may mean that the sale of an infrastructure asset, having been marked to market in previous years, would have little impact on the fiscal position. Operational or other improvements that affect bottom-line economic improvement in the asset need to be captured through general revenues or a special dividend to the government to record a gain. The sale of the asset might not achieve the objective of making a financial gain.

Alternatively, is the government looking for cash? If a government needs liquidity to deal with urgent spending needs or priorities, accounting rules are less important—and an operational change, such as increasing revenues of the government asset through additional fees for a service or changing pricing on an existing

service, may be quickest in the short term; however, a sale would have a substantial impact.

In other circumstances, for example, when a government is being asked by ratings agencies to demonstrate a path to more sustainable debt, the overarching concern might be the total balance-sheet impact on indebtedness, or ownership, or liquidity.

Or the government may be focused on none of these but rather on an indicator such as the ratio of debt or government spending to GDP.

In all cases, establishing clarity about goals is the first step to understanding which assets can be monetized and in which ways.

Scan and sift

With the objectives set, a thorough scan of government assets is needed. Such scans are often surprisingly hard—and surprisingly illuminating. Balance sheets can be opaque, and the data rarely exist in a central, usable format. In the United Kingdom, a national asset register was published for the first time in 1997, but it has not been updated since 2007 and does not include assets owned by local authorities.⁴ For regional governments and in many other nations, a trawl is needed of government statements of accounts, infrastructure agencies' assets, and agency-specific databases.

The results can include state-owned enterprises; real-estate assets, including real estate used by government agencies; vacant, undeveloped land; land for redevelopment; roads or transportation assets; and other monopolies that could be monetized, such as lotteries, gaming entities, or convention centers.

Many of these may be out of bounds given various challenges. Core government programs, such as health-care facilities, are often sensitive. Trusts, including pension-plan trusts, and deposit-insurance funds, regulators, and entities mandated by statute may be too legally challenging.

Others can be seen as clearly higher priority, based on revenue, expenses, or total asset base.

Identify opportunities

Opportunities can be identified rapidly, moving asset by asset.

First, and often least disruptive, there can be scope for a systematic, multiasset program of operational improvements without changing the ownership structure: new key performance indicators for managers, changes to pricing, reductions in general and administrative expenses, and optimized capital programs.

Opportunities in different industries or geographies will emerge via detailed benchmarking of revenues, cost, operating performance, balance-sheet health, and other measures, as well as through interviews with senior management.

For example, for one regulated retailer, a rapid diagnostic covered pricing, procurement, geographic coverage of stores, and labor productivity. It showed there were opportunities to make pricing more dynamic, flexible, and regional; to learn from the purchasing practices of private-sector and international peers; and to improve labor productivity through commonly used benchmarks and techniques.

The rapid diagnostic for a utility included outside-in benchmarks of operations and maintenance,

capital expenditures, and operational performance. It showed clear opportunities to improve billings and collections effectiveness, reduce generation-plant downtime through maintenance planning, and make capital spending more efficient.

And for a real-estate portfolio, the diagnostic revealed opportunities to rent to other occupants, charge for use, and develop some vacant land still owned by the government, as well as to pursue some outright sales.

Second, in addition to—or instead of—making operating changes, the business and financial model can be restructured. A state-owned retailer could move to franchising or licensing or become a wholesaler. These new approaches to the existing business model of a state-owned

entity could produce an entirely new stream of dividends to the government.

Third is a potential change in ownership. But this, too, can involve more options than many policy makers usually consider: whole or partial sales, stock-market flotation, strategic sales, or long-term concessions. Each can achieve different objectives. Incremental value can be unlocked by the “signaling effect” when a large state-owned asset is considered for sale. A partial sale provides a valuation marker and incentive for management to create even more value for subsequent sales of the asset. A “monopolistic value” strategy might require buyers to pay a premium to stake their claim on initial sales of an asset so as to stake their claim early and be better positioned for future sales.



Execute with care

Finding alternative ways to monetize an asset can sometimes be easier than a sale. But it is still not necessarily easy.

Above all, stakeholder support or resistance can make or break any opportunity. It's important to anticipate and carefully manage opposition from labor unions; government, environmental, or local groups; special-interest groups; management teams; and boards of directors.

Beyond that, however, there could be formal barriers. Changes may require a shift in government policy, the approval of regulators, or, at the extreme, legislation.

And there may be liabilities attached to the asset, from environmental liabilities on real estate to pension liabilities.

In fact, there is often a good reason—beyond simple inertia—for why a move that creates value has not already been made. This demonstrates again the benefit of a systematic program: alone, each objection or policy obstacle seems

insuperable given the value at stake. The prize is not worth the effort. Bundled together as a program, though, the combined value becomes sufficient to mobilize the forces and management time needed.



With an explicit understanding of motivations, a thorough scan and sift of assets, rapid diagnostics to identify opportunities, and execution with care, governments can create new sources of revenue. By exploring the range of options from asset sales to alternative approaches, governments can create unexpected value for the public. ○

¹ “New infrastructure plan published by government,” HM Treasury and Infrastructure UK, December 4, 2013, gov.uk.

² Peter Hartcher and James Massola, “Treasurer Joe Hockey earmarks \$130 billion in government-owned assets potentially for sale,” *Sydney Morning Herald*, February 14, 2014, smh.com.au.

³ “Setting out the store,” *Economist*, January 11, 2014, economist.com.

⁴ HM Treasury, The National Asset Register, January 2007, Cm. 7022.



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Inspired infrastructure

The secret to hitting a moving target is to aim slightly ahead of its trajectory. Stakeholders in infrastructure design, construction, and management face a similar challenge in working to develop cities capable of sustaining us tomorrow.

Uwe Krueger,
CEO, Atkins

At the inaugural meeting of the Global Infrastructure Initiative in 2012, we added our voice to those calling for a focus on infrastructure development. It remains one of the most pressing concerns of our age. The world's population is projected to reach nine billion within the next 40 years. By 2050, 64 percent of the population in the developing world and 86 percent of the population in the developed world are likely to be living in urban centers. These urban centers are already feeling the weight of shifting demographics, while being battered by increasingly volatile weather patterns and challenged by limited natural resources.

To create environments that are economically viable and able to withstand these unprecedented

challenges, we need to develop the right infrastructure in the right way. The right infrastructure fulfills multiple objectives; requires a coordinated, long-term approach; draws on the expertise of many; and above all is sustainable. Whether starting from scratch, rebuilding, or upgrading existing networks and structures in well-established cities, stakeholders that address these four areas will succeed in developing the right infrastructure in the right way.

Consider what the Malaysian government is doing with what used to be the country's main airport. Subang Skypark is being converted into Asia Aerospace City (AAC), a world-class hub for the aerospace industry. As lead consultant and master planner on the project, Atkins has to address

multiple objectives while ensuring this new city is sustainable for the long term. We must take into account numerous factors—including the ebb and flow of local populations, changing weather patterns, and the economic viability of the design. AAC will be designed as a smart city and include a convention center, state-of-the-art research and development facilities, integrated office suites, academic campuses, and residential areas. The government agency responsible for education and entrepreneurship hopes AAC will attract global aerospace-engineering services to the region.

Infrastructure development and design requires a coordinated, long-term approach. Governments must put policies in place now to protect cities' environmental, economic, and social fabric. And the industry must work together to support these policies with infrastructure that is fit for the 21st century. Qatar offers a case in point: its national-development strategy plans to deliver more than \$65 billion in infrastructure by 2016. The work will include diverse projects—roads, bridges, highways, railways, and ports—and require a coordinated effort. To make this happen, the Ministry of Municipality and Urban Planning created a central planning office that acts as an anchor for all major infrastructure schemes and creates solid links among engineering contractors, consultants, and various departments of government. Atkins's role in this endeavor is multifaceted: we need to be innovative designers, influencers, and good partners, keeping an eye on the long-term vision throughout.

Major infrastructure development in established cities creates challenges that would be impossible to solve without drawing on the expertise of a range of technical specialists. For example, the new east-west rail link through central London, Crossrail, has the potential to redefine the way the city moves. But weaving 42 kilometers of

tunnels through a maze of existing underground sewers, foundations, chambers, and lost watercourses is no easy feat. Getting the most out of this project and creating something truly sustainable requires tapping into the collective expertise of all engineers, government agencies, and contractor partners. At the same time, experts must maintain a clear view of the project's long-term goals: increasing investment opportunities through over-site development; putting more people within easy reach of the city, which is fundamental to the business case; adding extra capacity and cutting journey times; running more comfortable, energy-efficient trains; and creating strategic transport hubs. By breaking out of our silos, we as an industry can work together to create integrated solutions and measures for future proofing our cities.

How do we future proof our cities? How does the industry take the lead and emphasize the clear link between sustainable thinking and economic development? By promoting and delivering sustainability in everything we do, no matter the size or type of project. Consider the pollution challenges facing some cities in China. While experts may be tempted to seek out major infrastructure solutions to the problem, more sustainable alternatives exist. Smart solutions can be used to address inefficiencies in the manufacturing sector. A more energy-conscious and efficient manufacturing process could help reduce air pollution and revitalize the sector in China.

An exciting collaboration among UK Trade & Investment, leading academics, and industry representatives from the United Kingdom and China is one such alternative. These parties are working together to analyze Chinese factories' energy and water consumption and identify savings opportunities. They will offer a variety of recommendations—from replacing lighting to

How do we future proof our cities? How does the industry emphasize the link between sustainable thinking and economic development? By promoting and delivering sustainability in everything we do.

installing submeters, upgrading motors or kilns, and reusing water. The collaboration is still in the pilot phase, but experts anticipate that factory owners will realize savings within 12 months and return on investment within five years. Thousands of facilities have been identified as possible participants in the next stage of this program. Factories and pollution are not new challenges, but the key to unlocking their sustainable potential is the development of easy-to-install, low-cost technology. What's more, this example illustrates the power of innovative investment models and shows that sustainability efforts can pay for themselves by addressing existing inefficiencies. This concept is already

maturing in other parts of the world, such as Germany and the United States.

Cities can foster innovation and improve standards of living, but only if we ensure their future. Future proofing our cities means anticipating problems and finding solutions before the problems materialize, which cannot be achieved by working in isolation. This demands an unprecedented level of imagination and cooperation among engineers, scientists, planners, policy makers, and other experts from across the built and natural environment. And it means we must look beyond our immediate goals to what lies ahead, if we are ever going to hit our target. ○



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Infrastructure and the resilience dividend

Even the best planning can't always stave off an infrastructure failure when a major disruption hits. But building in resilience can help infrastructure withstand shocks or fail safely.

Judith Rodin,
president,
The Rockefeller Foundation

In the days after Superstorm Sandy, which left unprecedented damage across New York and New Jersey, government officials and urban planners were surprised to find an exception to the devastation: Arverne by the Sea, a 308-acre housing development on the Rockaway Peninsula a few miles south of John F. Kennedy International Airport, had weathered the storm almost completely unscathed. Arverne's local supermarket—and the electricity to power it—was functioning within days of the storm, while nearby communities went without either for weeks.

It wasn't just good luck. The project's developers had taken the possibility of a storm as powerful as Sandy seriously and factored the impact of

climate change and rising sea levels into their planning and infrastructure development. From energy-absorbing boardwalks and storm-water systems to underground electric lines, Arverne by the Sea was built to fail more safely and rebound more quickly.

In a century when shocks like Sandy would seem to be growing fiercer and increasingly routine, we need to build more developments like Arverne by the Sea, with resilient infrastructure integrated into the design and planning of not just houses but entire cities. And we need to act quickly. In less than 30 years, more than six billion people will call a city home, two billion more than today, putting more strains on existing infrastructure

and more people in the way of rising coastal waters and increasing weather events.

But to ensure that cities can imagine, finance, and plan the infrastructure needs of tomorrow, we need to change the mind-set around infrastructure from “keeping all bad things out” to creating new kinds of capacity to respond to the challenges that will inevitably come.

The first step is to move away from responding only to the last disaster and instead anticipate future threats and changes. In 2010, for example, designers in Portland, Oregon, revisited their plans for a light-rail bridge spanning the Willamette River to ensure it could withstand higher and more rapid waters. These were costly changes, but now the bridge will be ready for whatever may come and stands as the first transportation project in Oregon’s history to be conceived and planned with future storms and weather-related incidents in mind.

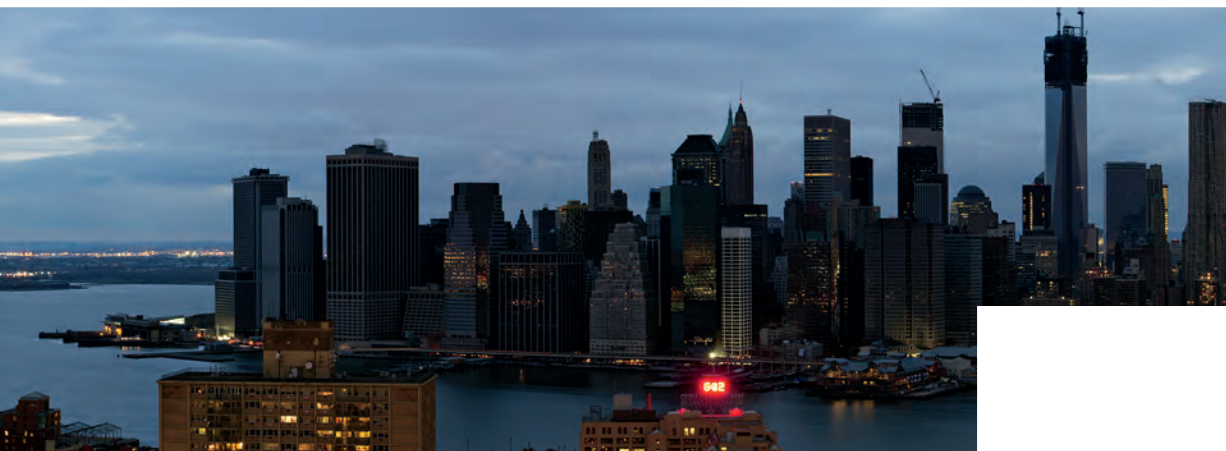
No matter how much we plan for and predict major disruptions, however, infrastructure failure is sometimes unavoidable given the increasing severity of shocks and stresses to our systems. Thus the second step is to build in mechanisms for infrastructure to fail safely, minimizing the disruption that can ripple across systems. We saw this need in New York City during Superstorm Sandy. The electric grid was too networked, so when one part of the system went down in a fantastic explosion, the entire lower half of Manhattan went with it. As a cochair of the New York State 2100 Commission, our recommendations to New York Governor Andrew Cuomo included smart-grid technology, which is designed to decouple and delink parts of the electric grid. Now, the local utility

Consolidated Edison is installing this kind of technology, including smart switches, which can isolate areas where a disruption occurs and limit widespread failure during future outages.

The third step to adopting more resilient capacity is to expand the expectation of who pays for infrastructure. Traditionally, this has been viewed as solely the realm of government. But the resilience of a business, and indeed an entire sector, is intertwined with the resilience of its community. The private sector has a clear interest and responsibility to put skin in the game.

One way to attract more private-sector capital is through infrastructure banks, like the one Mayor Rahm Emanuel has implemented in Chicago. Farther west, a partnership of government, community, business, and nonprofit groups from Washington, Oregon, California, and British Columbia has established the West Coast Infrastructure Exchange, aimed at strengthening financing for public–private projects that cross jurisdictions. The Rockefeller Foundation has supported both initiatives.

Another way is to better integrate infrastructure projects for public good with the needs of the private sector. To this end, we teamed up with the White House, the US Conference of Mayors, and innovators in the private sector to fund an initiative called RE.invest, which is supporting eight US cities to establish a new form of public–private partnerships that will help them package portfolios of investments aimed at building more resilient infrastructure. With the help of leading engineering, law, and finance firms, the cities will be able to use public resources more efficiently to leverage private investments—for example, in better storm-water infrastructure.



In this way, infrastructure investments can achieve multiple wins, or what we call the “resilience dividend.” Simply stated, this means financing, planning, and implementing solutions that help cities, systems, institutions, and people rebound more quickly from disaster if and when it hits and help spur economic development, job creation, environmental sustainability, and social cohesion between shocks. For example, the effort to create and maintain green infrastructure will necessarily spur the expansion of education and employment opportunities for a new generation of highly skilled workers.

To help more cities realize the resilience dividend, The Rockefeller Foundation launched the 100 Resilient Cities Centennial Challenge in 2013. Some 400 cities applied to become one of the first

to be selected, showing a clear appetite for these solutions. The cities will receive access to a suite of services and support to develop a resilience plan and hire a chief resilience officer to implement it. Infrastructure will be a central component, and the foundation’s platform will help cities access private-sector financing for resilience-infrastructure projects as part of their strategy.

If the recent series of disasters, from superstorms to typhoons to earthquakes, has a lining, it’s not silver, but gray and green—the colors of the infrastructure that must be built and supported in order to weather the shocks and stresses of this century. By changing our mind-sets, we can ensure that the survival of Arverne by the Sea is no longer an exception to the rule, but a harbinger of things to come. ○



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Rethinking conventional construction: An interview with Broad Group chairman and CEO Zhang Yue

Traditional construction practices can be costly, inefficient, and detrimental to the environment. In this interview, Zhang Yue reflects on how the industry can change.

Zhang Yue, chairman and CEO of Broad Group, is not one to shy away from ambitious targets. In 2010, his prefabricated construction company, Broad Sustainable Building, completed a six-story building, Broad Pavilion, at the Shanghai Expo in one day. He continued to challenge this feat by building two more structures at record paces—the 15-story Ark Hotel in less than one week and the 30-story T30 tower and hotel in 15 days. His latest ambition is to build the world's tallest structure. Known as Sky City, the 202-story steel skyscraper is expected to be magnitude-9 earthquake resistant and energy efficient. Ninety percent of the structure is being built at a factory and just 10 percent assembled on site. While the timeline is impressive,

what matters most to the Broad Group is its sustainable design and production process. Zhang sees this high-rise as a step toward redefining urbanization and addressing the energy and pollution problems that have accompanied industrialization in China. In this March 2014 interview with McKinsey's David Xu, a director in the Shanghai office, Zhang describes his journey to sustainable building and shares his thoughts on the future of construction and infrastructure in China.

McKinsey: *What are the biggest challenges facing the infrastructure and construction industry today?*

Zhang Yue: In general, the industry is underperforming. In many ways, we live in a very intelligent time. Yet there is still no precedent for a creative, low-emission, and practical approach to construction. From city planning to infrastructure development and building construction, from resource consumption to energy use, the industry is lagging the time in which we live. I think this is largely due to mind-sets and that humans must change. The construction industry is inherently long term. A small error in construction can cause significant harm to humans and the environment. The consequences of construction errors can reverberate for decades, centuries, and even a millennium. Yet the industry does not always think long term. We tend to think in terms of a project—one building or infrastructure asset—and its timeline.

McKinsey: *How can the industry change its thinking?*

Zhang Yue: We need to ask ourselves more strategic and long-term questions: What is the objective of this building or asset? How does it relate to the rest of the neighborhood and the city? How will it affect people's quality of life? How much energy does it use? What problems could it create?

In China, urbanization is happening rapidly. If it continues at this pace without careful consideration of the long-term consequences to the environment, it can cause severe problems. We must take a long-term approach to city planning, construction, and infrastructure and address resource and energy consumption. People living in big cities, with excessive pollution and energy consumption, can hardly enjoy a high quality of life. Urbanization should not

happen at the expense of land and the environment. Stakeholders in China can pursue a long-term path to land- and energy-efficient urbanization.

McKinsey: *Technology is evolving rapidly and disrupting other industries. To what extent is this happening in the infrastructure industry?*

Zhang Yue: Unfortunately, the construction and infrastructure industry is the exception. It is antiquated and out-of-date. Most work is still performed manually and on site, which is costly and time consuming. For example, today a skyscraper can take five years or more to complete. When the Empire State Building was constructed, it only took about 13 months.

McKinsey: *Why do you think technological innovation has failed to permeate the industry?*

Zhang Yue: There are two reasons. One, rapid urbanization in China is driving significant investments in infrastructure development. At the same time, innovative financing and investment products are also pouring money into the industry. When demand is strong and the market is good, people do not have much enthusiasm for new technology. They are not motivated to innovate because the profits are there.

Two, excessive regulation of the industry and its supply chain can hinder innovation. In China, there are so many regulations that they do not encourage innovative technology or even thinking. For instance, in construction design, regulations can be so detailed that they specify which types of materials to use and what standard of thickness the materials should be. So, in China the industry falls back on what we call "standard." Because regulations emphasize standard, builders pursue it at the expense of creativity, efficiency, safety,

and ultimately responsibility. As long as a builder does not violate standard, he or she does not bear responsibility for any issues.

McKinsey: *What do you envision as an alternative?*

Zhang Yue: I think Western countries offer an alternate model. Regulations exist and the guidelines are stringent, to be sure. A building or infrastructure asset must pass inspections and meet safety standards. While engineers bear responsibility for their work, they are free to explore different products and approaches. This model encourages innovation and accountability.



McKinsey: *Sky City is not the Broad Group's first sustainable project. When did you start thinking about sustainable building?*

Zhang Yue: We began to explore sustainable building after the Sichuan earthquake in 2008. I was attracted to the idea of challenging conventional thinking about construction. Our construction process places special importance on air quality, energy conservation, and sustainable materials. By using 20-centimeter insulation layers, quadruple-paned windows, power-generating elevators, light-emitting-diode lights, and Broad's cooling-heating-power and air-filtration technology, Sky City will be five times more energy efficient than a conventional building. In China, most builders use concrete because it is standard and they are familiar with it. Sky City will be made mostly of steel, all of which can be reused if the building is ever decommissioned.

McKinsey: *How does the use of an energy-efficient product or material challenge conventional thinking?*

Zhang Yue: One product can have tremendous effects. Consider thermal insulation. It does not require fancy technology, simply a willingness to do. A small, up-front investment in insulation significantly reduces the overall cost of a building by lowering heating and cooling expenses. Why then are so few builders in China using thermal insulation? In a word, it is about mind-sets. Thermal insulation is outside of their conventional process and thinking.

McKinsey: *How does your construction process differ?*

Zhang Yue: If conventional construction is a man building cars in his garage, our approach is

Zhang Yue



Vital statistics

Born in 1960, in Changsha, China

Married, with 1 son

Education

Earned a degree in fine arts from Chenzhou College

Career highlights

Broad Group

(1988–present)
Chairman and CEO

Fast facts

Holds patents for a number of inventions, including a nonpressurized boiler (1989), a nonelectric air conditioner (1992), and a combined cooling, heating, and power system (1999)

Received the Champions of the Earth award from the United Nations in 2011 for his contributions to building energy efficiency and sustainable production

Worked as a teacher and librarian in Chenzhou early in his professional life

to build cars on the assembly line. Ninety percent of the work for our prefabricated, sustainable buildings is done in the factory. Only the remaining 10 percent is done on site. Plumbing, electric, heating and cooling vents, plus the flooring and ceiling, are fitted into a module of 60 square meters. The walls, doors, and windows are stacked on top of the module, which is then transported to the construction site as a whole.

McKinsey: *What are the benefits of this process?*

Zhang Yue: Our production process is not only fast, but it maximizes efficiency and minimizes waste—less than 1 percent construction waste, compared with the 30 percent generated by conventional methods. Because the majority of work is done in advance, our approach also speeds on-site construction. And because our main site is the factory, our transport and logistics

costs are lower. We have greater capacity in the factory to store additional materials and supplies, whereas at a conventional construction site, materials like cement and steel are often delivered daily because the site cannot accommodate extra supplies. All in all, our construction process maximizes efficiency—in resources, labor, logistics and transport.

McKinsey: *As a new entrant, you are showcasing a vastly different business model. What is the likelihood that this model can be replicated?*

Zhang Yue: We hope to be a model in countries like China, where the urban population is growing, existing infrastructure is incomplete, and the demand for infrastructure development is significant. But the precondition is that we finish the job and do it well. I must build the best product with the highest efficiency, of the

We are constructing the tallest building to promote the concept that urbanization need not sacrifice land or energy efficiency.

highest quality, at the lowest possible cost. For other builders to follow suit, the production process must be efficient and cost effective, without sacrificing quality. If a building is expensive to develop, the market will be limited. If labor costs are too high, or the construction speed is too slow, the market will evaporate. If quality is hard to control or technicians are required to learn many new and advanced technologies, the barriers to entry will be too great. Return on investment must also be realized fairly quickly, in two to four years; otherwise, investors will lose patience.

McKinsey: *When complete, Sky City will measure 202 stories high, with 6 more stories below ground level. It could become the tallest building in the world. What does that mean to you?*

Zhang Yue: We are constructing the tallest building to promote the concept that urbanization need not sacrifice land or energy efficiency. This is the real significance of Sky City. When a building is taller, it naturally uses less land. Also, Sky City is a mixed-use development and will include residential housing; commercial space for business, shopping, and entertainment; a school; a hospital; and two square kilometers

of green space covered by 100,000 trees. Residents will have access to everything they need in this self-contained development. Think of how lovely our cities could be if we all traveled to work and school and ran errands on foot. Such a lifestyle lessens energy consumption and the number of roads, cars, and traffic jams in our city. According to our calculations, Sky City could help reduce the number of cars in Changsha by 2,000 and carbon emissions by 120,000 tons. These figures mean more than the title of world's tallest building. We are determined that Sky City will have an impact on the people and city of Changsha, on China, and ultimately on the world.

We hope this project leads three important revolutions: one is a revolution of the construction process; two is a revolution of resource efficiency; and three is a revolution of the construction-industry business model and oversight. If we do not take action and showcase a different model that challenges conventional construction, the industry will not change. There will be huge obstacles, many of which are beyond my imagination. But my resolve is strong. And I look forward to the day when we can reflect on those obstacles over coffee on the 202nd floor. ○



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Infrastructure's central role in China's 'new urbanization'

To bring the benefits of urban life to hundreds of millions of new residents in city clusters, infrastructure development and financing must be innovative, sustainable, and high quality.

Xiaodong Ming,
deputy director of
the planning department
of China's National
Development and
Reform Commission

People and their quality of life are at the center of China's approach to urbanization. By 2020, China aims to integrate 100 million rural migrant workers into urban life, offering them benefits such as access to jobs, schools, and health care. The country also plans to revamp shantytowns where around 100 million people reside and urbanize about 100 million people in China's central and western regions. This is a massive undertaking, but urbanization is not only about the numbers. Its basic principle is the importance of the roles of people and regions. The build-out of China's urban environment is an important story because it changes lives.

Of course, "new urbanization" faces multiple hurdles. Integrating migrant workers poses

an important population challenge. Coordinating regional development will have a critical impact on economic development. Upgrading the industrial capacity of cities as they expand will define, to a large extent, the future of China's growth profile.

All these important tasks require the support of better infrastructure construction. A modern economy depends on reliable roads and rails, electricity, and telecommunications. China has had the single biggest development of infrastructure in the history of mankind. Over the last 10 or 15 years, it has been the world's largest market for infrastructure. And there is clearly more to be done for China's "people-centered" urbanization approach to achieve its goals.

In order to develop an infrastructure plan that fits seamlessly into China's new urbanization blueprint, it is crucial to look at the overarching goals and strategy of China's urbanization, key areas for infrastructure construction, and methods of infrastructure financing.

Overarching goals and strategy

China's urbanization has entered a new stage; the focus has shifted toward higher quality and efficiency. At this stage, China's people-centered effort emphasizes city clusters as its major component. Urbanization will provide economic integration, growth, and the benefits of an urban lifestyle to populations of 10 million to 50 million people in each cluster. Comprehensive capacity and system innovation will support this integration. To achieve this overall goal, five major tasks must be accomplished.

The first is to promote migrant-worker integration step-by-step, which will help to eliminate the divide between urban and rural populations. To do so, household registration (*hukou*) reform should be pushed forward to provide equal access to public services for all citizens, and the process should be conducted in accordance with local conditions.

The next task is to improve the layout and patterns of urbanization, which will greatly increase the efficiency of land use in urban construction. The goal is to balance the spatial layout, optimize the scale of cities and towns, and coordinate development of small, midsize, and large cities, as well as small towns. It requires promoting urbanization strictly in accordance with plans for managing land, water, and ecology.

Increasing the sustainable-development capacity of cities is another goal. That means improving a variety of aspects in the development of cities—

industry job creation, the functions of downtown areas, regulation of city extensions, urban financing mechanisms. The overarching goal is to develop new cities that are innovative, green, smart, and human.

Coordinated urban-rural development should also be promoted, as it will vitalize the development of rural areas and narrow the gap between urban and rural regions, thus promoting new urbanization.

The fifth task is to improve the system and mechanism of urbanization. Relations between markets and government, and between central authority and local administration, should be aligned smoothly and effectively. The goal is to swiftly remove the hindrances to urbanization and create a favorable environment for healthy urban development.

The Third Plenary Session of the 18th Communist Party of China (CPC) Central Committee mandated that the new urbanization be people-centered. Advancing this policy—and delivering the desired living conditions for massive numbers of new urbanites—cannot be accomplished without the support of high-quality infrastructure.

Key areas for future infrastructure construction

The requirements of China's new urbanization strategy define the focus of China's infrastructure build-out. The strategy requires several interconnected elements: the transportation network needs to play a leading role, the build-out should follow a strategic spatial-planning framework for expanding economic growth and market areas from east to west and from north to south, and the layout and patterns of urbanization must be optimized. Moreover, public infrastructure should also be enhanced to cater to the needs of

China's sweeping urbanization is set to create tremendous demand for building out infrastructure and massive need for investment and financing.

the growing urban population and to economic development. Therefore, construction of China's infrastructure should mainly target four areas.

First, step up the capacity of integrated transportation in eastern city clusters. In doing so, city clusters could exercise effective and integrated management over transportation, narrow the economic gap between cities, and enhance eastern city clusters.

Second, accelerate the construction of high-speed railways and highways among major cities in the central and western city clusters. By shortening travel time between cities, high-speed railways and highways will greatly facilitate the flow and allocation of labor and capital. In central and western regions, the construction of high-speed railways and highways will also improve the attractiveness and overall competitiveness of city clusters. These projects will help to urbanize 100 million people and optimize the structure of urbanization nationwide.

Third, ramp up public-transport facilities that connect small and midsize cities and small towns to traffic hubs or cities with major transport routes. These cities and towns should be incorporated into the national traffic network to achieve coordinated urban development.

Small and midsize cities and small towns do not have the economic foundation or demand to serve as traffic hubs. As such, their connections to traffic hubs should become a focus of infrastructure construction.

Fourth, enhance public infrastructure to better support the growing population and demand for services. Increasing numbers of urban residents have posed great challenges to cities' infrastructure, public services, and environment. These areas have to be strengthened if China is to achieve true people-centered urbanization.

Investment and financing strategy

China's sweeping urbanization is set to create tremendous demand for building out infrastructure and massive need for investment and financing. To address this issue, the Third Plenary Session of the 18th CPC Central Committee explicitly stipulated that a transparent and well-regulated financing mechanism for urban construction should be established.

It also decided to allow local governments to issue bonds to add to their financing methods and to allow social capital in infrastructure projects through means such as franchises.

Within this framework, the urban-construction strategy should primarily include three aspects.

First and foremost, ensure investment from central and local governments. The central government can issue special treasury bonds to finance a particular project, while local governments should ensure their level of investment. It should be noted that although the government should invest in the development of cities, it should also control the financing scale to prevent risks.

Second, attract private investment. Since the central government has made it clear that social capital is allowed in urban construction, policies should be made to encourage private investment. Moreover, methods like investment subsidies and service procurement can also be used to engage more private capital in urbanization.

Finally, be innovative in devising financing mechanisms. For example, projects that contribute

greatly to public welfare are usually long-term projects with high credit ratings. If government investment cannot be secured and if it is difficult to raise funds in the market for such projects, those undertaking the project may issue long-term bonds or seek capital from investment funds or policy banks. For projects that aim for both public welfare and profitability, new models of public-private partnership should be encouraged and experimented with. In such projects, the roles and responsibilities of the government and those of the market should be properly defined.

With a growing population and increasing demand, China is urbanizing at a pace that has impressed the rest of the world. At this stage, it is important to maintain the efficiency and quality of urbanization. To achieve people-centered urbanization, it will be crucial to plan ahead and keep the big picture in mind. ○





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Critical issues in the next decade of China's infrastructure effort

More sustainable financing, higher quality in urban projects, and new markets to soak up construction overcapacity will determine how the country writes the next chapter of its remarkable story.

Zuo Kun, executive vice president, China Development Bank Capital

Over the past 30 years, China has become the world's largest infrastructure market, thanks to its economic reforms and burgeoning urbanization effort. As positive and dramatic as this evolution has been, it is now possible to identify several critical issues that will bear heavily on the direction and shape of China's infrastructure planning and its construction sector. In brief, the single-source financing model that underpins government-led infrastructure development is not sustainable, the quality of urban infrastructure is poor, and despite the vigor of China's infrastructure-building efforts, infrastructure companies now face overcapacity challenges similar to those in developed economies.

To understand where China's remarkable infrastructure story goes next, it is valuable to explore these developments and anticipate ways to address these critical issues.

Building a new finance model upon private infrastructure investment

Government-led infrastructure development's heavy dependence on a single source of financing has increased government debt significantly. The model is not sustainable. For a long time, China's infrastructure financing mainly came from government lending and land-transfer revenues. As revenues have diminished, solvency pressures and risks for local governments have risen to high levels. To address the issue, the central

government has made it an economic priority to control and reduce local-government debt risk this year by reducing the amount of credit banks provide to local governments and by increasing the level of audit and transparency of local-government accounts.

In light of these circumstances, a better infrastructure-development model would shift away from dependence on government to greater reliance on market finance. The central government is advocating the idea of diversified ownership by encouraging social investment in infrastructure operations through franchises, equity investment, and public-private partnerships (PPP).

China's Ministry of Finance is working to promote the PPP model in infrastructure projects by identifying the respective rights, obligations, risks, and revenues of both public- and private-sector partners. In this way, the government hopes to build complementary and mutually beneficial partnerships with the private sector on public projects. For example, Zhongtian Urban Development Group worked out such a deal with the government of Yunyan District in Guiyang to take charge of primary land development, road construction, river improvement, and other projects. The company and local government will work together to balance out development costs and land-transfer fees. Private investment in joint ownership of projects helps reduce government debt, solve financing issues, and improve operational efficiency and revenues at the same time.

Improving the quality of new urban infrastructure

The quality and operational efficiency of urban infrastructure, especially of new urban projects,

is poor. Recently, the Chinese government issued a national urbanization plan that extends to 2020; this sets the tone for its "new urbanization" effort, which calls for significant infrastructure creation. At the same time, however, more and more attention is focused on the fact that so much new infrastructure is of low quality. Moreover, inadequate urban infrastructure, low standards for construction practices, and operational management of projects contribute to a failure to meet the infrastructure needs of China's cities.

To solve the issue, the central government is determined to improve urban infrastructure in four areas:

- urban transit, including subway, light rail, and bus rapid transit
- city pipe networks, including water supply, rainwater, fuel gas, heat supply, telecommunication, power grid, drainage and waterlogging prevention, flood control, and utility tunnels
- sewage treatment and garbage disposal
- eco-gardens

President Xi Jinping recently announced plans to improve urban infrastructure quality and build an advanced, interconnected functional system to meet future demands. The fundamental idea is to create world-scale transport capacity linked to mixed-use development and district energy infrastructure. A good example is the Hongqiao Hub, a combined system with high-speed rail service, an airport terminal, and metro connection in one location that also includes a district energy system. In short, future urbanization and infrastructure construction will have to meet higher quality requirements, which imply bigger development potential.

After years of tremendous demand for infrastructure projects and construction services, infrastructure companies now face overcapacity pressures, as well as problems related to a shrinking construction market that many developed economies have experienced.

Globalizing ‘made in China’

After years of tremendous demand for infrastructure projects and construction services, infrastructure companies now face overcapacity pressures, as well as problems related to a shrinking construction market that many developed economies have experienced. China’s urbanization and infrastructure development has transitioned from rapid growth to stable development. Therefore, initiatives to boost domestic demand, such as the new urbanization effort, will have limited impact on domestic infrastructure-market expansion. Within ten years, significant demand will fade for the construction of highways, high-speed rail systems, ports, and airports, bringing the overcapacity issue in construction to the fore.

In the meantime, however, China’s construction industry still enjoys comparative cost advantages globally. That makes tapping overseas infrastructure demand a strategic priority. At present, developing countries in Asia, Africa, and Latin America are still in the early stages of industrialization and urbanization, which is

driving substantial demand for infrastructure. Simultaneously, developed economies—including the United States and European nations—are renovating and upgrading infrastructure on a large scale, which will also provide overseas opportunities for Chinese construction companies.

China’s government is pushing construction companies to go global. For example, on his recent visit to Southeast Asia and Central and Eastern Europe, Chinese Premier Li Keqiang promoted Chinese transportation-equipment manufacturing in sectors including high-speed trains. The Chinese government has also put forward plans for a “Silk Road Economic Belt” with Asia and Europe and a “Maritime Silk Route” with Southeast Asian neighbors to encourage cooperation and trade. As these connections would rely on interconnecting highways, railways, air routes, and other networks, the government anticipates that they will provide significant strategic opportunities for Chinese construction companies to go global and strengthen international cooperation. ○



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Energy infrastructure:

Seizing the opportunity in growth markets

In some of the most promising markets, supply of and demand for reliable energy has outpaced infrastructure. For discerning investors, the opportunity to fund energy infrastructure is significant.

Arif Naqvi,
group chief executive,
The Abraaj Group

More than 35 million Kenyans, 80 million Nigerians, millions of Ghanaians, and countless others in growth markets live without electricity. Some experts call this “light poverty.” But it is misleading to suggest that this unwired population—many of whom live in urban areas—cannot afford to pay for power or that governments cannot provide it. For many, a steady supply of electricity and gas would lower their cost of living by replacing inefficient, costly sources of energy such as kerosene and batteries.

The growth economies of Africa, South Asia, and Latin America are grappling with an energy-infrastructure investment gap. Existing power grids are limited, weak, and subject to

outages; generation is insufficient. In sub-Saharan Africa, nearly 70 percent of the population lacks access to electricity, and those with access find it unreliable. According to the African Development Bank, the region needs to invest approximately \$42 billion per year in energy infrastructure over the next decade. A similar gap exists in South America; in Peru, it is estimated at close to \$33 billion.¹

Investment can influence growth. For example, if Africa had invested an additional 3 to 5 percent of GDP in energy infrastructure, experts calculate that it could have gained \$0.7 trillion to \$0.9 trillion in incremental GDP from 2000 to 2010. Still, I believe that investing in new energy

infrastructure is not about stimulating economic growth in these countries—rather, it's about sustaining it. Growth markets are outstripping developed economies with respect to GDP growth. A majority of the global middle class² lives in growth markets, and that proportion is expected to increase significantly in coming years. Demand for reliable, affordable electricity from homes and businesses will only rise. The capital needed to close this infrastructure gap represents a unique investment opportunity.

The demand side of the energy story is well documented. However, many growth economies are not merely customers for oil and gas; they also have extensive natural resources of their own. Nearly one-fifth of the world's oil reserves are in Latin America. Africa holds almost 8 percent of oil reserves, in addition to shale oil and gas deposits. By 2030, 71 percent of global fuel supply is expected to come from markets that are not part of the Organisation for Economic Co-operation and Development (OECD). Energy transportation and storage infrastructure will be critical to extraction and distribution to the end consumer.

The reality is that in many of these markets, energy infrastructure must be built, as few existing assets are operational. Many global investors are hesitant to commit their capital to greenfield infrastructure, where development and construction risk is greater, particularly in non-OECD markets. Such thinking views growth economies as a monolith and overlooks the attractive rates of return such investments deliver. Rather than placing a blanket risk premium on all growth markets, I would encourage investors to take a closer look and recognize those countries that have transformed their investment environment in recent years. We have identified a number of key

growth markets that have created an outstanding investment environment for energy-infrastructure projects by combining viable project pipelines with a regulatory environment that mitigates risk.

Kenya is one such example. The country has an exemplary history of commissioning independent power plants from private investors and paying the agreed-upon tariff through its supply company, Kenya Power, while minimizing off-take risk and providing a strong, bankable credit. Kenya also intends to bring 5,000 megawatts—including 1,600 megawatts of geothermal energy—online in the next 40 months. Investors in geothermal projects can opt to invest after the initial exploration phase or take advantage of new insurance products coming onto the market.

Nigeria, another dynamic economy, will face a 13-fold capacity shortfall by 2020. The country needs massive investment to provide new capacity and replace existing diesel plants. The rising cost of diesel generation, combined with attractive feed-in tariffs for renewables, has created a major opportunity for solar-energy projects that generate a good rate of return and undercut existing power sources. A program to privatize ownership of ten newly built gas power plants has attracted interest from more than 100 investors around the world. Nigeria, like Kenya, waives duty on power-generation equipment. With the right approach, investments in Kenya, Nigeria, and other select jurisdictions can deliver excellent risk-adjusted returns.

Investing in energy-infrastructure projects is not without complexity. On the contrary, investors need to draw on technical expertise to ensure that projects are sound. As investors we demand bankability, but how we get there differs from

A majority of the global middle class lives in growth markets. Demand for reliable, affordable electricity will only rise. The capital needed to close this infrastructure gap represents a unique investment opportunity.

place to place. Adapting to each growth market's unique conditions requires flexibility in the capital structure and security provisions for each project. And to be successful, investors need a deep understanding of how the project will be built, how it will behave over its lifetime (including the various risks at each stage), how to control life-cycle costs, and how to deal with the unique risks and challenges of each host country. These complexities and nuances can be addressed. Experienced developers with a deep understanding of the rules, regulations, and customs of the local market are well positioned to deliver successful projects in conjunction with their financial partners. However, financial partners need to expand their role, moving beyond providing capital to bring deep operational, technical, and geographical expertise.

In 2009, The Abraaj Group assumed operational control of Karachi Electric Supply Company (now known as K-Electric), a vertically integrated power utility in Pakistan. While there was latent and rising power demand in the area, underinvestment had left the company stagnant. We put together a comprehensive turnaround

plan, and over the next four years, the company curbed losses in transmission and distribution, decommissioned old power plants, and built new ones. As a result, it has generated positive earnings before interest, taxes, depreciation, and amortization since 2011 and reported positive net income in 2012 and 2013—after 17 years of losses.

The energy-infrastructure challenge is a unique investment opportunity that will pass when the infrastructure in growth markets catches up with that in developed regions. Although investor appetite is growing, competition among investors still lags behind more mature markets. Investors with deep local knowledge and in-house technical and operational expertise who partner with experienced developers will find quality investments that meet—and exceed—their needs. ○

¹ *The Report: Peru 2014*, Oxford Business Group, 2014, oxfordbusinessgroup.com.

² For the purposes of this article, the global middle class is defined as households with daily expenditures between \$10 and \$100 per person in purchasing-power-parity terms.

Making the consumer case for major infrastructure

Dominic Maxwell, Julian Mills, and Stuart Shilson, McKinsey & Company

Making a better match between institutional investors and infrastructure investments

Frédéric Blanc-Brude, EDHEC-Risk Institute

Using PPPs to fund critical greenfield infrastructure projects

Thierry Déau and Julien Touati, Meridiam

Keeping 21st-century cities on the move

Jay H. Walder, MTR Corporation

Maximizing revenue from government-owned assets

Robert Palter and Stuart Shilson, McKinsey & Company

Inspired infrastructure

Uwe Krueger, Atkins

Infrastructure and the resilience dividend

Judith Rodin, The Rockefeller Foundation

Rethinking conventional construction:

An interview with Broad Group chairman and CEO Zhang Yue

Infrastructure's central role in China's 'new urbanization'

Xiaodong Ming, China's National Development and Reform Commission

Critical issues in the next decade of China's infrastructure effort

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