POSITIVE INFRASTRUCTURE
A FRAMEWORK FOR REVITALIZING THE GLOBAL ECONOMY
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Foreword and Acknowledgements

The theme for the Annual Meeting 2010, “Improve the State of the World: Rethink, Redesign, Rebuild”, could not better epitomize the current state of infrastructure development around the world. The dire need for infrastructure, be it water, transportation or energy, will require the designing, building and rebuilding of many infrastructure assets globally. However, none of this can be achieved without effectively rethinking the why and how of infrastructure development.

The Positive Infrastructure Initiative was launched in 2009 in response to a clear mandate provided to the Forum at the Annual Meeting 2009 in Davos by the CEOs of the leading global Engineering & Construction, Metals & Mining, and Aviation, Travel & Tourism companies to facilitate a year-long dialogue between policy-makers, industry and civil society in the context of massive fiscal stimulus packages on infrastructure development around the world. This report summarizes the outcome of this initiative and outlines the state of infrastructure development in four specific regions: Latin America, China, the United States and India.

We are extremely grateful to the project steering board for guiding the project from its inception to its completion: Klaus Kleinfeld, President and Chief Executive Officer, Alcoa, USA; Phillip Dilley, Chairman, Arup Group, United Kingdom; Anthony F. Pryor, Chairman, Halcrow Group, United Kingdom; Ajit Gulabchand, Chairman and Managing Director, Hindustan Construction Company, India; and Wallace King, Chief Executive Officer, Leighton Holdings, Australia.

We are also indebted to the following for providing input to the framework and authoring sections of the report: Ritu Anand, Chief Economist, Infrastructure Development Finance Company (IDFC), India; Norman Anderson, President and Chief Executive Officer, CG/LA Infrastructure, USA; Chen Chuan, Senior Lecturer in Construction Management, Property and Construction Program, University of Melbourne, Australia; Jurgen Feix, Managing Director, CBP Consulting Engineers, Germany; Marion F. Hellmann, Assistant General Secretary, Industrial Relations, Secretary Building Committee, International Federation of Building and Wood Workers (IFBWW), Switzerland; Fred Moavenzadeh, James Mason Crafts Professor of Engineering Systems and Director, Technology and Development Program (TDP), Massachusetts Institute of Technology, USA; Luis Miranda, President and Chief Executive Officer, IDFC Private Equity, India; and Catherine J. Revels, Regional Team Leader, Water and Sanitation Program, World Bank, India. We would also like to thank our project advisers at KPMG for their support of this initiative.

Sincerely,

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Executive Summary

Infrastructure is fundamental to both economic development and plays a crucial role in determining the quality of life of individuals and societies. In almost all parts of the world the need for new infrastructure assets or the need to modernise obsolescent assets are stark. However, we live in a world where economic and demographic growth, coupled with severe underinvestment in infrastructure, has created an infrastructure deficit that some estimate would require an annual investment of over US$ 2 trillion each year over the next 20 years. Fiscal stimuli programmes around the world structured in response to the financial and economic crisis of 2008-2009 provide an unprecedented opportunity to address this infrastructure deficit.

The World Economic Forum launched the Positive Infrastructure Initiative as a result of a clear mandate given to it by the CEOs of the Engineering & Construction, Metals & Mining, and Aviation, Travel & Tourism Partner companies to facilitate a dialogue between businesses, policy-makers and civil society to ensure that the massive fiscal spending on infrastructure not only generates the employment to restart the global economy but also creates infrastructure assets that foster long-term economic competitiveness, and are environmentally and socially sustainable.

The corporate champions of this project from its nascence to its completion were the CEOs of Alcoa, Arup Group Ltd, Halcrow Group Ltd, Hindustan Construction Company and Leighton Holdings, who have provided both sectoral and geographic diversity with their perspectives and vision for infrastructure development. The CEOs of these companies constituted the steering board of the project.

The Forum, with the support and guidance of the project steering board, convened a core expert group drawn from industry, civil society and the academic community that helped craft a framework to provide the enabling environment for ensuring that infrastructure projects undertaken as part of stimulus programmes are economically, socially and environmentally sustainable. Workshops were then conducted in the four largest infrastructure markets in the world – Brazil, China, the US and India – to vet the framework and explore some of the key opportunities and issues with infrastructure spending in these markets, and the question of sustainability in these markets. The regional workshops also provided input to the development of the regional infrastructure chapters that serve to highlight specific opportunities, trends and challenges in infrastructure development in these regions.

The framework is organized along three systemic themes – economic, social and environmental – to reflect the three drivers for the creation of infrastructure projects and their sustainability. Each systematic theme is organized into various pillars that reflect some of the key enablers of economic, social and environmental sustainability of infrastructure projects. The framework, based on the objectives established by the steering board, served as the key anchor for the conversations and deliberations at the various regional workshops, and highlighted some of the key strengths and opportunities for improvement in each region. The framework in its final form is presented below.

I. Economic Factors

I.1. Overall National Vision for Infrastructure Projects
   I.1.i. An overall model for a country to evaluate and make decisions on projects, and types of projects to be undertaken

I.2. Macroeconomic Attractiveness
   I.2.i. Availability of skilled local labour and productivity of local labour
   I.2.ii. Ease of importing skilled foreign labour to fill gaps in local labour market
   I.2.iii. Quality of local educational system
   I.2.iv. Fiscal responsibility
   I.2.v. Lack of trade barriers
   I.2.vi. Stable exchange rate regime
I.3. Stable Legal and Regulatory Framework
   I.3.i. Respect of property rights
   I.3.ii. Efficiency in dispute settlement
   I.3.iii. Stable and effective environmental regulation
   I.3.iv. Stable and effective codes and legislation on occupational safety and performance
   I.3.v. Effectiveness of law-making bodies in enforcing regulations and codes, and the independence of judiciary
   I.3.vi. Robustness of regulatory and legal framework to changes in political regimes

I.4. Sustainable Financing of Infrastructure Projects
   I.4.i. Access to debt and equity financing of infrastructure projects
   I.4.ii. Existence of adequate pension fund assets and other long-term, return-seeking investors
   I.4.iii. Access to long-term credit financing
   I.4.iv. Favourable cost of capital for infrastructure financing
   I.4.v. Instruments for sustainable public financing of infrastructure projects

I.5. Risk Mitigation Instruments
   I.5.i. Well capitalized multilaterals willing to provide political and conflict risk guarantees
   I.5.ii. Access to private insurance to mitigate construction and operational risks of infrastructure projects

I.6. Capacity for Infrastructure Project Creation, Execution and Management
   I.6.i. Public sector that has the ability to create high-value, competitiveness generating projects, which can be bid, adjudicated and managed to commissioning, and then overseen through the life cycle
   I.6.ii. Robust pipeline of projects that are ready to be financed

II. Social Factors

II.1. Social Sustainability of Infrastructure Investments
   II.1.i. Use of procurement practices and procedures developed by international organizations such as the World Bank and the International Labour Organization
   II.1.ii. Use and enforcement of labour standards that comply with those mandated by international organizations such as the International Labour Organization
   II.1.iii. Equitable treatment of migrant labour used for infrastructure projects

II.2. Public Ethics and Transparency
   II.2.i. Transparent procurement and contracting processes
   II.2.ii. Regular payment of contractors of public works
   II.2.iii. Lack of a track record of government expropriation of private assets
   II.2.iv. Transparency regarding changes in policies
   II.2.v. Openness to public dialogue on infrastructure projects
   II.2.vi. Honesty of politicians and public officials

II.3. Collaboration between the Public, Private and Civil Society Sectors
   II.3.i. Ongoing collaborative relationship between public, private and civil society sectors
   II.3.ii. The ability of the private sector to augment the public sector’s technical capacity through secondment arrangements

II.4. Society’s Willingness to Pay for Infrastructure Services
   II.4.i. Society’s willingness to pay taxes or usage fees in line with the costs of infrastructure services
II.5. Track Record of Infrastructure Investment
   II.5.i. History of distressed, cancelled or unilaterally renegotiated projects
   II.5.ii. History of government cancellation of projects

III. Environmental Factors

III.1. Environmental Regulation and Permitting Process
   III.1.i. Project approval process based on robust environmental impact assessment studies
   III.1.ii. Monitoring and enforcement of environmental standards on infrastructure projects

III.2. Environmental Impact Mitigation Opportunities
   III.2.i. Infrastructure projects that can reverse negative environmental impacts

III.3. Robustness to Environmental Risks
   III.3.i. Robustness of infrastructure investments to climate change risks
   III.3.ii. Resource usage by infrastructure projects that take into account the scarce nature of natural resources

The regional workshops and the regional report chapters highlight that infrastructure is fundamentally a regional issue, with regions, nations, provinces and even cities facing very different issues. While regional disparities are the norm, there are several specific elements that are consistent across all four regions where the regional infrastructure workshops were held.

Firstly, the workshops and the report chapters point to a consistent trend across regions that infrastructure investments are most successful in regions and countries that have an overarching vision of how infrastructure development would fit into their national economic development plan. While a few discussions got into the semantics of whether this vision should be national or regional, there was a clear need to coordinate this vision at the highest levels to ensure coherence of infrastructure development plans with those of national economic development plans. It is essential to strengthen institutional (largely public sector) capability and capacity including regulatory governance to ensure the delivery and coordination of infrastructure visions. Within the current spending plans, infrastructure spending in China is executed with a clear national vision. India, while still somewhat wanting in the realm of execution of infrastructure projects, has a vision for its infrastructure development. In the context of developed markets two issues that are extremely relevant are the issues of optimizing operational efficiency and managing demand when the inventory of existing infrastructure is quite high, such as in the United States.

The various chapters also clearly highlight that the private sector has a crucial role to play in infrastructure development, not just to plug the gaps in public sector capacity, be it capital, labour or technical, but also to promote efficiency gains in the development of infrastructure. It has become clear that the involvement of the private sector in infrastructure development has lead to the timely execution of infrastructure projects that have been more cost effective than projects solely executed by the public sector. This gain in efficiency should be the primary reason for the involvement of the private sector going forward, through mechanisms such as public-private partnerships rather than to meet the gaps in public sector capacity.

Another consistent theme that came through in all workshops was the need for infrastructure projects to be socially inclusive. Infrastructure projects where there has been an early engagement of various stakeholders have been far more successful than the ones where this has not been the case. This is particularly relevant when there are questions posed around society’s willingness to pay for infrastructure services and the benefits accrued to society as a result of some of these projects.

While the report and the four workshops conclude this phase of the project, the second phase to be undertaken in 2010 will encompass holding workshops in other regions and countries such as Canada and Australia, expanding on existing collaborations with multilateral donor organizations and partnering with other initiatives where there are clear synergies.
Chapter 1
Positive Infrastructure in Latin America
Overall, there is a very low level of infrastructure investment in Latin America, and a widening gap between Latin American infrastructure investment levels and those of competing countries around the world. Given that infrastructure is an efficient and dynamic opportunity creator, this is a problem that affects both the overall economic performance of the region and the critical area of income distribution.

In the immediate past, the challenge (which was never met to the extent of raising the level of GDP invested in infrastructure) focused on creating the conditions for the private sector to participate more heavily in all types of infrastructure throughout the region. In practice, the private sector focused on only a few types of infrastructure – telecommunications, electricity, some highways and ports, very little in terms of water, less in terms of waste water, and urban mass transit. Now, because of the financial crisis, the public sector role has grown de facto, without any corresponding increases in capacity or funding. Indeed, in terms of funding, quite the opposite has occurred, with declines in federal, state and municipal budgets by as much as 25%. This note is designed to address these issues.

Objective
Latin American countries invest between 1% and 2% of their GDP in infrastructure (Chile is the only outlier, investing between 3% and 5%), whereas investment levels should be in the 5-7% range. Moreover, much infrastructure investment over the last eight years took place in commodity-related areas, suggesting that the picture for the overall infrastructure sector is even less robust than thought. This is especially and increasingly true for the smaller countries. This paper assesses the problems with infrastructure investment in Latin America, and identifies concrete steps that might be taken to improve the level of infrastructure investment by as much as 400%, throughout the region and throughout critical infrastructure sectors.1

1. Assessment. There are deep problems in Latin America that consistently act as inhibitors to systematic infrastructure project development. Many of these issues have to do with the capacity and behaviour of the public sector. Another set of issues has to do with what might be called the institutional design of public sector entities. A third has to do with the fact that there is no generally accepted infrastructure model – over the last 15 years, public financing was replaced by privatization, and then by an urgent search for a public-private partnership model. Finally, there are private sector issues that need to be addressed. And running throughout this equation is the requirement for, and desirability of, an effective voice for the social and environmental community of non-governmental organizations (NGOs).

Before entering into this level of detail, it is important to position the debate at the right level. Overall, countries that are successful in infrastructure project creation over the long term (in recent years, Spain, Australia and China, along with Chile) have all had an overarching vision of how their countries fit into the world, and of the critical set of specific – or priority – projects required to realize that vision. This seems to be an issue both of leadership and of building a powerful consensus for making decisions going forward. It is noteworthy that, in every case, one characteristic of a strong vision is ambition – a successful vision is, in every case, extremely ambitious.

As a result in each case, the investment levels required are much higher than current levels. Infrastructure passes from being one of many competing interests to being a national priority, through to being the national priority. The result is highly focused executive attention, the priority deployment of executive resources, and – critically important – attention to, and a lack of patience with, shoddy planning, cost overruns and missed schedules.2

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1 The definition of infrastructure used is broad, but limited to the following: (1) ports and logistics; (2) highways; (3) airports; (4) electricity generation, including renewable energy; (5) electricity T&D, including smart-grid related; (6) urban mass transit; (7) water treatment; (8) waste-water treatment; (9) rail; and (10) digital infrastructure, narrowly defined from the infrastructure perspective. Oil and gas, mining and tourism investments are included, as these relate to the 10 infrastructure sectors listed above.

2 It may also be useful to think in terms of an overall Latin American competitiveness vision to drive the region’s infrastructure build, as one of this paper’s astute observers noted. At the same time, this is not a core action item of this paper because of (a) the different institutional machinery that would need to be mobilized – and in some instances created – to bring this about, and (b) the interstate rivalries that shadow this debate.
1.1 Capacity, behaviour and role of the public sector. As Latin American infrastructure investment has fallen from 3-4% of GDP in 1980 to 1-2% in 2008, the public sector in Latin America has lost status and capacity. It is not a coincidence. This is particularly true of planning ministries.

The largest weakness has to do with the ability to create and manage a pipeline of bankable projects. Without this level of capacity, complementing a vision that designates priority projects, the advent of each and every project turns into a design, environmental, bidding and financing battle. The manifestations of this problem vary across the region, from consistent cancellations of bids in Mexico and Colombia, to ongoing, nagging, financing problems in the Dominican Republic, Peru and other countries. Creating the capacity for the public sector to oversee, originate and manage projects is extremely important.

This is an obvious and serious weakness – the inability to create a project pipeline – but it points to a much more serious problem: in any infrastructure project, the public sector is extraordinarily important, and to the extent that the public sector is weak and cannot perform its role, the private sector will to that extent recognize increased risk in its participation in projects. In the short run, this problem slows down the execution of projects, increasing both risk and cost, but in the long run there can be no public-private partnership model when the public sector is weak.

1.2 Institutional design of the public sector regarding infrastructure. One of the extraordinary facts about infrastructure in Latin America is how astonishingly tedious it is to make projects happen. This is a time consumption that translates into real – and sometimes prohibitive – transaction costs. Infrastructure is Balkanized across industries and up and down levels; each ministry has its own budget and its own priorities, and each defends those priorities as tenaciously as possible. Complicating this distance between ministries is the distance within ministries for generating required permits. Three important ideas need to be explored.

First, there needs to be an overall coordinating body for priority infrastructure projects. In Mexico, there is a small office within the presidency that attempts to play this role. In Brazil, there is a unit within the president’s chief of staff’s office that plays this role. In the Dominican Republic, a special “coordinating cabinet” has been set-up to push priority projects through the permitting and finance process. The coordination issue needs to be addressed institutionally.

Second, the problem of distance – the presidency, the ministry of energy, the ministry of environment, planning, transportation, budget, etc. – makes it virtually impossible to generate the required innovation necessary to triple or quadruple infrastructure investment. It is increasingly clear that it is crucial to cut down this distance not simply through the creation of a coordinating body, but also through the development of an infrastructure cluster in which everyone works together in close physical proximity towards a common end.

Third, there must be regular reporting on performance. If infrastructure is strategic to a country’s health, there must be a unit in charge of measuring that performance. This unit, perhaps called the Infrastructure Accounting Office, would oversee projects, measuring the percent of GDP invested in infrastructure, the timeline for project execution, the percent of infrastructure invested in various sectors (as against targets) and other key performance metrics. Among other issues, this would powerfully address any issues of transparency and corruption.

1.3 An organizational model for infrastructure project creation and execution. As mentioned earlier, there is no real shared model for the financing of projects. This creates a significant amount of confusion, real inefficiencies and a dramatic lack of focus. Governments around the region are attempting to figure out how to implement public-private partnerships with very weak public sectors; they are trying to determine how to do concessions while resisting the payment of shadow tolls or the provision of guarantees; and they are slowly turning to the general fund financing of critical projects, without the financing capacity to fund even minimal projects. It is clear that a public sector lead model, with significant private sector participation, is the only model that will work – but the form that this model takes, and how it will engage the private sector, is open for debate.
It is important to recognize that the issue of project financing, extremely delicate in Latin America over the last 10 years, has become critical. The closing of private credit markets, the crowding out of Latin American infrastructure finance needs (especially in small countries) by large country deficit requirements and the consequent over-burdening of multilateral budgets suggests that now is the moment to revisit how projects are financed in the region. It may be that a new kind of national infrastructure bank – modelled after Brazil’s BNDES, for example, should be developed in each country of the region. Certainly structures should be created to mobilize more local capital, including that of pension funds, for long-term investment in infrastructure projects and infrastructure project-related companies.

The lack of a clear model and of a reliable, technically credible, financing source focused on a country’s priorities is an extreme inhibitor of investment in infrastructure throughout the region.

1.4 The role of the private sector. The private sector – engineers and construction executives, financial professionals, lawyers, consultants – has a fundamental role to play in infrastructure project creation. In fact, infrastructure may be the one area of economic activity that requires a full role for both the private and public sectors. Perhaps it is this fact that accounts for the institutionalized antagonism in infrastructure between the two sectors. Enabling a dynamic, positive private sector role should be the aim of public policy. This is a fundamental key to addressing the challenge of getting investment up to 5-7% of GDP.

The problem in the recent past is that far too much was required of the private sector to make and sustain large investments, and without a complementary strong and professional public sector, the level of risk in investment, effort and time was extremely high.

The relationship needs to be rebalanced. There are four fundamental roles for the private sector in any effort to massively increase project investment. First, there is a large role in project origination, one that is often ignored in the “church and state” separation of the private and public sectors on the infrastructure issue. The public sector can set the priorities, but the private sector often knows which projects are best, ready and ripe because it is imbedded in the business community. Chile offers a 10% advantage on any project suggested by the private sector when that project comes to public bid; this is a common sense solution that both addresses any conflict of interest issues and generates a productive level of cooperation between the two sectors.

Second, engineering/design work, along with construction, is almost always a private sector function. Once again, the private sector has a dynamic, cutting-edge role in this area, but the public sector must be capable enough to set a detailed scope of work, monitor performance and push the envelope of that performance. Spain, as an example, has a highly sophisticated public sector populated by top engineers who take pride in enabling cutting private sector performance.

Third, financing from the private financial sector is increasingly dependent on coverage from the public sector, including overwhelming competence – also including sovereign guarantees and companion loans from the multilateral development banks. This is not a question regarding privatization or private participation in infrastructure, but rather the alleviation of the budget burden on the general fund. Areas of high potential financial participation include all types of leasing, especially rolling stock; asset ownership, based on performance variables, for example transmission lines and power plants; and straight project financing, including through special purpose bonds.

Fourth, operation and maintenance contracts are highly appropriate for private sector participation, whether in terms of financing or straight fees for service operations contracts.

1.5 The role of social and environmental NGOs. In many ways, this is the great, unrealized opportunity for the region in infrastructure project design and creation. Creating systematic structures for involving the NGO community is not only critical but highly desirable, particularly at the level of project design. This “voice” is
crucial.2 Over and over again, it is evident that projects that take advantage of social and environmental ideas and insights tend to be better designed than projects that ignore this input.

Of particular interest in terms of timing is that, when thinking of infrastructure as a well-stocked and well-prepared project pipeline, it is clear that the participation of social and environmental NGOs – and economic development ones as well – will yield stronger, quicker to market and more productive projects.

In sum, the overall lack of trust between the public and private sectors needs to be addressed. The two need to work together, hand in glove. The church/state problem has created a real crisis of communication, coordination and competence; rather than easy collaboration across lines of authority and expertise, there is a kind of mistrust that obscures a significant opportunity. Clearly, there should be a fairly dramatic revision of the rules governing public and private interaction. The NGO role here is potentially quite fertile – economically, socially and environmentally – bringing highly intelligent insights to the process during the origination phase. It should be noted that the multilateral development banks often exacerbate the public-private divide, given their justified worries about corruption and transparency, and should be encouraged to address these concerns by including the private sector more systematically in the discussion.

2. Action Items. Given the long decline in the level of infrastructure investment, the deterioration of the public sector and the current financial crisis, it is clear that recommendations for increasing the level of infrastructure investment in the region should be extremely ambitious and suggestively precise. There are a number of factors that are absolutely critical for enabling long-term investment – investment that leads to both long-term competitiveness and job creation.

The “what” of the problem is fairly clear; the “how” of solving a complex problem that has been developing and evolving for over 20 years is much more complex.

2.1 Setting the vision. A long-term consensus infrastructure vision should be developed within each country. The overall objective is to define a country’s comparative advantages, and then build an infrastructure plan and a list of projects to breathe life into that plan. Chile’s non-partisan 30-year infrastructure build, focusing on agricultural value-add and wide-gauged opportunity creation, is an example of such a vision.

2.2 Rebuilding the public sector, correctly. Creating over time a strong public sector is fundamental for infrastructure project creation.4 Two functions are probably most important: a strong public sector technical capacity so that a project pipeline is created and projects are bid, adjudicated and monitored; and a public sector strategic capacity to ensure that projects are bid on in a timely manner and are carried out according to contractual timetables and budgetary obligations.

This requires not just a higher level of public sector capacity, but also the creation of a coordinating body – like a ministry of infrastructure – with real budgetary authority. The Ministry of Public Works in Chile is an example (although “public works” is a term that denotes both short-term projects and a lack of attention to competitiveness and opportunity creation). It is fundamental for the optimization and velocity of project development that decision-makers are located close to each other, facilitating their internal communication as well as efficient project permission authorization. The creation of independent and influential ministries of infrastructure will break down the public sector silos, which are harmful to rapid and innovative decision-making.

3 The NGO voice was left out of the first draft, confirming the project developer’s common “haste makes waste” mistake of seeing this kind of input as time consuming negatives rather than as a positive part of the process, best taken advantage of as early as possible.

4 The intent here could not be further from “public sector strengthening” or “institution building”; rather, the idea is to halt the long-term trend towards a weak public sector by emphasizing that the overall and natural result in infrastructure of a weak public sector is a private sector that (a) has little appetite for the enormous risks implied in doing business with a weak public sector, and (b) will charge an inordinate amount if it decides to go ahead and undertake that business. Short-term solutions could involve seconding private sector executives to the public sector (a suggestion made at the 2009 World Economic Forum on Latin America in Rio), and increasing the private sector’s role in public management through specific, well-defined project management roles (as is the case with CH2M-Hilli’s role in the Panama Canal project).
2.3 Creating the capacity for funding at a 5-7% of GDP level. Currently, Latin America invests roughly US$ 40 billion per year in infrastructure and is on course to invest US$ 200 billion through 2014; the region should invest roughly US$ 160 billion each year, or a minimum of US$ 800 billion through 2014. In addition, investment should be retargeted to areas critical to long-term competitiveness, opportunity creation and health. While that should be the objective, the opposite is true – every country in the region is currently having tremendous difficulties in simply maintaining current levels.

There is no current evidence that the region is capable of increasing investment in infrastructure. The model is broken. Fixing the model would involve the steps discussed above, and would especially include the creation of internal financial capacity to generate feasibility and public sector seed funding for priority projects. This might take the form of an infrastructure capital bank, focused aggressively on (a) creating a pipeline of bankable projects through feasibility studies, and (b) providing a leading public sector counterpart to private sector and multilateral funding. This counterpart might guarantee projects, invest directly in projects, invest in project-related firms or join with local pension funds in the creation of project development funds. The overall result would be a significant increase in the ability of local authorities to create, promote and invest in the right projects.

2.4 Measuring performance. The public sector, perhaps with the help of the multilateral development banks (MDBs), needs to create an agency in each country that monitors three basic metrics:

- Yearly infrastructure investment by sector
- The operational performance of infrastructure assets – comparing those with performance indicators globally
- The results of infrastructure project investment, both in terms of financial performance and in terms of what might be called a “competitiveness IRR” – jobs created directly and over the long-term, businesses created, new tax revenue generated, etc.

The fact is that this level of intelligence would generate transparency, alleviate corruption, improve knowledge and, if done well, dramatically improve the public’s support for infrastructure projects.

Even more, this level of information – once developed and considered reliable – could be shared across sectors and across countries. Even more importantly, by showing the improvements in the level of well-being – from public health to per capita income to job creation – and tying those rising indices to infrastructure investment, the kind of critical constituency for infrastructure investments so necessary for sustaining those investments would be built in the right areas over time.

2.5 Creating a strong private sector role. This topic is discussed in detail above, but it is exceedingly important that entities be created, either in terms of general infrastructure or in terms of specific sectors, that will public and private sector executives to communicate with each other on a regularly scheduled basis. Participants from the private sector would include business executives, environmental firms and representatives of public citizens groups. Deliberations would be a matter of public record.

2.6 Defining a catalysing role for the MDBs. In all of this, there is a new dynamic and the suggestion of a quite different role for the MDB institutions. Currently, these institutions are slowly adapting to a radically altered financial landscape, pleasantly surprised by their newfound central role – as one high-level executive stated with a certain level of pride during the 2009 World Economic Forum on Latin America in Rio: “We have four times the demand for resources, without any additional staff.” The private sector also comments that the MDBs are the only source of funding open for infrastructure projects.

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5 The idea of creating a feasibility study culture is important, because that would capacitate local engineers and financiers in building bankable feasibility studies – creating a dynamic body of local, very high-level infrastructure capital.

6 There are four main MDBs operating in Latin America: the Andean Development Corporation (CAF); the World Bank (including MIGA and the International Finance Corporation); the Inter-American Development Bank; and the Central American Bank for Economic Integration (CABEI). The CAF is said to lend more to infrastructure projects in Latin America than the other three institutions combined.
If the region is to invest 5-7% of GDP in infrastructure, the MDBs will have a fundamental, active and strategic role to play, including:
Seeding (or capitalizing) country-level infrastructure entities
Providing expanded risk coverage for projects (the World Bank’s Multilateral Investment Guarantee Agency, MIGA, is particularly adept in this area)
Lending intellectual capital to country-level feasibility study agencies, so that pipelines of uniformly bankable projects are created throughout the region
Lending intellectual capital to infrastructure performance monitoring agencies, so that metric coordination across the region is meaningful (apples to apples)7
Direct lending to projects, as they currently operate

Note that this is a narrower, deeper and enabling role for the MDBs that would facilitate strong country-level decision-making. In addition, it is very important that the MDBs develop a much closer relationship with the private sector. Much of the church/state rules in Latin America, and the problems created by those rules, can be directly traced to MDB requirements. It would be highly advisable for the MDBs to form regular public-private groups to review innovative opportunities across the range of infrastructure sectors, as well as in key areas like finance and technology.

Summary
If there is one word that comes up whenever the issues of infrastructure in Latin America are discussed, from both the public and private sector points of view – but especially from the point of view of the private sector – it is “slow”. And that small word translates into enormous costs in terms of time, transaction costs, avoided projects and corruption.

The fact is that there is enormous room for innovation in infrastructure throughout the region at every level. Eviscerating distance – public-private distance, permission distance and discussion distance – will lead to the creation of better projects, increased velocity of project financing, better project performance and increased public support for projects. The key is to generate a consensus vision of the future, create an overall infrastructure competitiveness plan and a series of projects that define that plan, and make sure that projects are designed, executed and operated optimally. A high-performing infrastructure culture will take time to develop, and will only proceed if public sector capacity is raised to such a level that the private sector, far from being a threat, can be safely seen as an active participant at each stage of the process.

Generating a 5-7% level of GDP investment across Latin America for a sustained period will require enormous changes, not only in the public sector and in how the private sector relates to the public sector, but also in how people in each country across the region understand the profound competitiveness and opportunity-creating nature of great infrastructure.

7 The metrics issue is exceedingly important. Two examples: (1) in water projects, it is exceedingly difficult to compare performance across firms – whether employees per connection, leakage, investment levels or some other fundamental measure; and (2) in highway concessions, it would be highly useful to have a clear sense of metrics on controversial issues like shadow tolls, and an agency with the credibility to not only address those issues but also propose and execute solutions in moments of stress.
Chapter 2
Characterizing Infrastructure Development in China
The past three decades have seen large-scale infrastructure development in China; however, this rapid development has had its ups and downs and is mixed with imbalances along regional and sectoral dimensions. The dynamics of infrastructure development is further accentuated by the transition of the economy as a whole and the resulting evolution of the legal system in China. In the meantime, foreign and local private investors and developers have become an important force, although they still cannot challenge the dominance of governments and state-owned enterprises. Hence, there are many unknowns and uncertainties about the future of infrastructure development in China. This report first outlines the current state and emerging trends in infrastructure development in China, and then reports in particular on the patterns of private sector participation in infrastructure.

Part One: Infrastructure Development in China

I. The importance of infrastructure development in China

China’s pressing need for infrastructure development is driven by pressures such as the country’s massive urbanization, industrialization and privatization programmes and by globalization generally. Although, to development economists, the relationship between infrastructure development and economic growth is still not very clear (e.g. Ford and Poret 1991; Taylor-Lewis 1993), it appears that the Chinese government has never doubted the pull and push effects of infrastructure to other economic sectors. This is reflected in a well received slogan, “Build a road first if you want to get rich”. In the 1980s, infrastructure investment in China accounted for about 4.4% of GDP, and the figure increased to 7.5% in the 1990s. Currently, it is around 8-9% of GDP. In the near future, this ratio may escalate to 13%. This trend is clear in Figure 1, based on statistics on fixed assets investment in major infrastructure sub-sectors. Despite significant public financing, the rate and quality of infrastructure development still lags behind the levels needed to sustain rapid economic growth, and is still believed by the government to be a “bottleneck” in the process of economic development.

![Figure 1: Fixed assets investment in energy, water, transport, environment and urban facilities (2003-2007)](image)

Source: China Yearbook 2008* (not inclusive)
II. Regional differences in infrastructure development in China

The infrastructure sector of China cannot be considered an even and integral market; infrastructure development in China is not balanced regionally.

The country is administratively divided into three regions – west, central and east – as shown in Figure 2.

The regional distribution of fixed assets in infrastructure in major infrastructure sub-sectors is depicted in Figure 3. In terms of infrastructure investment volume, the eastern region received the largest amount, followed by the central and western regions. In terms of investment volume per capita, the difference between the three regions is less significant, while in terms of infrastructure investment per square kilometre, the imbalance is more serious. There is immense room for improvement in the central and western regions, and it seems that the government is trying to reduce this regional difference by launching the national strategy of “west development”, which contains many initiatives to develop the infrastructure in the western region. However, the current investment environment of the western region cannot be transformed in one day. An example of the current state of affairs is illustrated by the recent case of the US-based Hans Technologies, which had hoped to focus on the niche water supply market in Western China. In the process of developing a portfolio of water build operate and transfer (BOT) projects in Qiannan City of Guizhou Province, the company has run into resistance from local farmers, who are demanding increased job opportunities and more compensation for property acquired from them.

Data source: China Yearbook 2008
III. Predicting future infrastructure expenditures

China is a county in transition from a Soviet-style planned economy to a market economy, often termed socialist market economy – essentially, socialism with Chinese characteristics. Current plans for infrastructure development can be assessed by scrutinizing the various master plans enacted by the central-level State Council and line ministries, as well as the governments at provincial and municipal levels. At the central level, the most important documents that guide the planning for infrastructure development at lower administrative levels include:

1) *The Eleventh Five Year Plan for Energy Development (National Development and Reform Commission).* According to the plan, the preference of the government has transferred from traditional thermal power generation and hydroelectric generation to nuclear power generation and the national power grid. The plan also elucidates the government’s focus on environmental protection.

2) *Medium- and Long-term Development Plan for Renewable Energy in China (National Development and Reform Committee, September 2007).* This is an ambitious plan and the implementation is on fast track, particularly in biomass power. By 2010, the installed capacity of biomass power will reach 5.5 GW. On the wind farm front, about 30 100-MW-scale wind farms will be established, mainly in the eastern coastal areas and the Three Norths Region.

3) *The Eleventh Five Year Plan for Railway* by the Ministry of Railway, and *Long- and Medium-term Railway Network Plan.* In the eleventh five-year term, 1,250 billion Yuan (about US$ 155 billion) will be spent to construct new railway lines stretching 17,000 kilometres and to develop a comprehensive railway and rapid transit system network, consisting of four trunk lines from the north to the south and four trunk lines from the east to the west.

4) *The Eleventh Five Year Plan for Transport and National Highway Network Plan,* which also presents an ambitious blueprint for the construction of roads, sea ports and airports. For example, in the 11th five-year plan period, the construction of the highway network will increase the total road mileage by 0.4 million kilometres, including 24,000 kilometres of expressway.

5) Given the regional differences of infrastructure development in China, it is also valuable to examine the *Eleventh Five Year Plan for West Development.* According to the programme, apart from increasing government spending in the west, China will make more effort to further open up the western region to foreign investors.

The 11th five-year plans are now almost at their culmination and an interim evaluation report in 2008 indicated a good implementation progress (China Daily 2008). The government is now formulating plans for the next five-year period (12th five-year plans, 2011-2015), which will have an influential role in how the Chinese infrastructure market develops in the near future.

IV. State-of-the-art in financing infrastructure investments in China

With the deepening of reforms, there are more and more infrastructure financing methods emerging in addition to traditional fiscal allocation, which includes interest subsidy. Such new sources of financing include local bank loans either from policy banks such as the State Development Bank or commercial banks such as the Bank of Construction; public, quasi public or local private enterprises’ investment; foreign direct investments and loans; grants or concessional loans from multilateral and bilateral agencies; holding funds in trust; bonds issued by central and local governments; and domestic and foreign capital markets.

Funding from the government still dominates investment in infrastructure, particularly in the impoverished western region, but its stake has been declining. There is concern about the broad and deep involvement of state-owned commercial banks in financing long-term infrastructure projects, because infrastructure projects feature long-
term high investment, high policy dependence, low equity/debt ratio and low rate of return, and do not match the traditional loan conditions of state-owned commercial banks (Yan 2008). There are 30 or so companies listed in the Hong Kong Stock Exchange focusing on the infrastructure market of China, covering most sub-sectors including power, transport, water, gas, sea ports and airports. There are also several developers listed in the Singapore Stock Exchange that are particularly active in the water sector of China. Recently, Macquarie Bank formed a joint venture with China Everbright Group to run two infrastructure funds in China. Local insurance companies have become important investors in the infrastructure sector.

V. Pricing of infrastructure services and products in China

In China, the pricing of infrastructure products and services is a big issue. In the power sector, for example, the grid companies purchase electricity from power producers and the purchase price is usually not based on the supply and demand relationship. This means that a foreign independent power producer cannot adjust the price of electricity based on the variable costs associated with the production of power, such as the cost of coal. This creates a situation where foreign power plant developers cannot compete against local companies that receive subsidies from the government, and many are forced to leave the Chinese market.

In the water supply sector, subsidies are common because water has long been considered a welfare product. Municipal governments usually provide raw water supply and off-take guarantees as well as offer minimum prices for water supplied. However, in recent years, water tariffs have increased rapidly across many cities. There are various reasons for this, among them the increased waste-water treatment costs (in many cities waste-water treatment expenses are included in the tap water tariff), loss of water utilities and raising money for some water supply mega-projects (e.g. the project to move water from the south of the country to the north). Nevertheless, it seems cities tend to abate their subsidies in water supply.

Toll roads, bridges and tunnels are plentiful in China, and the resulting fees are perceived as a burden by the drivers. However, there are few alternatives to taking the toll-based transportation system. Subsidies are also provided to wind farm projects, which partially explains why this sub-sector is thriving in China despite the relatively high installation costs.

VI. Infrastructure project procurement

As public financing still dominates, government procurement methods deserve attention. According to the Government Procurement Law, government procurement shall take the following forms: 1) open bidding; 2) invited bidding; 3) competitive negotiation; 4) sole source procurement; and 5) inquiry about quotations. The fifth method does not apply to infrastructure procurement. Open bidding is by far the most commonly applied approach, with others being applicable under special conditions. In practice, auctions are also popular in privatizing new or existing public infrastructure projects. In an open bidding or auction, sometimes the competition can be so fierce that the final price can be much higher than the base price. In March 2007, Veolia won the bid to acquire 50% of Haikou Water Group based in Hainang Province for 950 million Yuan, while the base price was only 310 million Yuan. In China, as in many other parts of the world, price is the criterion overemphasized in bid evaluation, and other conditions such as technical solution, public safety, financial soundness of the sponsor and environmental impact are often overlooked. This often results in low quality, delays, disputes and other problems over the longer term.

VII. Infrastructure project governance

The complex, rigid and time consuming project approval system of China has long been criticized. Deregulations have occurred since 2004 in this area. According to new regulations, government approval will no longer be required for projects not funded by the government. Instead, “authorization” and “record-filing” will be used where appropriate. However, the enterprises should apply for certificates of environment protection and land use as before. For foreign invested infrastructure projects, the verification process will not differ much from the former foreign investment approval process. The National Development and Reform Commission (NDRC) and its local
branches will continue to approve application reports of foreign developers/investors. An improvement is that, under the new project approval system, local authorities will enjoy enhanced approval powers, which is often favoured by foreign developers. For example, the provincial-level NDRC can authorize: 1) encouraged projects with a total investment less than US$ 100 million; 2) permitted projects with a total investment less than US$ 100 million; and 3) restricted projects with total investment of less than US$ 50 million. In general, public, quasi public and local private companies benefit more from this deregulation process than foreign private developers.

VIII. Sustainable infrastructure development
According to the Law of the People’s Republic of China on the Environmental Impact Assessment, the infrastructure developer shall complete a report of environmental impact, a report form of environmental impact or a registration form of environmental impact (i.e. environmental impact appraisal documents) according to the following principles: a) if the environmental impact might be significant, a report of environmental impact must include an all-round appraisal of the environmental impact; b) if the environmental impact might be less significant, a report form of environmental impact must include an analysis or special appraisal of the environmental impact; c) if the environmental impact might be minimal, it is not necessary to conduct an appraisal of the environmental impact; a registration form of the environmental impact should be completed.

Some initiatives have also been launched to encourage sustainable infrastructure development. For example, the State Environmental Protection Administration and the State Development Bank (SDB) signed an agreement in 2004, based on which the SDB has offered 50 billion Yuan in policy-related loans, normally earmarked towards infrastructure development, to support environmental protection infrastructure programmes during the 11th five-year plan period. The Chinese government’s commitment to environmental protection in the future is clearly reflected in the recent organizational adjustment by which the State Environment Protection Agency was upgraded into the Ministry of Environmental Protection in 2008.

IX. The impact of financial crises
The 1997 Asian financial crisis had severe negative repercussions on foreign investment in infrastructure in China, particularly in the power and transport sub-sectors. One of three BOT pilot projects, the Changsha Power Plant, failed to achieve financial closing because of the dwindling project financing markets. As an effective countermeasure, the Chinese government increased public investment in infrastructure. Bonds were issued by the central government to finance large-scale infrastructure development. With the support of strong public financing, infrastructure played an important role in sustaining the continued rapid growth of the economy through the crisis. Regarding the current global financial crisis, it is well known that China has launched a much larger economic stimulus package focusing on infrastructure development, but how the private sector participation in infrastructure has been impacted is still unknown. The impact may be very limited, according to the data collected by Public-Private Infrastructure Advisory Facility (PPIAF) so far. Nevertheless, it is still too early to draw any conclusions.

Part Two: Private Participation in Infrastructure (PPI) in China
Given the huge demand for water, transport and power facilities, it is increasingly important and necessary for governments to turn to the private sector, either local or foreign, for resources and skills. In China, the private sector first entered the traditionally government-controlled infrastructure sector in the late 1980s, and during the course of the past two decades the sector has developed into a dynamic infrastructure market where private developers have not just harvested gains but have also suffered pains. There is a significant lack of knowledge about the whole picture of this huge emerging market. This section empirically analyses characteristics of private participation in infrastructure in China based on the PPIAF PPI dataset from 1984 to 2007.
I. Market trends
Figure 4 shows market trends regarding different infrastructure sectors – power, transport and water – in terms of deal numbers and investment value. It can be seen that the number of new water supply and sewage treatment projects has been steadily increasing in recent years. This trend reflects the increasing market attractiveness as well as private developers’ continued interest in this sector. This trend, in terms of deal numbers, is inconsistent with the fluctuating total investment value. The inconsistency may come from the fact that some large projects dating to 2002 and 2003 were excluded from the analysis. For example, the Shanghai Pudong water project, sponsored by Veolia, was not measured in 1,000 cubic metres but in the number of connections, and, therefore, its capacity is not incorporated in this analysis. Excluding the effects of these large projects and lack of continuity in the data, the continuously increasing trend in privative investment in the infrastructure market is fairly clear.

Figure 4 also shows that the growth of PPI transport project development peaked in 1996 in terms of project numbers. After 1996, there was a declining trend until around 2000, and then it is followed by another increasing trend. Because the World Bank dataset usually features a time lag when it includes the latest projects, it is difficult to make inferences from the drop in 2006 and 2007. However, it is clear that in 2005 the number of PPI transport projects was higher than in 1996 when measured by investment value. The number of PPI transport projects in 2005 is smaller than the number in 1996, indicating there have been relatively bigger project sizes on average in recent years. The Asian financial crisis in 1997 may well explain the declining trend starting from 1997. Chronologies of PPI power projects by number and total investment value resemble those of the transport sector: the increasing trend also ended around 1997, followed by a modest amount of PPI investment until 2008.

II. Regional distribution
Figure 5 shows that the western and central regions have attracted similar amounts of private investment; however, they lag far behind the more developed eastern region, either by project number or by investment value.
Table 1 lists the top 10 provincial markets for each infrastructure market. It can be seen that Guangdong has attracted the largest amount of private infrastructure investment. It is striking to see that there are seven provinces (municipalities) included in all the ranking lists, i.e. Guangdong, Jiangsu, Shandong, Liaoning, Anhui, Zhejiang and Beijing.

III. Models for accessing the Chinese infrastructure market

In general, there are four models by which private investors can access the infrastructure market: 1) management and lease contracts; 2) concessions (or management and operation contracts with major private capital commitments); 3) greenfield projects; and 4) divestitures (each mode is defined in Table 2).
Figure 6 presents the distribution of the PPI projects regarding the four modes by number and investment value, respectively.

As shown in Figure 6, there are few management and lease contracts, indicating the strong demand for capital investment in China, rather than pure management skill and technology transfer. In the water sector, it would appear that concession and greenfield projects dominate. By number, there are more greenfield projects than concession projects, but less in terms of investment value and facility capacity. This may show that private developers intend to participate in new and smaller projects but also make investments in existing and larger projects. This intention is reasonable, considering the lower risk involved in acquiring partial or full ownership of existing projects so that private developers feel more comfortable in committing more investment. In the power sector, there are many more greenfield and divestiture projects than any other types. This, however, does not mean that private developers are more interested in developing new facilities or prefer long-term commitment. Chinese government agencies tend to involve foreign private developers in power project development through greenfield and divestiture methods to import new technologies and management skills while transferring development risks. With management and lease contracts and concessions, these objectives are hard to achieve.
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Chapter 3 The Future of Infrastructure in North America
The Future of Infrastructure in North America
Prepared for the World Economic Forum by Fred Moavenzadeh and Kyle Frazier, Massachusetts Institute of Technology

1 Introduction and Background

Undergirding the activity of the world’s economies is a set of engineered infrastructure systems which provide critical services in sectors such as transportation, energy, water and communications. From a global perspective, increasing the capacity of these infrastructure systems will be necessary to accommodate continued world economic growth and development; one recent study, published by the consulting firm Booz Allen Hamilton, estimated global infrastructure investment needs for 2005-2025 at US$ 41 trillion \(^1\). In emerging economies, the central challenge will be to meet demand for increased capacity through continued construction, or physical expansion, of infrastructure systems. Conversely, the existence of vast stocks of legacy infrastructure in developed economies, and the high costs of expanding these systems in the dense urban locations where need is greatest, shifts the challenge to modernization and improvement of the capacity and efficiency of legacy systems. Approaches to addressing these challenges are numerous, and there exists no clear consensus on the best ways to move forward. Varying viewpoints abound, with advocates of physical construction, new technologies, pricing and demand-side management, and other organizational and institutional changes each contributing ideas to the debate.

The United States is an example of a developed economy with a large, aging infrastructure stock, and modernizing these infrastructure systems is a daunting challenge for infrastructure policy-makers and providers, including the engineering and construction industry. To meet the challenges of providing needed infrastructure services and facilitating continued growth in the economy, the US infrastructure community must take a fresh look at both the demand and supply sides of infrastructure markets. Ultimately, the solutions to the problems of infrastructure provision in a developed economy will likely be drawn from a mixture of demand-side and supply-side strategies, but the nature of the challenges requires a shift in emphasis away from construction of new facilities and towards expanded capacity and renewed vitality of existing infrastructure assets. Research, development and deployment activities – integrating technological, policy and systems dimensions of infrastructure – will be critical to the long-term success of any strategy for addressing infrastructure needs.

1.1 Infrastructure Definition and Typology

The term “infrastructure” can denote a wide range of facilities and systems, and the precise boundaries of the concept it embodies are open to interpretation. At its most essential, infrastructure means “the underlying framework or basic foundation (as of a system or organization)” \(^2\). Modern societies contain many such frameworks, including economic and financial infrastructure, social infrastructure and physical infrastructure. The last of these, physical infrastructure, is a major engineering and construction market segment and is the focus of this paper. In the context of engineering and construction, “infrastructure” is quite commonly used to describe transportation systems, electricity transmission and distribution networks, water and sewage utilities, and telecommunications systems. Other physical systems and facilities may also be classified as infrastructure; for instance, schools may be considered an infrastructure for delivery of educational services, and hospitals might likewise be considered part of a healthcare infrastructure. Each of the numerous infrastructure systems which undergird modern economies has a unique purpose and history, but together these systems facilitate economic activity and make possible the quality of life enjoyed by residents of those states, providing mobility, communications, electric power, clean water, sanitation and other services.

Although a widely accepted typology does not exist, physical infrastructure systems can be broadly classified as economic infrastructure (e.g. transportation, energy, information and energy systems), social infrastructure (e.g. educational, healthcare, water supply, waste management, recreation and environmental protection) and national security infrastructure (e.g. defence facilities and installations, and border security systems).\(^3\) This functional

\(^1\) These categories are not completely separable, as one type of infrastructure system might play significant roles in more than one of the three categories. For instance, the US interstate highway system is a vital facilitator of commerce, but its official name, the Dwight D. Eisenhower System of Interstate and Defense Highways, belies its intended role as not only an economic asset but also a portion of the national security infrastructure. Likewise, water systems may be considered social infrastructure because of clean water’s importance to public health and welfare, but water is also an essential resource for much economic activity.
classification can be augmented by adding a second dimension, based on specifying the form of these systems as network-based or stand-alone, to generate a simple, two-fold typology.

Network-based infrastructure systems include transportation, telecommunications, electricity and gas transmission, sewage and water supply and distribution systems. The characteristics of any given component of a network infrastructure system typically are relatively well understood, and performance of an individual component can be predicted with reasonable accuracy. Generally speaking, complexity of a network system and uncertainty about its performance increase with the number of interconnecting links, the density of development and the degree of capacity utilization. The difficulty of planning, designing and managing network-based infrastructure systems also tends to increase in line with these factors.

A second infrastructure form is the stand-alone facility or system. Examples include power plants, waste-water treatment plants and facilities like schools and hospitals. As the label “stand-alone” suggests, these types of infrastructure assets can be analysed independently more easily than network-based systems. Large-scale, stand-alone infrastructure assets often exhibit considerable internal integration and complexity, and they must be fully completed to begin generating value. (Network-based infrastructure systems, by contrast, often can be expanded incrementally, rather than requiring large, discrete investments.)

1.2 Perspective: Infrastructure in a Broader Context

Infrastructure systems, as part of the built environment, exist at the intersection of the social (or socio-economic) system, the natural system and the technological system. (This is illustrated in Figure 1.) Demand for infrastructure arises from within the socio-economic system, which is also responsible for providing the regulatory framework for provision of the infrastructure systems needed to meet this demand. This system also includes the economic activities which mobilize resources for building, operating and maintaining infrastructure. The natural system serves two functions, as both a source and a sink. As a source, the natural system provides the physical inputs to infrastructure systems: land and raw materials. As a sink, the natural system must absorb the waste and other environmental effects of infrastructure construction, operation and eventual abandonment. Finally, the technological system provides the knowledge and tools with which the demand for infrastructure, arising from the socio-economic system, is realized within the constraints imposed by the natural and socio-economic systems.

Within the socio-economic system, demand for infrastructure derives from its value for two broad objectives: economic competitiveness and socio-economic development. Infrastructure systems contribute to development through impacts on both households and enterprises. Prud’homme identifies three main mechanisms: improving welfare, enlarging markets and lowering costs. Water supply and sewage create positive public health and welfare effects through their contribution to sanitation; power supply and access to transportation services similarly raise welfare for households. Infrastructure can facilitate trade by enlarging and connecting markets, and it can reduce barriers to the flows of goods, labour and ideas. Finally, economists view infrastructure as a subset of capital stock and as a factor in the cost of production for firms; efficient infrastructure systems reduce production costs for the enterprises which utilize their services. This last point not only affects socio-economic development but also serves as the basis for infrastructure’s role in theories of economic competitiveness. The quality of a city, state, region or nation’s infrastructure systems affects the attractiveness of that jurisdiction for potential investors, businesses and residents – a fact reflected in the economic development policies of governments worldwide.
Infrastructure’s location at the intersection of the socio-economic, natural and technological systems also highlights the importance of considering both socio-economic and environmental impacts when responding to demand for infrastructure services. Using sustainability as an overarching design goal for infrastructure systems provides a mechanism for balancing infrastructure’s effects on these two systems, minimizing environmental impact without unduly constraining economic growth. In this context, sustainability is a broad concept encompassing not only environmental sustainability but also dimensions relating to economics, politics and social equity [5].

2 Points of Agreement and Competing Ideas

Two points of general agreement among infrastructure experts offer a useful starting point for examining the state of infrastructure markets and the forces likely to influence them in the future. First, if infrastructure capacity is to be maintained at a level sufficient to accommodate economic growth, then investment in upgrade and expansion of infrastructure systems will be necessary. Secondly, while the need to upgrade or expand infrastructure systems is generally applicable worldwide, significant differences in the infrastructure endowments and needs of developed nations and emerging economies exist, suggesting that different strategies will be needed to provide infrastructure in these two cases.

2.1 Investing in Infrastructure to Support Economic Growth

Infrastructure needs are notoriously difficult to assess at the macro-scale. Economists have attempted to measure various effects of aggregate stocks of infrastructure as a means of uncovering the relationship between infrastructure and other variables, like economic growth, but these studies have fallen short of providing any reliable guidance on how much infrastructure is needed to achieve a given target for economic growth, development or productivity. Benefit-cost analyses can provide a useful indicator of the value of some infrastructure investments but are of limited utility overall because of the prevalence of external or indirect benefits and costs, which can be difficult to identify and quantify. Engineering needs assessments offer another perspective on infrastructure investment needs, but these studies typically focus on the condition and performance of existing infrastructure systems and rely on engineering-based descriptions of the desired conditions2, incorporating little economic analysis in the process [6].

Figure 1: Infrastructure at the intersection of systems

Need, in these studies, is thus based on the gap between current conditions and the desired conditions.
Despite these measurement and assessment difficulties, there seems to be little doubt that global infrastructure needs over the next few decades will be substantial. A simple mechanism is at work: if the global economy is forecast to grow, and the demand for infrastructure is positively correlated with this growth\(^3\), then the demand for infrastructure services must trend upwards as well. The International Monetary Fund (IMF) projects 3.1% growth in world GDP in 2010, reflecting expected recovery from the paltry, recession-driven projection of 1.1% growth for 2009 \(^7\). It follows that, unless surplus capacity has been created by previous over-investment in infrastructure systems, upgrade and expansion will be essential to providing the capacity and service quality to support economic growth.

In a 2007 report, the consulting firm Booz Allen Hamilton assembled an estimate of investment needed between 2005 and 2030 to “modernize obsolescent systems and meet expanding demand” for infrastructure worldwide; the estimate was US$ 41 trillion and included four sectors: water (US$ 22.6 trillion), power (US$ 9.0 trillion), road and rail (US$ 7.8 trillion), and airports and seaports (US$ 1.6 trillion) \(^1\),\(^4\). The language of that estimate points to a second factor driving demand for infrastructure investment: upgrade and modernization. While economic growth contributes to demand for additional infrastructure capacity, investments in maintenance, repairs and modernization are necessary – independent of economic growth – simply to maintain service quality in existing infrastructure systems. In the United States, deferred maintenance has been a concern on the infrastructure policy agenda for decades, with each apparently underfunded year further increasing the forecast for present and future infrastructure systems investment needs.

### 2.2 Differentiating between Developed and Emerging Economies

A second point of agreement among experts is that the infrastructure investment needs of developed nations and emerging economies are, generally speaking, quite different. One factor contributing to this distinction can be found in a closer look at the IMF’s forecast of world GDP growth for 2010. The aggregate 3.1% growth estimate masks sharp differences in the prospects for these two groups; the IMF projects 5.1% growth in emerging economies, compared to just 1.3% growth in “advanced economies” \(^7\). Advanced economies typically have relatively large stocks of infrastructure capital, much of which is in need of repair or replacement, while infrastructure capital stock in emerging economies often is much less extensively developed. These differences, in turn, imply a need to approach infrastructure development in different ways for each of these two broad cases.

In emerging economies, physical infrastructure capacity is typically one of the factors constraining economic growth, leading to demand for construction of more physical infrastructure to relieve this constraint. Urbanization trends have fuelled the growth of mega-cities in many developing economies, and with these cities’ development comes a need for more and better infrastructure systems. Thus, the primary infrastructure policy problem centres on finding ways to expand the physical capacity, coverage and quality of infrastructure systems. This includes investing in new physical infrastructure facilities, rolling stock, control networks and other infrastructure system components. With potential demand for new capacity on the order of 10-15% per annum in some countries, assembling the capital and mobilizing the resources needed to carry out such a programme of planning and construction are likely to be very important challenges.

In a typical advanced economy, the need for physical expansion of the infrastructure stock is relatively small compared to the base already in place, although this does not preclude demand for physical expansion of infrastructure systems. In the United States, for instance, there are approximately four million miles of public roads (from interstate highways to local roads) built over many decades, and annual construction of new road infrastructure is very small relative to this existing stock. New construction is likely to remain necessary or advantageous in some instances, but it will not be a sufficient solution to the nation’s transportation infrastructure capacity needs. Thus, the pressing questions do not centre on how to build massive new amounts of infrastructure but instead concern the challenges of extracting more capacity from the infrastructure networks already in place.

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\(^3\) The variety of services provided by infrastructure virtually guarantees that economic growth will create demand for some type of infrastructure, although the distribution of demand for infrastructure across its various types will depend on the characteristics of the economic activity fuelling growth.

\(^4\) For comparison, the 2008 world GDP was approximately US$ 69.6 trillion (current) on a purchasing power parity basis.
2.3 A Variety of Viewpoints

Beyond these two points, there seems to be little agreement on how to resolve the issue of infrastructure capacity. Viewpoints vary widely from those who champion institutional change to those who emphasize the importance of devising more efficient financial mechanisms to those who argue for strategies to encourage technological change.

The remainder of this paper uses the infrastructure challenge in North America, particularly in the United States, to illustrate the diversity of strategies for meeting infrastructure needs and to suggest a basic, conceptual framework for analysing and addressing infrastructure capacity issues.

3 Infrastructure in North America

The state of infrastructure systems and services in the United States and Canada aligns with the situation described for developed countries in general. The installed stock of all types of infrastructure is quite large, and much of that stock is nearing or already beyond the end of its intended useful life. As a point of reference, the North American (US and Canadian) share of the infrastructure needs estimate cited earlier is US$ 6.5 trillion through 2030; broken down by sector, the report’s authors estimated needs of approximately US$ 3.6 trillion in water, US$ 1.5 trillion in power, US$ 1.0 trillion in road and rail, and US$ 0.4 trillion in air and seaports [1]. As these nations continue to grow, they must grapple with the twin problems of meeting increasing demand placed on their infrastructure networks while also improving the efficacy of maintenance and renewal for aging, existing infrastructure. As a committee of the US National Research Council has recently observed,

How we as a nation choose to renew our infrastructure systems in the coming years will help determine the quality of life for future generations. It will also help determine our success in meeting other national challenges, including … remaining economically competitive. [8]

Another report frames the issue even more bluntly, stating, “The [United States] faces a stark choice – either avert its slide from prosperity through greater investment and innovation or hurtle into more gridlock, congestion and potential systemic failure” [9]. The prominent role of infrastructure expenditure in the American Recovery and Reinvestment Act crafted by the US Congress in early 2009 is a testament not only to the perceived job-creation potential of such spending but also to the growing acceptance among key stakeholders that continuing to pursue business-as-usual strategies with regard to the nation’s infrastructure is likely to have undesirable consequences.
4 Mechanisms for Addressing Capacity Issues

As policy-makers, industry and other stakeholders seek to address infrastructure capacity issues, they have several alternative mechanisms at their disposal. Infrastructure capacity can be increased through physical expansion or addition of facilities or by improving the operational efficiency of existing infrastructure systems. Demand-side management strategies constitute a fundamentally different approach, taking capacity as fixed and seeking to adjust demand to match that available supply. Introduction of new technologies and adoption of institutional or organizational changes may, at one scale, be part of one of the strategies above, yet these alternatives merit separate mention as well because of their potential to lead to transformational changes in the infrastructure system. Each of these mechanisms is further discussed in the sections that follow.

4.1 Expanding Infrastructure Stock through Addition of Physical Facilities

One option for increasing the capacity of infrastructure systems is to physically expand those systems through construction of new facilities. This is a pure supply-side strategy and, in some cases, it may be the most straightforward option because it is unlikely to require significant technological or institutional change. Increasing the capacity of a highway by adding lanes to the roadway is one example of this approach. In the absence of significant constraints on resources like land, labour and materials, widening a highway is likely to be relatively inexpensive and uncomplicated.

However, physical expansion of infrastructure systems is often most difficult in the very locations where additional capacity is in highest demand: cities and densely populated metropolitan areas. This difficulty derives from three factors. First, the density of existing development in urban areas increases the costs of acquiring land for additional infrastructure assets. Second, the complexity of the urban environment and the need to build new facilities without unduly disrupting the functioning of existing facilities during the construction process increase the challenges of planning, design and construction. Finally, the density of public stakeholders – be they users, neighbours or otherwise – in an infrastructure project can complicate the political dimensions of implementing a physical expansion approach to relieving capacity constraints. The not-in-my-backyard (or NIMBY) phenomenon is quite relevant. All of these factors tend to drive up the financial and time costs for providing new infrastructure facilities in urban areas.

A second shortcoming of this approach derives from the interdependence of supply of infrastructure capacity and demand for its services. In the context of the previous example, widening a highway to relieve congestion may only encourage more driving.

In part because of these constraints, the construction of new facilities can address only a small percentage of the need for additional or improved infrastructure services, and the volume of new facilities constructed will be only a small percentage of the total infrastructure stock5.

4.2 Increasing the Capacity of the Existing System

Taking measures to increase the capacity of the existing system, typically through the pursuit of greater operational efficiency, is a second supply-side alternative. The underlying mechanism is similar in concept to increasing the flow rate of water through a pipe in order to deliver more water to a destination. (By contrast, increasing the supply of water at the destination by addition of physical facilities might be achieved by replacing the original pipe with a larger one or by adding a second pipe to augment the first.)

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5 In the United States, decades of construction have produced a public roads network in excess of 4 million miles. Over 46,000 miles of interstate highway cross the nation, yet linear mile additions to this network averaged only 60 miles per year between 1997 and 2007, the most recent 10-year period for which data is available from the US Department of Transportation.
In practice, increasing capacity of an existing infrastructure system is likely to involve the use of technology to facilitate the desired operational improvements. Application of sensors and information technology can aid capacity management and can help alleviate congestion on infrastructure networks, and advances in these technological fields over the past several decades have greatly expanded the realm of possibility. In transportation, many technology-enabled, capacity-enhancing approaches fall under the umbrella of intelligent transportation systems. For instance, the introduction of electronic toll collection technologies on some highways has enabled vehicles to flow faster and more freely through toll collection points, reducing the problem of congestion at traditional toll booths. Other initiatives seek to improve capacity (as well as other aspects of system performance, like safety) by integrating vehicles and infrastructure more closely. In the highway sector, one example is the US Department of Transportation’s IntelliDrive programme, which is intended to provide improved traffic and road condition information to both transportation managers and the system’s users. In railroad networks, GPS-enabled positive train control systems offer a way to increase the operational capacity of the rail infrastructure by providing more accurate data on train speeds and locations, thereby reducing the headway required for safe operation and improving track capacity. Many of these “intelligent”, information technology-based systems have been the subject of research and development activity for a decade or more, but have not yet seen widespread deployment.

4.3 Implementing Demand-side Management Policies

Increased application of information technology to infrastructure systems also may enhance opportunities to address capacity issues through demand management, which offers an alternative to supply-side infrastructure strategies. Demand for the services of infrastructure systems displays significant temporal variance; for example, demand patterns fluctuate over the course of a typical day – as in the case of peak travel demand on a transit system coinciding with the daily commutes of workers. Designing infrastructure systems to accommodate peak demand may be prohibitively expensive and inefficient, and it is, in any case, difficult or impossible to adjust the physical capacity of many infrastructure systems to match dynamic, incremental growth in peak demand. Demand management strategies are intended to reduce demand at peak times, reducing the associated costs of congestion or unreliable service. While managing demand by fiat is a theoretically possible though heavy-handed approach, demand management strategies typically are designed to work via pricing by extracting the appropriate cost for infrastructure services provided and, in so doing, providing incentives for users of infrastructure to economize on their use of available infrastructure capacity.

One example of this approach is congestion pricing, which is a system of charging users for their use of transportation systems during periods of peak demand to reduce traffic congestion. Such systems have been made feasible through developments in electronics and information and communications technologies. As these technologies continue to advance, the scope of feasible infrastructure pricing mechanisms is increasing, from relatively fixed and inflexible schemes to increasingly dynamic ones. Technologically, it may soon be possible to institute a vehicle-miles-travelled pricing system that charges drivers based on the time and location of their trips anywhere in the roadway network. In the United States, the prospect of these developments and concerns about the adequacy of traditional highway infrastructure financing approaches have led to discussion of pricing as a general mechanism for generating revenues for the roadway system rather than simply as a means of reducing congestion in specific problem areas.

Because advances in congestion pricing – or infrastructure service pricing, generally – enable the price to be adjusted for time and location of use, pricing should – at least in theory – be more effective and efficient than traditional infrastructure finance mechanisms like indirect taxation (e.g. expenditures on infrastructure funded through the economic stimulus package in early 2009) and direct user taxes (e.g. fuel taxes designated for infrastructure maintenance or construction). Congestion pricing, however, remains a controversial strategy and, in practice, experiences with its implementation have thus far been mixed. The City of London introduced congestion pricing in early 2003, and the programme has been viewed generally as a success. Drivers are charged to enter the city centre on weekdays during specified time periods, and the charges have resulted in
reduced congestion while providing a source of revenue for transport system maintenance and improvements. The success of the scheme is partially due to the characteristics of the transportation system in central London, where there is virtually no capacity to physically expand the road network but there are viable alternatives like subway, taxi and bus. Some large measure of success must also be attributed to management of the political dimension of the scheme, which was championed and shepherded into existence by a strong mayor and then gained broader political acceptance as the effects in terms of reduced congestion became clear. According to one analyst, “London’s experience shows that congestion charging is technically feasible and effective, and that it is possible to overcome the political and institutional resistance to such pricing” [10]. The 2008 failure of a congestion pricing proposal for New York City, modelled on the London example, provides a contrasting example that highlights the importance of the thorny political and social equity issues surrounding pricing and demand management. The New York City plan, again championed by the city's mayor, failed to gain approval in the state legislature due to opposition from “a broad array of politicians from Queens, Brooklyn and New York's suburbs, who viewed the proposed congestion fee as a regressive measure that overwhelmingly benefited affluent Manhattanites” [11]. While the immediate political future of such large-scale, city-centre congestion charges remains in question in the US, congestion pricing principles are being applied to infrastructure in other ways. For instance, high-occupancy toll lanes have been used in California, and projects are underway to design and construct similar facilities in the Washington DC metro area.

Although the principle of extracting appropriate cost for infrastructure services is consistently interpreted in the context of congestion pricing, it can be applied to the extraction of value from other infrastructure facilities as well. One example is the use of rights-of-way on city streets to provide on-street parking. Dedication of street infrastructure to on-street parking comes at a high opportunity cost (e.g. eliminating the potential to use that right-of-way for additional traffic lanes to increase roadway capacity), and the fees collected for parking in these spaces do not fully offset this cost. While this suggests an opportunity to re-examine policy with the goal of ensuring that appropriate costs of infrastructure are captured in revenue streams, it is important to acknowledge that assessing the economics of on-street parking or determining the appropriate fees for utilizing this service requires consideration of both direct and indirect costs and benefits. In some cases, community economic benefits from access to on-street parking may justify the decision to provide parking with relatively low user fees, but it is also possible that added traffic congestion caused by drivers searching for available on-street parking might outweigh the benefits.

### 4.4 Introducing New Technologies

A fourth alternative for addressing infrastructure capacity issues is to introduce new technologies to infrastructure systems. As previously noted, the introduction of new technologies can be an integral component of implementing one or more of the first three approaches outlined above; as a separate approach, however, the emphasis is on breakthrough technologies that significantly alter attributes of the infrastructure system. New technologies might lower the life cycle costs of an infrastructure system, they might extend the system service life, or they might increase the effective capacity of the system. The high, up-front capital costs of infrastructure systems are a significant impediment to their provision; technological breakthroughs that could lower the cost of constructing (or re-constructing) facilities could thus have a large impact on infrastructure capacity provision. In urban areas, for example, many utilities and some elements of transportation networks may be located underground, yet the economic efficiency of expanding and improving these systems is limited by the costs of tunnelling. Technological advances in tunnelling that result in lower costs would alter the calculus of urban infrastructure provision and could facilitate improvements in capacity and service quality.

Numerous obstacles impede the development and deployment of transformational new technologies for infrastructure systems. Regulatory and institutional factors, like the transaction costs of complex permitting procedures and use of competitive bidding in procurement processes, may act as barriers to the development or

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6 High-occupancy toll (HOT) lanes use pricing and occupancy requirements to manage the number of vehicles using them; the goal is to enable the facility to maintain free flow traffic speeds even during times of peak travel demand.
adoption of new technology. Design teams and contractors often lack incentives to take the risks associated with introduction of new technology, and the fragmented and decentralized nature of the industry increases the costs of coordinating technology development and dissemination. Large-scale investment in infrastructure renewal may present a unique opportunity to reap the benefits of technological change in infrastructure (in fields such as automation and robotics, information technology and computing, and advanced materials and processes), yet attempts to exploit this opportunity would need to address or overcome the obstacles outlined above.

4.5 Adopting Organizational and Institutional Changes

A final approach to addressing infrastructure needs emphasizes the potential benefits of changes in the organizations and institutions that govern, manage and deliver infrastructure services. The potential changes are numerous, but three examples should illustrate the approach.

First, it may be beneficial to alter the focus of institutions to emphasize the delivery of infrastructure services rather than the provision of infrastructure facilities. Building and maintaining facilities is a critical component of infrastructure service provision, but focusing on the quality of services provided would be a better indicator of the value of infrastructure investments.

Second, gains may be achieved through tighter integration of organizations and alignment of their missions. The infrastructure enterprise is highly fragmented and decentralized along multiple dimensions. On one such dimension, both in research and in practice, the system is organized primarily along modal divisions, not only creating useful concentrations of expertise within modal organizations but also creating potential barriers to holistically addressing inter-modal, multi-modal and system-wide challenges, which are rising in importance. On another dimension, the federal nature of the US political system fragments the system into multiple layers of public authority: the US federal government, state governments, local and city governments, and some mixed jurisdictions, like agencies with regional or metropolitan-scale authority. Furthermore, the enterprise often is additionally divided into organizations with expertise in or authority over guide ways and infrastructure, vehicles and rolling stock, system operations and other functions. Some degree of decomposition of system complexity and division of responsibility or expertise is logically necessary to reap the benefits of specialization – or simply to make certain problems tractable – but too much fragmentation can be detrimental to the system as a whole. For example, many states have departments of transportation which are not fully integrated for multi-modal or intermodal missions; even if these modally-oriented mission agencies effectively carry out their missions, the result is likely to be a sub-optimization of the broader transportation system.

Finally, institutional change might take the form of an initiative to develop institutions explicitly on the basis of aligning and putting in place incentives which will guide individual stakeholders towards socially efficient management and use of infrastructure systems. In the current system, perverse incentives abound. For instance, the transportation department described above has bureaucratic incentives to increase its budget (and thereby bureaucratic power), not necessarily to use its resources most efficiently. If it suddenly does more with less, it is likely to have its budget cut, not be rewarded for its efforts.

5 Conceptual Framework for Addressing Infrastructure Capacity Issues

Research, development and deployment (RD&D) of new policies, technologies and strategies will be critical to the success of any attempt to address infrastructure capacity needs. The conceptual framework (shown in Figure 3), which organizes infrastructure issues into three domains, can be a useful tool for developing RD&D strategies.
In the framework, each of the three dimensions is informed by the broad perspective on infrastructure outlined in section 1 of this paper, and the three dimensions should be viewed as integrated parts of a holistic approach to infrastructure systems development and provision. Although the relationships between the three domains can be quite complex, a basic conceptual understanding that technologies are integrated into systems, which are in turn enabled and governed by policies, provides a starting point for discussion.

The policy domain includes activities such as identification and evaluation of presently available infrastructure policies, associated institutions, organizational structures and financing mechanisms. Policy-focused analysis would primarily address demand-side management of infrastructure, although policy has significant implications for supply-side alternatives as well. Infrastructure policy choices establish the framework within which many stakeholders interact to deliver infrastructure services, including establishing the missions of public sector agencies and governing the conduct of business and formation of partnerships with private sector entities. Particularly in the public sector, further exploring the merits of emphasizing delivery of infrastructure services over provision of infrastructure facilities is an important part of policy domain activities.

The technology domain emphasizes RD&D in areas like new materials, new infrastructure construction technologies and novel technologies to make transportation rolling stock more efficient. Technology RD&D includes both basic and applied research into new technologies as well as technology transfer and adaptation (e.g. scans of other economic sectors or international markets for promising technologies not yet integrated into US infrastructure systems). For example, the basic technology for high-speed rail services has been proven in numerous applications worldwide, yet high-speed rail remains virtually unknown in North America. Recent, high-profile government support of high-speed rail in the United States has raised the possibility that the technology will be adopted for certain travel corridors, and the introduction of higher-speed rail lines in the US has the potential to enable more efficient rail transportation by increasing the speed of train travel. As with any new technology, however, the benefits of such improvements must be weighed carefully against the costs, and at present it is far from clear that the economic benefits of high-speed rail systems justify the costs of construction and operation using available technology. RD&D activities leading to new technology developments could make high-speed rail systems economically competitive in more corridors.

Finally, research and related development and deployment activities in the systems dimension emphasize the interactions of different systems and subsystems within the broad domain of physical infrastructure. An important area of work in the systems domain is the expansion of knowledge about interdependencies among different infrastructure systems. Interdependencies exist among components and subsystems of a given infrastructure system as well as among different types of infrastructure systems, yet these linkages have traditionally
received little attention from researchers, designers or operators of infrastructure. For instance, interactions and interdependencies among different modes of transportation have a significant effect on the efficiency and performance of the transportation system as a whole, but most transportation knowledge and authority is vested in modally-oriented institutional structures. Accidents, acts of terrorism and natural disasters have served as stark reminders that interdependencies among different infrastructure systems, like power and transportation, are critical vulnerabilities in these systems, and better understanding these interdependencies may not only facilitate improved security and reliability but also provide opportunities to reconfigure infrastructure systems in ways that improve efficiency or fundamentally alter the delivery of services.

This points to a second role of RD&D in the systems domain: exploring the potential to reorganize or transform systems for provision of better services. The confluence of technology and market factors has in the past demonstrated the capacity to catalyse significant technological and structural change in industries that did not previously seem to have much interaction or integration. For example, television, telephone, computer and other telecommunications and media industry segments historically each had separate trajectories and business models, but the interaction of technologies, market forces and policies has fundamentally reshaped the telecommunications and media industries. Vertical integration and distinct technology solutions for each of these sectors have weakened, and horizontal organizations providing technology platforms, software or consumer interfaces have grown in prominence. The potential may exist to leverage technological developments and complementary policies or strategies to effect similar changes in infrastructure systems. True multi-modal integration of the transportation system might yield levels of mobility and access that cannot be delivered by the present system, which is dominated by vertical integration along modal lines. Similar opportunities might be explored and exploited in the domain of energy and power distribution systems. One significant change happened in the late 20th century, when restructuring of the electric power industry separated generation and transmission functions, providing open access to transmission and distribution infrastructure and precipitating the rise of independent power producers. The system now appears primed for another such change. Development and deployment of new power generation technologies, like solar and wind energy power plants, provide intermittent supply, which is creating pressure for a more sophisticated transmission and distribution system capable of coping with these fluctuations. On the demand side, pressure for a “smarter” grid capable of supporting differentiated pricing complements the supply-side trends. Recognition of the potential benefits of such a systemic change is evident in the federal government's inclusion of a US$ 3.4 billion smart grid grants programme in the stimulus package passed in February 2009.

6 Conclusion

To meet the challenges of providing needed infrastructure services and facilitating continued growth in the economy, the North American infrastructure community must take a fresh look at both the demand and supply sides of infrastructure markets. On the demand side, it will be important to find ways to rationalize demand, more closely linking the use of infrastructure with payment for those services and enabling the use of demand management tools to improve operation of the networks and facilities. On the supply side, improving efficiency (lowering cost of infrastructure provision) will be a central challenge. The costs of constructing new facilities and replacing or rehabilitating old ones generally are highest in the areas in which they are needed most. Metropolitan regions are powerful engines of the national economy, and finding ways to improve the effectiveness of infrastructure delivery in these regions is integral to facilitating continued economic growth. Ultimately, the solutions to the problems of infrastructure provision in a developed economy will likely be drawn from a mixture of demand-side and supply-side strategies, but the nature of the challenges requires a shift in emphasis away from construction of new facilities and towards expanded capacity and renewed vitality of existing infrastructure assets.
6.1 Author’s Note

Most of the issues outlined in this paper are already being discussed at different levels of government and industry, and what is most needed is the will to expand these discussions and translate them into purposeful action – though this task will require continuing to expand knowledge about potential solutions and engage in careful analysis of alternatives. In Massachusetts, the organizational structure of the state’s transportation system is undergoing notable reform, with several independent agencies being abolished or combined into a single department of transportation, but it remains unclear how integrated this new department will be in practice and what real effects these organizational changes will have on the services provided. At the national level, important stakeholders (e.g. the National Academy of Engineering, the Transportation Research Board, and congressionally-chartered commissions as well as influential think-tanks, professional bodies and industry associations) have weighed in on the infrastructure debate, and – to draw yet another transportation example – the multi-year authorization of transportation programmes looming in the US Congress promises to provide telling insights into the availability of political will to act in one important infrastructure sector.

References

Chapter 4 Infrastructure Development in India
It is well known that India's infrastructure investment needs are enormous. The Planning Commission has called for an estimated US$ 514 billion (in 2006-2007 prices and at an exchange rate of Rs40/US$) investment in 10 major physical infrastructure sectors during the 11th Five Year Plan (2007-2012). Of this, it projects the private sector's share would be 30% (or US$ 155 billion), up from 18% during the 10th Plan. Most (93%) of the private investment is anticipated to be in five sectors – electricity, telecoms, roads, ports and rail – but private investment forms a significant share of the investment in all of the infrastructure sectors except irrigation, water supply and sanitation (see Table 1).

Indeed, India has opted for a model that relies to a significant extent on the private sector in infrastructure development. It was recognized early on by the government of India that the private sector would need to finance, build, operate and manage infrastructure facilities. In 1991, power generation was among the first few sectors to be opened up for private sector investment, with attractive incentives offered for setting up power plants and allowing 100% FDI. After much trial and error, the policy with respect to private sector participation (PSP) has evolved over the years, not just for power, but also for other core infrastructure sectors, with tangible results: the private sector now is a serious player in India's infrastructure development, providing both capital and efficiency gains.

The year 2004 marked a watershed with a quantum jump in private investment in infrastructure (see Figure 1). Since then, private interest in infrastructure has gained momentum. In fact, the last five years account for almost three-quarters of total private investment in infrastructure since 1990 (US$ 90 billion out of US$ 124 billion; PPIAF database). Private investment in infrastructure has risen to 2.5% of GDP in 2007-2008, a respectable share compared with public sector infrastructure investment of 4.8% of GDP (Planning Commission).

### Table 1: Projected Investment in Infrastructure during 11th Five Year Plan (US$ million)

<table>
<thead>
<tr>
<th>Sectors</th>
<th>Total</th>
<th>Of which Private</th>
<th>Share of Private in Sector Investment (%)</th>
<th>Sectoral Distribution of Private Investment (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electricity (including NCE)</td>
<td>166631</td>
<td>46378</td>
<td>28</td>
<td>30</td>
</tr>
<tr>
<td>Roads and Bridges</td>
<td>78538</td>
<td>26698</td>
<td>34</td>
<td>17</td>
</tr>
<tr>
<td>Telecommunications</td>
<td>64610</td>
<td>44422</td>
<td>69</td>
<td>29</td>
</tr>
<tr>
<td>Railways (including MRTS)</td>
<td>65452</td>
<td>12589</td>
<td>19</td>
<td>8</td>
</tr>
<tr>
<td>Irrigation (including watershed)</td>
<td>63325</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Water Supply and Sanitation</td>
<td>35933</td>
<td>1355</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>Ports</td>
<td>21999</td>
<td>13620</td>
<td>62</td>
<td>9</td>
</tr>
<tr>
<td>Airports</td>
<td>7742</td>
<td>5408</td>
<td>70</td>
<td>3</td>
</tr>
<tr>
<td>Storage</td>
<td>5595</td>
<td>2797</td>
<td>50</td>
<td>2</td>
</tr>
<tr>
<td>Gas</td>
<td>4214</td>
<td>1632</td>
<td>39</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td>514038</td>
<td>154898</td>
<td>30</td>
<td>100</td>
</tr>
</tbody>
</table>

Source: 11th Five Year, Planning Commission, Government of India
The private sector’s presence is visible in several key infrastructure sectors – in telecoms, ports, airports, power generation and roads (see Table 2). India’s telecom sector, which is one of the world’s fastest-growing cellular markets, is dominated by the private sector (in the fast-growing wireless segment) and boasts tariffs among the lowest in the world. Private sector port terminals, which now account for the bulk of container traffic volume, have raised performance standards to world-class efficiency. In airports, the two largest airports – Mumbai and Delhi – have been privatized, and the private sector has built greenfield airports in two other metros. The private sector has finally gained traction in the power sector and will for the first time meet the target of installed capacity set for it in the Five Year Plan. Going forward, it is likely to increase its share in power generation significantly as the current pipeline of projects suggests. And while road development by the private sector slowed down in the last few years, there are indications that it will substantially pick up. Indeed, India has the largest PPP-based national highway development programme (NHDP) in the world: over one-half the NHDP of 54,500 kilometres is aimed to be on a PPP toll basis and another one-quarter on a PPP annuity basis.

Table 2: Private Participation in Infrastructure

<table>
<thead>
<tr>
<th>Share of private sector in:</th>
<th>March 2009</th>
<th>November 2009</th>
</tr>
</thead>
<tbody>
<tr>
<td>Telecom: wireless subscribers</td>
<td>85%</td>
<td>87%*</td>
</tr>
<tr>
<td>Telecom: wireline subscribers</td>
<td>12.83%</td>
<td>14.7%*</td>
</tr>
<tr>
<td>Power: total installed capacity (excluding captive)</td>
<td>15.5%</td>
<td>17.7%</td>
</tr>
<tr>
<td>Ports: container volume</td>
<td>72%</td>
<td></td>
</tr>
<tr>
<td>Ports: container volume for federal (major) ports</td>
<td>85.8%</td>
<td></td>
</tr>
<tr>
<td>Airports: passenger traffic movement in private airports to total</td>
<td>60%</td>
<td></td>
</tr>
<tr>
<td>Airports: cargo traffic movement in private airports to total</td>
<td>70%</td>
<td></td>
</tr>
<tr>
<td>Roads: length of NH built or under construction through PPP in NHDP (kms)</td>
<td>7958</td>
<td></td>
</tr>
<tr>
<td>as a % of total length built or under implementation under NHDP</td>
<td>43.4%</td>
<td></td>
</tr>
</tbody>
</table>

Sources: NHAI, Indian Ports Association, JNPT, IDFC-SSKI, CEA, TRAI

The private sector’s presence is visible in several key infrastructure sectors – in telecoms, ports, airports, power generation and roads (see Table 2). India’s telecom sector, which is one of the world’s fastest-growing cellular markets, is dominated by the private sector (in the fast-growing wireless segment) and boasts tariffs among the lowest in the world. Private sector port terminals, which now account for the bulk of container traffic volume, have raised performance standards to world-class efficiency. In airports, the two largest airports – Mumbai and Delhi – have been privatized, and the private sector has built greenfield airports in two other metros. The private sector has finally gained traction in the power sector and will for the first time meet the target of installed capacity set for it in the Five Year Plan. Going forward, it is likely to increase its share in power generation significantly as the current pipeline of projects suggests. And while road development by the private sector slowed down in the last few years, there are indications that it will substantially pick up. Indeed, India has the largest PPP-based national highway development programme (NHDP) in the world: over one-half the NHDP of 54,500 kilometres is aimed to be on a PPP toll basis and another one-quarter on a PPP annuity basis.
Clearly, the private sector has established that it is willing and able to deliver. Yet, there are several challenges in accelerating private investment and extending private sector involvement to other infrastructure sectors. These challenges include financing issues, coordination and implementation issues, and capacity of the government to undertake PPP projects. Unless these key issues are addressed, among others, it is unlikely that India will meet its ambitious infrastructure development targets.

Financial Intermediation

Infrastructure financing presents a number of challenges. The large scale of investment and long gestation period require investors to be prepared for a long horizon for debt repayment and return on equity. But many financial institutions are limited in their ability to invest in very long-term illiquid assets. Moreover, infrastructure projects entail non-recourse or limited recourse financing, so market and commercial risks assume greater significance for lenders. This, in turn, requires specialized appraisal skills. Besides the usual project risks, infrastructure investment has other risks because of its public interest nature. These include political and regulatory risks. As a result, complex risk mitigation and allocation arrangements are needed among the various parties. Clearly, all this indicates the special nature of infrastructure financing, requiring a mature financial system and a sophisticated class of investors.

A mature financial system can respond to these challenges in various ways. It can bring a range of investors to various stages of the project. Investors with requisite skills and risk appetite are needed at the initial stage of the project, and once the project starts yielding a stable revenue stream a different type of investor may come in thus widening the pool of investors and reducing the overall financing cost of the project.

So far, India has been able to ramp up private investment in infrastructure largely because of commercial bank financing (notably public sector banks), both direct and indirect. But, to what extent is this sustainable? It has led to a growing concentration of risks in the commercial banks’ balance sheets. These risks arise from the maturity mismatch created by financing long-duration infrastructure projects from the essentially short-term nature of banks’ liabilities. Moreover, many banks are reaching exposure limits to infrastructure-related borrowers (because of large project size relative to bank capital). Of course, bank consolidation could ease this constraint somewhat (as many small banks do not have any infrastructure exposure). But it would not address the need for long-term finance. Moreover, the same issues apply to specialized non-bank finance companies (NBFCs) that lend to infrastructure. They are reliant on commercial bank funding for their resources, in the absence of a well-developed bond market.

Pension funds and insurance companies, though well-suited to fund infrastructure because of their long-term liabilities, are still an insignificant source of funding infrastructure in India despite the growth in insurance penetration of around 4% of GDP. The primary reasons are pre-emption of insurance resources by the government, stringent investment guidelines for insurance companies that most infrastructure projects cannot meet and overall risk aversion by the insurance companies themselves.

Equity financing is essential to support higher debt and, in recent years, there has been increased activity in both public markets and private equity (PE) – barring the temporary impact of the global financial and economic crisis. Since developers/promoters have a limited amount of capital, it is important to bring in financial investors so that the promoters’ risk capital can be recycled into other projects. However, rules for sell-down of equity have been quite stringent and act as a deterrent to the entry of more financial investors who would like greater flexibility in exit options. There are other issues as well, such as tax on sales of unlisted projects, and inadequate termination payments for government agency defaults in many concession agreements, which deter financial investors. The biggest constraint to the development of a strong domestic PE industry, however, is the very narrow base of domestic investors. To reiterate, institutional investors, such as insurance companies and pension funds, have limited ability to invest in alternative asset classes as yet in India.

Several actions can be taken in the near term, such as improving tax and exit policies to make it easier for investors to exit from unlisted infrastructure projects and enabling public sector banks to raise additional capital to avoid sector concentration risk. Some measures have already been taken or are being considered. For instance,
concession agreements for highway projects now allow promoters holding the majority shareholding to fully
divest two years after project completion.

Most importantly, though, securitization of their loan portfolio could enable banks and NBFCs to distribute their
risk more widely as well as to ease their balance sheet constraint by enabling them to offload infrastructure loans
when the projects start yielding a revenue stream. Needless to say, proper regulation needs to be in place to
avoid perverse incentives kicking in with the transfer of risks, as witnessed in the recent sub-prime mortgage
crisis in the US.

Of course, securitization itself cannot take off without access to deep and liquid debt capital markets. A bond
market is necessary to provide the mechanisms for greater liquidity and risk minimization. The corporate bond
market in India is relatively small and illiquid. Various committees set up by the government have given recom-
mandations on how to develop the bond market as well as to facilitate the financing of infrastructure. Some
initiatives have been taken by the government and regulators – the most recent being to introduce repo-ability of
corporate bonds, but overall progress is slow.

Clearly, the development of a deep and liquid market for long-term corporate bonds, with a wide array of inves-
tors and financial products, will take a long time. In the meanwhile, a refinancing facility, such as the Indian
Infrastructure Finance Company Limited (IIFCL), established by the government, could mitigate the asset-liability
maturity mismatches of banks and NBFCs engaged in infrastructure lending. The IIFCL can borrow lower cost
long-term resources using its sovereign rating and on-lend to banks and NBFCs for infrastructure.

That should contribute to addressing one source of risk – the liquidity risk that banks face. But it does not ad-
dress the concentration of risks in banks and NBFCs. A second catalytic role such an agency could, therefore,
play is as an aggregator and credit enhancer. It could purchase infrastructure loans from the loan originators and
repackage them into long-term securities backed by cash flows for sale to other investors. Cautious investors,
such as insurance companies and pension funds in India, are more likely to buy such paper; the credit risk of
infrastructure projects could then be spread more evenly across the financial system. It should be remembered
that the now discredited Fannie Mae and Freddie Mac did play a vital role in homeownership in the US when the
ecosystem of sophisticated investors and financial products did not exist. Similarly, what is needed in India today
is such an agency for intermediating infrastructure credit. A first step is being taken with the IIFCL preparing
guidelines for takeout financing. Under this scheme, the IIFCL would take over a loan from a bank after four or
five years and fund it over a longer term of 15 to 20 years. While it may be able to take a certain amount of loans
on its own books, it would be more effective if it could sell these loans to long-term investors.

Coordination and Implementation Issues

Infrastructure is unambiguously a national priority now, after years of neglect. But, while there is an overall vision,
there is often inadequate detailed planning and coordination. For instance, there may be a master plan for a
city, but zonal development plans and detailed project reports are either not prepared or are of poor quality.
This leads to infrastructure which is not aligned to the priorities or is under-supplied. Additionally, ad hoc and
uncoordinated infrastructure development leads to costly and poor quality infrastructure. For example, a road-
widening project that is not coordinated with utilities (water, sewer, electricity) may result in the recently widened
road being dug up repeatedly to provide these utilities later one by one. This is not only costly; it also reduces
the quality of the infrastructure. Lack of adequate planning and coordination may also result in delays and
under-use of infrastructure because the support facilities were not provided in a timely manner. There have been
instances of port and airport development without concurrent road and rail connectivity. For example, the new
Bangalore airport was ready, but could not start commercial operations for some time because there was no
road connecting the airport to the city. And most recently, 3G spectrum auctions are being delayed because of
differences between ministries.
Not only is there an issue of coordination between sectors and ministries, but also one of coordination between different levels of government. The political dimension exacerbates this issue. The interplay between a federal constitutional structure and a multiparty system, in which coalition governments at the centre need to coexist with opposition parties in various states, accentuates a culture of non-cooperation and confrontation. Some infrastructure sectors come under the jurisdiction of the central government, such as telecoms, railways, major ports, national highways, whereas some are under state governments, such as roads other than national highways, and some are in a concurrent list such as electricity. While incentives should be aligned in developing central infrastructure in state territory, often apathy of state governments, for example in giving clearances, can add to delays.

In fact, infrastructure development has repeatedly fallen short of targets. There are many reasons for this: delays in land acquisition, clearances from a multitude of authorities, unavailability of equipment, inadequate pipeline of projects and so on.

It is widely acknowledged – and recently corroborated through an official project review and CII survey of project developers – that land acquisition is the most important impediment to infrastructure project implementation. There are three particular risks relating to land from the infrastructure development perspective. First, there is usually limited flexibility in location. For instance, a thermal power plant should be built near coal reserves or near a port if it is using imported coal. Similarly, airports have to be close to cities. Second, contiguous plots of land need to be consolidated. The problem is that most of the land is in small fragmented holdings. Acquiring the land displaces numerous small landowners. So, unless all occupants of the land agree to vacate it, there can be endless delays in the entire development initiative. And often those displaced do not have the skills to survive without land. Third, the land to be acquired for infrastructure development may adversely affect the environment. While there is no simple way to resolve this conflict, a decision has to be taken each time such a conflict appears in a relatively short period of time.

Moreover, the market for land is underdeveloped and distorted. The way in which land records are maintained makes it difficult to establish land titles, resulting in frequent disputes. As a consequence, the private sector often prefers the government to exercise its eminent domain powers in acquiring land on its behalf.

The problem is that too often the state has been invoking its powers of eminent domain to acquire land for projects, the benefits from which are not perceived to be fairly distributed. Under the Land Acquisition Act of 1894, the government can obtain land for public purpose at a fair compensation. Unfortunately, public purpose has been too liberally interpreted and compensation has been inadequate, and especially so when compared with market values of the land after change in land use (to non-agricultural uses) and development of infrastructure, the windfall gains of which are not shared with the original landowners.

The Amendment Bill to the Land Acquisition Act provides for a narrower definition of public purpose and the National Resettlement and Rehabilitation Policy provides non-monetary compensation to the displaced, including the landless whose livelihood depends directly or indirectly on the land. Enacting these into legislation should improve the situation. In any case, the government should use its eminent domain powers sparingly, regulatory distortions to land markets should be removed, working towards security of title should receive priority, the private sector should negotiate directly and transparently, schemes for sharing of land value gains should be adopted so that the displaced have a regular income source, and alternatives to land acquisition, such as land pooling and readjustment, should be used more extensively.

Another major source of delays is the need for clearances from numerous agencies. Initiatives like the Ultra Mega Power Projects (UMPP) are a step in the right direction, wherein all inputs and clearances are tied up by a government agency through the formation of a special purpose vehicle; then the private sector is invited to bid. But not every project is conceived and developed as a UMPP.
Various options that have been used by other countries include single window clearances, a super minister or apex body. India still needs to find an appropriate solution for expeditious and coordinated development of the infrastructure sector.

**Government Capacity**

The government record on implementing projects on its own has been poor – barring some notable exceptions such as the Delhi Metro. But, bringing in the private sector by way of a PPP is not an easy substitute either. In fact, a key issue is weak government capacity to design and execute PPP projects. It may not be a coincidence that most of the private investment to date has been in greenfield projects in telecoms and energy, comprising 80% of the total private investment. Projects in these sectors are mainly private, rather than PPPs. To some extent, drawing the private sector into these sectors with mainly private projects is simpler, once the policy and regulatory framework is reasonably in place, and the private sector sees attractive prospective returns. For instance, in power generation, it is up to the private sector to decide on plant location, choice of fuel and plant size, and enter into a power purchase agreement (PPA) with a distribution utility or trading company.

PPP concessions, which are prevalent mainly in the transport sector, account for less than 15% of total private investment. These PPP projects are inherently more complex and require a great deal more effort and skill from public sector staff than is needed for engineering procurement contracts (EPC). As concessions are typically for 20 to 30 years, projections have to be made for this period from various perspectives – development, construction, operation and maintenance, financing, commercial and policy aspects. Risks have to be assessed and allocated among the stakeholders. All this groundwork is necessary for the public sector to have a better understanding and be able to deal with the private sector at various stages of the project: designing the concession agreement, assessing the bid awards, monitoring performance of the PPP contracts and assessing the need for readjustments. Building a project pipeline is difficult under these circumstances, especially in core urban sectors, where the capacity is weakest.

At the national level, it has taken considerable time to develop a model concession agreement for the roads sector. Even then there have been a lot of issues the government has had to address as it aimed to find an appropriate balance between regulating excessive private returns and altogether dampening private sector interest in the highway programme. Ultimately, the government has accepted the recommendations of a committee that it set up to remove roadblocks impeding the NHDP. The recommendations include relaxing the cap on upside revenue potential, rationalizing the eligibility requirements for bidding, relaxing the conflict of the interest clause, enabling early exit for the promoters, allowing the National Highways Authority of India (NHAI) to award projects that receive single bids, and reducing the lending risk by permitting lenders to create a charge on the escrow account. It has also been recognized that the NHAI has to strengthen its capacity to undertake PPP projects.

Going forward, the role of the states and local bodies will be key to furthering the development of infrastructure as much of the anticipated investment is in areas under their jurisdiction. The capacity of urban local bodies (ULB) to structure and implement PPP projects needs to be strengthened, but the magnitude of the task is enormous given that India has over 3,700 ULBs, of which 109 are municipal corporations for larger urban areas and over 1,400 are municipal councils for smaller urban areas. Of course, not all ULBs can be expected to undertake PPPs but even the larger municipal corporations do not have the adequate capacity. Under the Jawaharlal Nehru National Urban Renewal Mission (JNNURM), which is leveraging central government grants for urban reforms and projects in 65 cities, a total of 463 projects have been approved as of June 2009, of which only 65 are PPP projects. Moreover, it is not clear how many PPP projects are actually being implemented.

Many ULBs will require technical assistance in structuring PPP projects. Unlike national highways, where efforts have been made by the NHAI to standardize project structures and documents for BOT projects, similar standardizations have not happened at the ULB level. Some states like Karnataka (IdecK), Kerala (KINFRA),
Rajasthan (PDCOR), West Bengal (I-WIN) and Tamil Nadu (TNUDF) though have formed entities through public-private partnerships in building capacities, assisting ULBs in project structuring and financing. There are also state-level agencies with similar mandates in some states. In Karnataka, the Karnataka Urban Infrastructure Development and Finance Corporation (KUIDFC) assists urban agencies in the state in planning, financing and providing expertise to develop urban infrastructure. Smaller municipalities in the state have implemented projects on a PPP basis with the help of KUIDFC.

The impact of these agencies in spearheading PPPs has been limited. This has been mainly due to two reasons: (1) lack of empowerment of these agencies by the state to enable them to carry out the mandate with which they were set up and (2) the funding from state government to these agencies as was originally envisaged to undertake a financing role did not come through in many cases. At one level, it is important that states have dedicated entities (preferably with skills from public and private sectors) to provide technical support particularly to ULBs for structuring PPPs. What is important though is the need for empowering these entities to carry out their mandates.

Conclusion

The development of India’s infrastructure presents a huge task as well as a huge opportunity. The previous sections have raised some of the key issues that will need to be addressed for a major step-up in infrastructure development. But there are other challenges too. It is important to draw attention to two of them in particular. The first concerns the environment. Building good quality infrastructure is integral to the development of a competitive Indian economy that is expected to play a larger role in the world economy. And building it rapidly with the least damage to the environment is important. How the huge growth in power generation, transportation and urbanization can be managed is therefore especially important.1 A second issue is the importance of transparent processes of bidding and procurement if a PPP is to play a major role. Fairness and a level playing field must be firmly established and not perceived to be compromised at any stage.

There is no doubt that India’s infrastructure is a growth sector: it is clearly recognized as a national priority. The infrastructure will be built. The question is how well will the process be managed: how sustainable, transparent and fair will it be?

1 The dominance of coal-based power generation in India has the risk of causing great environmental damage as it scales up, just as China’s power sector did. Two-thirds of India’s CO2 emissions come from burning coal, mainly in power stations.
References


Chapter 5

Appendices: Related Initiatives
The current global economic crisis is severely hitting developing countries. Growth prospects for emerging and developing countries have been revised downward by a magnitude similar to that for advanced economies. Low-income countries (LICs), initially shielded from the direct impact of the sudden stop in private capital flows, are now being affected as the crisis effects have spread through other channels, at a time when many LICs are still coping with the impact of the earlier food crisis. The impact could set back the global fight against poverty, and jeopardize the progress made towards achievement of the MDGs. Recent World Bank analysis suggests that the crisis will result in 53 million more people living in extreme poverty (below $1.25 a day) in 2009, or 65 million more if the $2 a day measure is used; 200,000-400,000 more infants will die every year and many poor children will lose the opportunity to attend school.

There is a clear need for counter-cyclical spending in developing countries. President Zoellick has proposed a Call to Action that developed countries pledge an amount equivalent to 0.7 percent of their stimulus packages as additional aid, over and above existing ODA commitments, for the low income countries and the poor and vulnerable in the developing countries. Donors can choose where and how to channel their additional monies be it through their own bilateral aid agencies; UN agencies such as the World Food Program, FAO or UNICEF; the World Bank Group and other multilateral development banks; or non-governmental organizations. Crisis support is not only about protecting poor and vulnerable families and long-term development goals. It is also a critical part of the overall global response agenda - developing countries need assistance to raise global aggregate demand, maximize the impact of the global stimulus, safeguard future growth and limit the potential for civil unrest.

The World Bank Group’s operational crisis response initiatives focus on three thematic areas: protect the most vulnerable against the fallout of the crisis; maintain long-term infrastructure investment programs; and sustain the potential for private sector-led economic growth and employment creation, particularly through SMEs and microfinance. The thematic areas are being addressed through three operational platforms – the Vulnerability Financing Facility (VFF), the Infrastructure Recovery and Assets platform (INFRA), and the IFC-led private sector platform, respectively. This approach draws on lessons learned in dealing with past crises. The three priority themes are inter-related and span the core development mandate of the WBG. They complement an over-arching focus on macroeconomic stability at the core of the crisis response.

This document describes one of the components of the Vulnerability Framework: the Infrastructure Recovery and Assets (INFRA) Platform. INFRA aims to support adequate infrastructure provision in IDA and IBRD countries during and after the crisis. The actions described below are fully in line with the recent initiative by the IFC through its Infrastructure Crisis Facility which have been described in other documents. As energy and energy access are important aspects of infrastructure development, the INFRA Platform also includes the Energy for the Poor Initiative (EFPI) which has been launched in June 2008 to expand energy access to the poor and help them reduce their vulnerability to volatile energy prices. A specific Africa INFRA Program is also being developed on an accelerated pace to finance a package of high priority, high return infrastructure investments. It is further described below. Many Donors and IFIs are also adapting or reinforcing their existing instruments to support developing countries’ efforts in infrastructure. INFRA provides suggestions for a coordinated Donor response to the crisis in the areas of infrastructure and options for various modalities of donor participation and financing of such activities.

1 IFCF launched the Infrastructure Crisis Facility last December to help ensure that viable, privately-funded infrastructure projects in emerging markets have access to the funding during the financial crisis.
The Crisis and Infrastructure

The global financial and economic crisis is expected to severely impact infrastructure services in developing countries, as governments are faced by shrinking resources and private financing flows are declining. For example, growth projections for Africa were recently halved, as Africa recent economic achievements are severely threatened by the crisis. It is essential that infrastructure investments be protected as high growth rates came in Africa also from progress in infrastructure and infrastructure sector policies. Improvements in ICT infrastructure for example were a strong contributor to the region’s improved growth performance over the period 1990 to 2005, and responsible for adding almost one percentage point to per capita growth rates. More than three quarters of infrastructure spending in developing countries (90% in many IDA countries) is currently financed by the public sector. Experience from previous crises has shown that infrastructure investments often bear the brunt of shrinking public expenditure at the national and sub-national levels. Private investment also declines dramatically during crises, and cannot meet the financing gap of the public sector’s much larger portion of infrastructure financing. Reduced funding for infrastructure, while expedient in the short run, can be particularly detrimental in the longer term as infrastructure services are key drivers of sustained economic growth and poverty alleviation. The “Lost Decade” of development after the East Asian crisis showed how countries can suffer both from a decline in infrastructure assets and services, particularly to the poor, and from a weaker foundation for sustainable growth. The catalytic role of infrastructure in poverty reduction has been recognized in the Millennium Development Goals (MDGs), which single out access to water supply and sanitation service targets to be achieved by 20152. The crisis may also result in countries compromising on their environmental and climate oriented commitments due to the need to reallocate budget resources to more short-term actions.

Responding to the Crisis

With fewer funds at their disposal, Governments face a twofold challenge in the infrastructure sector: (i) how to ensure its population, and especially the vulnerable groups, continue to have access to critical basic services; and (ii) how to continue financing infrastructure investments. Counter-cyclical public spending in infrastructure is an effective tool to provide the foundation for rapid recovery and job creation and to develop a robust economic platform for long term growth. Several governments are hence planning to stimulate the economy through infrastructure investments, but not many have the means to do so in the poorest countries. The objectives of the proposed three-year INFRA Platform are to: (a) assist partner country governments respond to the negative effects of the global crisis on their infrastructure services and investment programs; (b) provide them with customized policy options to minimize the impact of the crisis, while limiting market distortions; and (c) provide technical and financial support for continued private sector activity and for public investment projects in infrastructure.

Such INFRA objectives should be achieved by:

• Stabilizing existing infrastructure assets by providing funding to those infrastructure projects which are facing temporary liquidity problems; ensuring continued preparation of investment projects with updated project designs; restructuring ongoing projects to ensure sufficient counterpart funding; supporting government efforts to cover the costs of maintenance and protect countries’ existing infrastructure assets; providing safety nets to protect the poor’s continued access to services; and advising governments and utilities to efficiently manage currency, interest rate, and commodity risks;

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2 Although not explicitly stated as goals, access to other infrastructure services such as electricity, transport, and telecommunications is indispensable for achieving the health, education, gender, and income poverty goals spelled out in the Millennium Declaration of the UN General Assembly.
• **Ensuring delivery of projects that remain government priority** by providing additional financing for infrastructure investments, sub national lending and technical assistance; and advancing the lowcarbon agenda through climate finance instruments. Essential infrastructure spending that should be protected against revenue shortfalls will be identified and capacity for improved budget management will be provided given its increased importance in a more constrained fiscal environment;

• **Supporting Public Private Partnerships (PPPs) in infrastructure** by bridging the current gap of government commitment to private or PPP infrastructure projects in emerging markets. This will help stabilize viable infrastructure projects with private participation which are facing temporary liquidity problems in light of changed market realities and enable the continuation of some new private project development.; and

• **Supporting new infrastructure project development and implementation** by providing financing and advice to those governments that intend to launch growth and job enhancing infrastructure programs and projects and by supporting investment planning and management by creditworthy subsovereign municipalities and utilities3.

The Infrastructure Framework for Recovery and Assets (INFRA) Platform

The INFRA Platform will be implemented through the following components:

• **Increased diagnostic and advisory support.** A rapid diagnostic tool is being developed to identify those countries where infrastructure financing is most at risk and those projects most appropriate for INFRA support. The diagnostic will provide a detailed assessment of infrastructure spending and a methodology for the preliminary assessment of the impact of the crisis. To facilitate coordination, the country assessments prepared by WBG staff will be made available not only to the government but also to the INFRA donors. In depth diagnostic will be important to ensure that priority financing focus on growth-enhancing investment, take into account sustainability criteria, and prevent the financing of low-productivity and low-quality projects. It will help inform, shape, and coordinate donors’ support to eligible countries, and could promote rapid decision-making by other partners. In addition to the diagnostic, technical assistance to governments that intend to develop fiscal stimulus packages, or that are seeking ways to maintain and accelerate their infrastructure priority and investments, will be provided. Best practice guidelines and guidelines on Dos and Don’ts on infrastructure for government in crisis will also be prepared and disseminated.

• **Scaled up financing through parallel financing initiative** from donors to ensure complementarities of means and responses for countries and projects impacted by the crisis. The development partners should agree on a framework of actions to ensure adequate collaboration and complementarities. Financial resources channeled through the INFRA Platform could be used to respond to country demands for additional financing by leveraging donor financing. The preferred method of cooperation will be parallel financing to ensure a speedy response and multi-donor instruments for investment financing to allow financing gaps to be bridged by different donors more easily. The World Bank Group is also considering ways to support existing infrastructure programs and facilities managed by other Donors.

• **Targeted financing.** Priority projects identified through the diagnostic assessment may require concessional financing in certain countries or under specific circumstances. A specific window will be established to provide incremental financing for project preparation, for existing projects and programs

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3 The Bank will also provide continued support to governments on planning and implementing infrastructure projects as major component of public spending through Public Expenditure Reviews (PERs) and Medium Term Expenditure Frameworks (MTEFs).
and for countries planning to implement fiscal stimulus packages with infrastructure investments. Another concessional window could be established for countries under financial stress, to provide temporary subsidies to infrastructure services to ensure continued access for the most vulnerable groups and to finance technical assistance and capacity building. For example, after identification of the priority project, through the diagnostic tool, the concessional facility could provide funds to projects that provide access to basic services, ensure sustainability by funding O&M costs which could not be otherwise recovered because of the crisis, and to avoid asset deterioration. In the case of IDA countries, if substantial additional financing can be secured, grant funds could be used for blending and to reduce borrowing costs. The initial focus of any concessional window will be on funding project preparation. All IFIs participating in INFRA will have access to this concessional window, provided their project and programs are included in the INFRA Platform. Ways will be developed to ensure that there is consistency between the fiduciary responsibilities of each of the participating Donors and IFIs to the INFRA Platform.

- Monitoring and Coordination. The development of a common tracking system will be created to report on projects, reduce overlaps, and ensure that synergies among Donors are further exploited.

**Acceleration of the Clean Technology Agenda.** INFRA will have a particular focus on green investments and will support Governments who want to use infrastructure investments to advance the "green agenda". This will be done by leveraging financing for the pipeline of investments from new facilities, such as the Carbon Partnership Facility, Clean Technology Fund, green bonds and from similar programs managed by other Donors. Due to the severity of the impact the crisis on Africa, a specific Africa INFRA Program under INFRA is being developed at an accelerated pace to finance a package of high priority, high return infrastructure investments. Such investments would be aimed at reducing the impact of the crisis on growth, ensuring maintenance of assets, setting the conditions for renewed growth impetus when the world recovers from this global crisis, and creating employment, notably in cities.

Africa INFRA focuses on areas with proven high impact. It aims particularly to: (i) safeguard implementation of some highest priority regional integration projects; (ii) preserve strategic infrastructure assets, maintenance spending, and support selected new projects (otherwise likely to be dropped from the government financing in the absence of INFRA); and (iii) preserve investments in urban infrastructure. Countries benefiting from INFRA financing would also commit to make significant progress in key policy areas. Regional integration had become a new focus of recent infrastructure finance in Africa, helping provide effective linkages to regional and international markets. Most of Africa's countries are simply too small to be able to develop infrastructure cost-effectively on their own. Regional integration holds the key to reducing Africa's exceptionally high infrastructure costs. More effective road corridors can improve competitiveness of African products. The bulk of WBG financed regional integration projects have focused on infrastructure, accounting for nearly 70% of regional commitments under the IDA regional pilot program. While the total commitments are large in absolute terms, the total project costs typically far exceed this commitment and must be supplemented by financing from other sources.

The role of the WBG in Africa has been critical as a facilitator to bring other multilateral, bilateral and private co-financiers to the table (e.g. US$0.2 billion IDA leveraging US$0.4 billion from AfDB, EC and AFD to support the CEMAC Transport Project / AfDB and EIB joining IDA under the West Africa Power Pool). Under IDA 15, the WBG is mobilizing about US$2 billion from its own resources for Africa INFRA estimated at US$5-6 billion. Thus, the financing gap for Africa alone is identified in the order of US$3-4 billion, which is being sought from donors.

**The Energy for the Poor Initiative.** This initiative aims to maintain focus on expanding energy access, help the poor adjust to energy shocks, and reduce their vulnerability to volatile energy prices. In the short term, the initiative will be implemented through grant financing for project preparation and investments, and in the
medium term, it will promote co- and parallel financing with several donors of projects that are already in the WBG and donors’ pipeline in the areas of energy access, energy diversification and energy efficiency4.

Existing Initiatives and the Donors’ Response

Many Donors have in recent years and in the months preceding the crisis, increased their financing of infrastructure and created new facilities with the scope to facilitate synergies, coordination, and leverage funding, often by a combination of private sector, grants, and concessional financing. For example, the EUAfrica Infrastructure Trust Fund or the Infrastructure Project facility in the Western Balkans. Donors could decide to reinforce financing of some of these facilities to provide additional infrastructure financing or they could expand the range of other instruments available to the beneficiary countries. In those cases where the World Bank or other Donors are not part of these already established facilities, ways to increase coordination and synergies to ensure the efficient delivery of funding and the acceleration of the crisis infrastructure agenda could also be explored.

The World Bank Group intends to make funds available to support the launch of the INFRA initiative, including by leveraging existing World Bank-administered projects. INFRA is already being used within the WBG to ensure that infrastructure lending is not reduced, as experienced in previous crises, and to substantially increase infrastructure lending.

Modalities for operationalisation and implementation of INFRA5

INFRA does not intend to create new process or structures but, in line with the spirit of the Paris Declaration and the Accra Agenda for Action, it plans to leverage the existing work of Donors more effectively and to further develop the instrument of parallel and co-financing. The aim is to maximize the use of existing World Bank Trust Funds and the coordination with other Donor facilities to rapidly and effectively support and complement infrastructure needs in MICs and LDCs. A light mechanism will be established to coordinate efforts, keep track of Donor financing, develop and disseminate the diagnostic products, ensure flowing of information on project pipelines and on the parallel and co-financing, and ensure synergies on the selection of priorities projects and programs.

Next Steps

The response to the worst economic crisis must be global, coordinated, flexible, and fast. Policy challenges need to be addressed at the country level, but it is more critical than ever for the international community to act in a coordinated way. Donor government and institutions, and among them the WBG, should respond quickly and effectively to these demands. Infrastructure must remain at the core of the development agenda and increased financing for infrastructure in developing countries should continue to be a priority of all Donors. The World Bank estimates that in addition to its scale up efforts for financing, which would bring own infrastructure lending to US$15 billion per year, substantial additional financing could be leveraged through the Platform via the parallel instrument (estimated in the order of US$5 billion over three years) and especially if concessional financing could be made available (the estimated need is of US$8 billion over three years including the financing gap for Africa identified in the order of US$3-4 billion).

The INFRA Platform aims to facilitate timely, transparent, and concerted actions to support infrastructure and to encourage increased collaboration among multilateral and bilateral development organizations. This would increase the effectiveness of the response in the beneficiary country in terms of quality, quantity, and speed. The World Bank Group is currently working with IFIs and bilateral donors to further develop the Platform.

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4 Co-financing is also being pursued with other initiatives such as the Scaling-Up Renewable Energy Program (SREP) and the Africa Energy Access Scale up program (AFREAS), in coordination with donors.

5 These would be further developed based on discussion with the Partners.
The World Economic Forum’s Water Initiative

A major bottleneck in the development of successful win-win water projects in water scarce regions of the world such as India and sub-Saharan Africa is the significant time and effort required of all parties to engage in a project development process. Collaboration is often hindered by the lack of a process or platform for various stakeholders, such as national/provincial/local government representatives, industrial and agricultural users of water, and communities to engage in an up front, joint design process. The World Economic Forum Water Initiative’s Partnership Projects workstream was launched in 2006 to catalyse multistakeholder platforms to develop practical water partnership projects and stimulate public-private financing.

The pilot experience demonstrated by catalysing and supporting a network of key stakeholders in a facilitated joint design process up front, multiple projects were developed and significant public-private co-financing for such projects subsequently stimulated. In India, an initial grant of US$ 200,000 from USAID was used to support a pilot network and process, which resulted in US$ 20 million in committed project financing from both public and private sources.

To date, three networks have been catalysed – India, Southern Africa and Jordan – each with its own project pipeline. Projects have varied from the use of grey water from a municipality for use in industrial facilities to the use of water from mining activities, after treatment, for local communities. These projects have enabled the improved management of scarce water resources and have been designed to improve social access to water as well as secure reliable water resources for economic activities. Work continues with public and private partners on this project to increase the activities within existing platforms and to other regions, aiming to mainstream the model and win-win opportunities.

The Construction Sector Transparency Initiative (CoST)

CoST is an international, multistakeholder initiative designed to increase transparency and accountability in the construction sector. It was launched by the United Kingdom’s Department for International Development (DFID) in May 2008 and is supported by the World Bank. CoST is being piloted over a two-and-a-half-year period in seven countries: Ethiopia, Malawi, the Philippines, Tanzania, the United Kingdom, Vietnam and Zambia. Guatemala recently joined CoST as an “associate country” and, with support from the World Bank, has launched its own pilot project. Other countries have expressed interest as well.

What is CoST’s objective?
The aim of CoST is to enhance the accountability of procuring entities and construction companies for the cost and quality of public sector construction projects. The core concept is to “get what you pay for”. The “you” in this context applies equally to national governments, affected stakeholders and the wider public. The main emphasis of CoST is on the period between contract award and the completion of construction.

Why is CoST necessary?
Public sector infrastructure projects make a major contribution to economic growth and poverty reduction, but mismanagement and corruption during the planning, implementation and monitoring of construction projects can undermine the potential social and economic benefits. Recent studies show that corruption in public construction contracts is widespread, with bribes often accounting for 10% or more of the contract price. Corruption leads to unnecessary, unsuitable, defective and dangerous construction projects – buildings that collapse and roads that break up. Corruption also undermines the rule of law and hinders the development of strong and accountable institutions that are essential for economic growth and social justice. The effects of mismanagement and corruption are especially hard on the poor, who are often most reliant on the provision of public services.
How does CoST work?
CoST provides for the disclosure of material project information on selected construction projects. “Material” in this context is intended to indicate that sufficient information be provided to enable stakeholders to make informed judgements about the cost and quality of the infrastructure concerned. The disclosures include, for example, a description of the project, its purpose and location, and, at the implementation stage, summary details of the original and final project specification, project cost, contractor and completion dates. The disclosures also include justification for any significant differences between the original and final information, as well as project evaluation and completion reports. Disclosure of raw information on its own is unlikely to be sufficient to achieve greater accountability due to its complexity. The disclosures need to be reviewed and analysed by an “assurance team” to ensure that they are comprehensible to all stakeholders. CoST is developing the systems and procedures required to meet this need.

Stakeholders in CoST
An essential feature of CoST is the engagement of a wide range of stakeholders with an interest in publicly financed construction projects. They include procuring entities, public financial management bodies, construction companies and associations, civil society organizations and private financiers. Each pilot country has established a multistakeholder group that comprises representatives drawn from these backgrounds.

How can I find out more about CoST?
More information is available at www.constructiontransparency.org, or you can contact CoST.
The World Economic Forum is an independent international organization committed to improving the state of the world by engaging leaders in partnerships to shape global, regional and industry agendas.

Incorporated as a foundation in 1971, and based in Geneva, Switzerland, the World Economic Forum is impartial and not-for-profit; it is tied to no political, partisan or national interests.
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