NEW CITIES FOUNDATION

Handbook on Urban Infrastructure Finance

Dr. Julie Kim, Senior Fellow, New Cities Foundation

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Preamble

In early 2015, New Cities Foundation launched the *Financing Urban Infrastructure* Initiative to address critical infrastructure financing issues and challenges facing cities today. This handbook is the culmination of that initiative.

Infrastructure financing is a complex subject that requires a great deal of knowledge and experience. At the same, infrastructure and its financing needs affect everyone. And their effect is not a frivolous one—our basic livelihood often depends on them. There have been other guidebooks and reports on the topic, some a helpful list of various financing instruments available, others more geared to investors and financial professionals well versed in this area.

The main thrust of this handbook is the global urbanization trend and how cities need to cope with providing basic infrastructure services in the face of rapid growth. Because most of this growth is projected to occur in mid-size cities[1] in the emerging world, the handbook is written with them in mind, recognizing that these cities often have limited financial savvy and knowledge. And they are not alone in this—even those of us who have devoted most of our lives on the subject are often at a loss in the maze of an ever-changing financial landscape.

This handbook focuses on financing challenges at the local, sub-sovereign level rather than at the national, sovereign level where many larger and critical macroeconomic issues are at stake—e.g., development of capital markets, currency limitations—that are beyond the control of local governments and addressed amply elsewhere. This handbook does not provide a laundry list of the state-of-the-art infrastructure financing tools and instruments (although we do provide these as necessary) or detailed case studies on a select few. Rather, it explains the basic underlying concepts so that the myriad financing vehicles available today are understood in their proper context. The concepts presented are sufficiently cohesive and are intended to help cities and local governments better navigate the complex world of infrastructure financing. In this regard, this document is indeed a "handbook" and is more a "how-to" guide than a policy paper.

This handbook is intended for the public sector. Infrastructure, after all, embodies public goods and services.

[1] Mid-size or the so-called "middle-weight city" is defined as cities with populations between 200,000 to 10 million.

Many infrastructure assets such as energy utilities are already mostly in private hands and, though continuously evolving, their financing market is mature. The most critical infrastructure financing challenges today, however, lay with those assets that are still in the public domain—where the financing is largely dependent on subsidies, taxes, and other sources that are unsustainable in the long run. We focus less in this handbook on transfers and subsidy-like funding and more on financing instruments that help cities become more self-sustainable in the long run. Because many of these financing instruments are more prevalent in countries with a mature market economy, the case examples we present tend to weigh in their favor.

Finally, in addition to a comprehensive literature review, this handbook was prepared based on extensive interviews with key industry stakeholders from both the public and private sectors.

Executive Summary

Introduction

Urbanization is a well-known phenomenon that has become an integral part of our modern culture. Credible institutions like McKinsey are predicting 65 percent of the future growth in global productivity will come from top 600 cities, a majority being mid-size cities spread out across 57 countries and 440 of them—the so-called *Emerging* 440—from the developing world. With rapid and highly concentrated growth, these 600 cities will undoubtedly face many difficult challenges in the foreseeable future.

Urbanization cannot happen in a vacuum. Cities need to provide basic infrastructure services—clean water, power and electricity, roads, public transit, sewage systems, telecommunications, schools, hospitals, to name a few—to support the rapid growth and the basic livelihood of their citizens and businesses. Infrastructure is capital-intensive and expensive to build and, once built, lasts a long time. Unlike the digital world that defines our ethos today, however, infrastructure embodies hard, fixed assets that are least of all agile or robust—and the services do not come cheap.

With rapid urbanization, we are currently facing a global infrastructure financing crisis. On the demand side, various estimates indicate we need between $57 to $67 trillion in infrastructure spending worldwide—almost 5 percent of gross world product every year from now until 2030. This amount reflects a 60 percent increase over and above historical spending levels and 75 percent of it is needed by cities around the world. Furthermore, not all of this spending need is in new construction. In many developed economies with mature but aging infrastructure systems, a significant amount is needed to barely maintain current levels of service. An added challenge for many cities is the shifting of funding responsibility from national to local governments.

On the supply side, the irony is that there is plenty of money, especially in the private sector. There is currently an oversupply of private capital. In particular, there is also an unprecedented appetite for infrastructure assets from the private investment community—in part because the asset class has performed consistently well in recent years. Institutional investors, such as pension funds who are particularly suited for infrastructure assets with their "long-termism," have been increasing their allocations steadily in the infrastructure investment space in recent years. International financial institutions and development banks (collectively known as IFIs) are also becoming much more active

in this space—and, increasingly, their activities are at sub-sovereign, local levels.

The issue at hand, hence, is not a lack of money, but rather insufficient infrastructure projects in the pipeline to keep up with the money supply. There is an important distinction between *financing* and *funding*. Infrastructure financing, in essence, is raising the high upfront costs to build the infrastructure when and where needed by leveraging the future revenues that can repay the upfront costs. *Financing* is the raising of this upfront capital to expedite the process. *Funding* is the revenue streams in the future to repay the financing. The lack of projects in the pipeline is due in reality to many projects that are not financeable because of the lack of clear revenue sources.

This handbook is the culmination of the *Financing Urban Infrastructure Initiative* launched by the New Cities Foundation (NCF) in early 2015. The primary aim of the Initiative is to address critical infrastructure financing (and funding) issues and challenges facing cities today as they undergo rapid urbanization. Through this handbook, we hope to provide a set of practical guidelines that can help cities become smarter in the urban infrastructure finance space and respond more effectively and timely to the basic infrastructure service needs of their citizens and businesses.

This handbook is written primarily for mid-size cities in the emerging world where most of the urbanization and growth is projected to take place and where infrastructure financing challenges are most daunting. Most likely, local governments in these cities have limited financial savvy and knowledge in what is available in the market place. Rather than providing a running list of the state-of-the-art financing tools and instruments or detailed case studies of a select few, this handbook focuses on important concepts underlying the myriad financing vehicles available today so that they are understood in proper context. In this regard, this handbook is intended to be more of a "how-to" rather than a major policy document.

An overview of various urban infrastructure financing instruments available to cities today are provided as well as effective ways of addressing the issues related to sustainable funding sources described above. It also discusses new and innovative financing models that are emerging and critical roles each stakeholders have to play in dealing with the global infrastructure financing crisis.

Urban Infrastructure Financing Instruments

Although many infrastructure assets (e.g., energy utilities) are in private hands, the most critical infrastructure financing challenges facing cities today are those assets in the public domain (e.g., public transit, roads, water/wastewater treatment) where the public sector is

responsible for owning and operating the assets and where financing largely relies on grants, subsidies, taxes and other sources that are unsustainable in the long run. Currently, for these public assets, infrastructure can be financed completely by the public sector or can involve the private sector.

Public Sector Financing Instruments

Public sector financing is almost always 100 percent debt financing (i.e., fully leveraged with no equity capital at risk). The cost of this debt financing is significantly lower relative to the private sector due largely to taxes and other public assets that effectively serve as collateral on the debt. Taxpayers are thus de facto equity holders of government investments and any risks associated with these investments are ultimately borne by the taxpayers. These risks, however, are not reflected in the debt financing costs per se because they are considered relatively risk free, implying taxpayers are obligated to make the debt holders whole in one way or another.

For fully publicly financed projects, first and foremost, cities rely on their national and state governments for support, which are essentially inter-governmental transfers in the form of direct grants, subsidies, low-interest loans, and/or various forms of credit enhancements. In conjunction with these transfers from higher tier governments, cities can seek their own financing options. In this handbook, we focus less on transfers and subsidy-like funding and more on financing instruments that help cities become more self-sustainable in the long run. Because many of these financing instruments are more developed in the advanced economies, the case examples we present tend to weigh in their favor. In most countries, cities commonly rely on bank loans to finance their infrastructure projects, either through commercial banks or public banks—e.g., landesbanks in Germany—that serve local needs. However, one of the most robust financing instruments available for cities today is municipal bond financing (and many variations thereof).

The U.S. has by far the largest and most mature municipal bond markets in the world. For cities and local governments in the U.S., municipal bonds have played a critical role in their ability to self-finance major infrastructure projects, either partially or fully. Most municipal bonds are tax-exempt bonds, where the yields bond holders earn are not subject to income taxes. Tax credit bonds (e.g., BAB bonds in the U.S.) have been emerging in recent years as another viable municipal bond instrument. They are taxable bonds that are considered more cost effective because tax subsidies are paid directly to issuers or bond buyers. They also appeal to a large group of investors with no in-country tax liabilities, e.g., institutional and foreign investors, who have been largely excluded from the tax-exempt bond market in the past.

Although the municipal bond market is not yet well developed outside the U.S., many cities around the world are beginning to explore it as a viable financing option. Cities like Ahmedabad and Bangalore in India and Johannesburg and Kigali in Africa already have issued bonds for their infrastructure. Others that are new to the municipal bond market, however, must ensure basic building blocks are in place. Especially for cities in the developing world, these building blocks should include, in addition to credible institutions, support from one or more IFIs, establishment of their own credit rating where possible, and full buy-in from their national government, which may ultimately be held responsible if they default.

Private Sector Financing and Delivery Models

Private sector financing becomes attractive when the public sector is fiscally constrained and facing serious debt capacity issues. Private sector financing is generally perceived to be more expensive because it almost always involves at-risk equity capital. Also, unlike public sector financing, the risks underlying the investments are fully manifested as risk premiums in the financing costs of both the equity and debt capital.

Unlike public sector financing, equity capital plays an important role in private sector financing. It is used as a leverage to raise the needed debt capital. Third-party managed infrastructure equity funds have been the critical source of this equity capital. By some measure, these funds have been able to raise about USD $300 billion over the last decade, which, based on typical leveraging that occurs in the industry, could potentially mean as much as $1-1.5 trillion of financing available to support infrastructure projects. In large part, this equity capital is sourced from institutional investors who collectively oversee over $100 trillion in investment assets globally. Although their investment in infrastructure has been slow in growing, their role in helping to close the global infrastructure financing gap—perhaps as much as 20 percent—is now generally recognized. More recently, institutional investors have also been taking up the slack in the long-term infrastructure debt space left behind by commercial banking and insurance industries as a result of more stringent liquidity and leveraging requirements in the post-2008 crisis environment. Sourced from institutional investors, major infrastructure debt funds have also been emerging, offering a wide range of products from bond-oriented to subordinated debt and with varying terms and risk-return profiles.

When private sector financing is involved, it is also generally combined with the delivery of infrastructure projects. Historically, relative to the public sector, it has been shown that the private sector can be much more cost effective in the delivery, but their financing can be more

expensive. Private sector participation thus is better accepted politically when (a) overall cost of providing infrastructure is non-recourse in nature, i.e., the private sector takes on most of the risks by not adding any significant new debt to the public sector's balance sheet, and (b) financing costs can be minimized, especially to the extent that the cost savings from efficiency gains in the delivery surpass the higher financing costs associated with private financing.

Two primary infrastructure delivery approaches under private sector financing are: (1) public-private partnerships (P3) where the government continues to own its infrastructure assets and play an active oversight role but, through a long-term concession agreement, delegates its service delivery responsibilities to the private sector over the lifecycle of the assets and (2) divestment or privatization, where the government sells its infrastructure assets to the private sector in whole or in part through a one-time transaction relinquishing its responsibilities commensurate with the shares sold.

P3 has been evolving continuously since the 1990s. The key consideration is whether the private sector takes on the brunt of the overall financial risks (revenue-risk model) or the public sector has the ultimate financial liability in the long run (availability payment model). Because preplanning and procurement processes can be long, complex, and costly regardless of project size, P3 is generally preferred for large-scale, capital intensive projects that have long-term strategic importance. In addition to financing, P3 offers a number of advantages over the traditional approach to delivering infrastructure. Most importantly, P3 provides an opportunity for the public sector to transfer some or all of the risks inherent in infrastructure projects to the private sector. Other advantages include opportunities for innovations, lifecycle approach to cost and operational efficiencies, accelerated implementation of critical infrastructure projects, and bundling of multiple projects across multiple jurisdictions for economies of scale.

Privatization is essentially a brownfield transaction where the public sector receives capital from the sales proceeds of existing facilities. These proceeds are unencumbered in that the public sector has no repayment obligations. Privatization transactions thus have the dual benefit of the private sector taking over all the upkeep associated with the existing infrastructure and also providing additional capital for the public sector's disposal. Privatization often involves the decoupling of vertically integrated sectors (e.g., railroads, water utility) to separate out those operations/assets that are more amenable to competition and thus benefit from privatization (e.g., train operations, water reservoirs) from those that are more monopolistic in nature, better left in public hands (e.g., railroad tracks, water pipeline

networks). Decoupling also helps to defray the conflict of interest situation often facing vertically integrated sectors, where the government plays both the owner and regulator roles.

Often, private sector financing and delivery can be mired in political controversy. There is sufficient evidence to prove, however, that wider public acceptance is possible if there is a clear mandate on the use of the proceeds to reinvest in infrastructure, credible institutions such as public pensions are involved on the buyer side, and a clear regulatory regime is established to protect social objectives.

IFI Financing Support

In addition to public and private sector financing, IFIs provide critical financial support in the global infrastructure financing space. IFIs are public sector development banks and development finance institutions that are owned by one or more national governments. Operating at international, regional, and national levels, IFIs provide a critical nexus between the public policy goals of governments and the international capital markets that allocate financial resources on a global scale. Collectively, IFIs provide both mobilization of significant capital and, perhaps as importantly, knowledge on institution-building, policy development, and the blending of financial instruments for investing in urban infrastructure.

Many IFIs have developed new sub-sovereign level instruments to specifically address urban infrastructure investment challenges. Though limited, some can also supply capital to municipal governments directly without a state guarantee. They have also developed other mechanisms such as municipal funds, risk-sharing facilities, or specialized financial instruments that support urban developments specifically. Today, IFIs typically earmark 10 to 15 percent of their total portfolio for urban programs. Much more is also earmarked for infrastructure projects that ultimately impact cities. By some estimates, as much as 60 percent of total IFIs lending has some impact on cities and urban areas around the world.

Credit Enhancements and Leveraging Tools

Whether public or private sector financing, it can be said that the basic goal of infrastructure financing is to get as much money as possible as cheaply as possible. There are many credit enhancement and other financial leveraging tools that help to achieve this goal, especially on the debt financing side. Most of these tools are intended to decrease the risk and increase the liquidity on the overall investments. Low-interest subordinated loans and standby contingent credits are often provided by national governments or by IFIs to help reduce risks to investors and allow cities to borrow at lower interest rates. In recent years, these subordinated

debt instruments have been used to target large strategic infrastructure projects to leverage significant private sector financing, especially in the form of senior debt (e.g., U.S. TIFIA program and EU-EIB Project Bond Credit Enhancement Facility). Financing costs can also be reduced by providing tax incentives (e.g., tax-exemption in municipal bonds) or various forms of insurance products or guarantees (e.g., MIGA political risk insurance, HM Treasury Guarantee in the U.K.).

Secondary refinancing markets also provide additional liquidity for early-phase investors to further leverage their investments into new project opportunities, thus improving the overall infrastructure funding picture. Recapitalizations through secondary markets involve replacing short term, high risk, expensive capital with longer term, lower risk, lower cost capital. Sometimes this is accomplished through pooling and securitization of multiple assets into asset-backed securities (ABS) that can be reissued and traded on capital markets. Through these secondary markets, cities can have a deeper and wider dip into the private investment pool for infrastructure.

Funding Considerations and Sustainable Revenue Sources

In one form or another, financing is always tied to repayment obligations and does not address per se the fundamental problem of reducing the infrastructure funding gap. To effectively reduce the funding gap, we need to address the revenue issue and make more transparent where the buck really stops ultimately.

Historically, many cities around the world have generally relied on direct grants and subsidies from IFIs and/or their national and state governments as the primary funding sources. These funds in turn come from taxes that are levied at national and state levels and, where available, from sovereign wealth reserves tied directly to publicly owned commodities and assets. Although limited, direct grants and subsidies from philanthropic sources can also be an important funding source for cities. These direct grants and subsidies have no repayment obligations and can be further leveraged to secure additional infrastructure financing.

Outside direct grants and subsidies, the two prevalent revenue funding sources available currently for infrastructure are taxes and user charges. Compared to taxes, user charges are still limited as a significant funding source for infrastructure, especially for non-utility sectors where a user-pay culture is yet to be established. Increasingly, however, taxes need to be supplemented with user charges and striking the right balance between the two sources will be critical in addressing the impending infrastructure funding crisis.

Taxes

Regarding taxes, in addition to national and state taxes, cities can increase their self-reliance by enhancing their own local taxing authority. In general, regardless of who levies the taxes, as is the case for vehicle-mile-traveled (VMT) tax, the basic approach to taxing for infrastructure should be closely tied to the wear-and-tear of facilities and the actual cost of producing infrastructure services to make funding more sustainable in the long run. For cities specifically, the value capture approach and developer exactions have proven particularly effective. For both, the value of improved infrastructure is captured by monetizing the resulting increase in property values through various taxing schemes (e.g., tax increment financing, special assessments, land value tax, betterment tax), incentive payments (e.g., impact fees, tap fees, linkage fees), or other means (e.g., joint developments, negotiated exactions, land or air rights lease/sale). For many cities in the developed world, these value capture approaches are largely within the current tax regime without requiring major tax reforms.

User Charges

Compared to taxes, it is generally easier to tie user charges directly to the cost of producing services so a perpetual funding shortage can be avoided. They are thus a more self-sustaining source in the long run. Imposing user charges can be politically sensitive, especially for sectors such as water supply where the services are often viewed as entitlements that should be subsidized. Despite potential public hostility, user charges can be the key to unlocking private sector capital and attracting innovative, self-sustaining financing solutions in the long run. Better quality service, more service options catered to specific users, user vouchers, and automated collection systems are a few potential solutions that can help incentivize users and their willingness to pay.

There has been an ongoing debate about the viability of user charges as a legitimate and substantive funding solution, especially in non-utility sectors (e.g., roads) where the degree of externality is higher. Two notable shifts in the infrastructure industry at large at this juncture, however, may trigger a more user charge-friendly funding regime in the future. First, as funding responsibility and infrastructure provisions become more localized, it could become easier to assign specific benefits to specific users. In the case of toll roads, for example, because toll facilities are by nature local, public acceptance of tolling have varied widely by location and tolling policy at national level have had limited effect. Decisions about tolling thus could be made more effectively at the local level. Second, as the role of the private sector continues to feature prominently in the potential infrastructure solution space, it is important to recognize that the user charge funding regime is the preferred and

more sustainable model in the long run to engage the private sector more effectively. The full potential for user charges has yet to be explored. Our collective challenge is to unleash this new source of funding by creating a new value paradigm for infrastructure that incentivizes users and their willingness to pay.

Reducing Funding Needs through Cost and Operational Efficiency

In addition to taxes and user charges, an indirect approach to dealing with the infrastructure funding issue is by reducing overall funding needs. Several indirect options are currently available to reduce funding needs. One option is to increase overall project efficiency and minimize total project costs through a lifecycle approach that integrates design and construction with operations and maintenance (O&M). A P3 delivery model is the primary mechanism that enables such lifecycle approaches. Because O&M costs are often a large part of infrastructure funding needs, another way is to increase O&M efficiency through various conservation and efficiency measures, demand management, and congestion pricing strategies that are aimed at maximizing the use of existing facilities. Most green and sustainability initiatives and smart city concepts serve this purpose. Reducing financing costs is another indirect way to reduce the funding needs which, as discussed earlier, can be achieved by using various credit enhancement and leveraging tools.

For smart city concepts in particular, no conversation about cities can now take place without considering their "smartness" in one form or another. The primary goals of these concepts are to improve the quality and performance of urban services, reduce resource consumption, and engage more effectively and actively with its citizens. Smart city concepts are continuing to evolve and, in most cases, the benefits are well recognized. The challenge, however, is figuring out how to pay for them, especially for cities and local governments experiencing fiscal constraints. Potential financing approaches to several key smart city concepts are provided in this handbook to help cities face the challenge and reap the benefits.

Brownfield Recycling for Potential Funding Source

There is a limit to how much taxpayers and users can take on to pay for infrastructure. Applied successfully in Australia in recent years, brownfield recycling (also referred to as social privatization) can potentially provide a third major source of funding for infrastructure. Brownfield recycling is essentially the leveraging of existing public infrastructure assets by leasing or selling them to the private sector and using the proceeds therefrom to fund new infrastructure projects. Paired with the right set of regulations, this approach provides as close to free, unencumbered funding as possible with no repayment obligations. In general, the size of the proceeds tend to be quite high and, coupled with no repayment

obligations, this is one of few options that begins to address the sheer magnitude of the funding need at hand.

Innovations in Urban Infrastructure Finance

For cities that must take on the brunt of infrastructure provision responsibilities in the face of rapid urbanization, innovative ideas in urban infrastructure financing could provide a welcome relief. They would also be better served knowing the best practices and new ideas that are emerging in the world presently. Several innovative urban financing models and best practices are presented in the handbook, each specifically mitigating the critical funding and financing challenges cities are facing today.

CEPAC Bonds for Additional Revenue Source

In addressing the funding and sustainable revenue issue, CEPAC (Certificados de Potencial Adicional de Construção or Certificates for Additional Construction Potential) bonds in Brazil represent an innovative urban funding instrument that combines value capture, development exaction, and air rights sale approaches. Although they have been around since 2004, their use has been very limited outside Brazil. CEPAC bonds are issued by municipal governments as additional development rights on specially designated areas within their cities that need redevelopment. The bonds entitle the bond buyers (typically, developers and investors) to build above the density limit specified by the current zoning regulations (referred to as "up-zoning"). The bonds are offered both through public and private auctions and are openly traded in the stock market. The City of Sao Paolo, for example, was able to raise over R$1.6 billion (US $800 million) for two small redevelopment areas in the first five years of their CEPAC bond offering. These bond proceeds represented almost 60 percent of the annual property tax revenues for the city as a whole. The proceeds provided upfront funding to build roads, transit, and affordable housing in the designated redevelopment areas. Bonds sold in private auctions were also used by cities as non-budgetary funding to pay for infrastructure and housing contractors and vendors that provided goods and services in the redevelopment areas.

Crowdfunding for Small Projects and P3 Equity Capital

Because user charges will play an increasingly important role to supplement tax revenues, cities need to rethink innovative ways to engage users more effectively in both defining and financing infrastructure needs. A crowdfunding approach can help cities in this regard. Crowdfunding combines the key aspects of crowd sourcing with those of micro-financing by establishing the connection between (1) entrepreneurs—who aim to raise capital—and (2) novel investors—

who form an emerging source of capital in small amounts—through (3) internet-based intermediaries. In the infrastructure financing space, "civic" crowdfunding initiatives that cater to serving the broader public good have proven particularly effective, especially for small projects (e.g., bike lanes or public parks) or as a strategic financing option (e.g., "last mile funding" to help a mature initiative reach fruition, seed funding to create momentum to secure larger funding, or a matching fund to fulfill grant requirements). "Mini" bonds that are in small denominations (e.g., in $500s instead of the usual $20,000s) have also proven to be an effective tool for cities that target small "crowd" investors. In Denver, for example, an on-line crowdsourcing platform the city provided was instrumental to the success of their issuance of $12 million mini-bonds, which were sold out within a single hour. Crowdfunding is also emerging as an important source of equity capital for P3, helping to broaden the pool of potential P3 equity investors. In addition to social and political benefits, crowdfunded P3 equity helps drive the rate of return down and lower the overall cost of capital, ultimately passing the savings on to the public sector in the form of lower availability payments or reduced tolls.

LGFA for Multi-City Pooled Approach

For many mid-sized cities around the world, a critical challenge is in establishing their own credibility in the global market place and having projects of sufficient size to warrant substantive investments. Local Government Funding Agencies (LGFA) is a multi-city pooled approach that provides a conduit for financial cooperation between cities to build such credibility. LGFA, a long-proven concept in Scandinavia and the Netherlands, has had limited applications outside these countries. For those few that exist currently, all of them are AAA-rated and, collectively in 2012, they were able to raise €70 billion (U.S. $80 billion) in the global capital market. In a number of countries in Europe and elsewhere, the establishment of LGFAs is currently being seriously considered. In France, for example, Agence France Locale was created in late 2014 and the planning of its first bond issuance is currently underway. LGFA is an agency jointly owned by member cities and local governments (sometimes with a minority ownership stake by the national government) whose primary mission is to pool the borrowing needs of the local authorities and to issue bonds in the capital markets. The proceeds of these bonds are then on-lent to member cities and local governments. The process leading to the creation of an LGFA supports the building of local creditworthiness, helps to create local markets, and increases transparency in local decision-making. It has the potential to reduce financing costs, transaction costs, and also risk exposure as a result of increased diversification. An LGFA is furthermore a self-regulating entity in that it prohibits the individual members from excessive borrowing.

At its best, infrastructure serves communities at large and embodies public goods and service. At a larger public policy level, we also need innovative financing approaches that are not all about financial returns, but also address important issues such as sustainability and social equity. Many socially responsible financing approaches have been emerging in recent years, including green bonds, carbon tax/cap-and-trade, and social impact bonds.

Green Bonds, Carbon Tax, and Cap-and-Trade for Sustainability

Cities can issue green bonds to fund "green" projects that have environmental benefits, be they related to renewable energy, low carbon transport, forestry, or others that mitigate climate change. Initially used primarily by IFIs and national governments, the market is fast expanding to lower levels of government and the private sector. Gothenburg, Sweden, and Johannesburg, South Africa, are two cities that successfully issued green bonds recently. Between 2013 and 2014, the market more than tripled from $11 billion to almost $37 billion, which is projected to increase even further to $100 billion in 2015. Green bonds offer a number of benefits that regular bonds do not, including, for issuers, access to a broader range of investors and, for investors, repayments that are tied to the issuer rather than the "green" project. The green bond market is still evolving. Because there currently are no standardized criteria for what makes a bond "green," nor strict requirements for tracking or reporting on proceeds, concerns of "green-washing" have been increasing in recent years.

Carbon taxes and cap-and-trade are also environmentally focused, but they specifically address pollution and global warming. The revenues therefrom are generally used to fund energy, transport, and other infrastructure projects that address greenhouse gas emissions and other related environmental issues. Although many countries have explored the implementation of carbon taxes with much political debate, only a handful of countries—e.g., India, Japan—have been able to adopt the tax scheme as a matter of national policy. The City of Boulder in the U.S. was the first city to pass a municipal carbon tax measure in 2006, where tax proceeds were used for citywide programs that reduced greenhouse gas emissions. Regarding cap-and-trade, the European Union (EU) has operated by far the largest program thus far, but it has largely been unsuccessful due to widely fluctuating auction prices that have crashed on more than one occasion. Cap-and-trade can be an effective approach to meeting carbon emission reduction goals, but collection of any revenues from these programs is generally considered to take a long time. The State of California has been a unique exception in this regard in that it has been able to set up a working cap-and trade auction program. The state has already collected $2.3 billion in revenue, $250

million of which is specifically earmarked for its high speed rail project.

Social Impact Bonds for Socially Responsible Investing

A social impact bond (SIB), also referred to as *pay for success* or *social benefit bond*, is an innovative performance-based financing tool that enables governments to pay for only those programs that deliver. The SIB concept is still new, but beginning to generate significant interest from countries like the U.K., U.S., Australia, and Canada. For cities, SIBs can be a useful tool to fund municipal programs that address larger social issues such as public safety, prison rehabilitation, homelessness, workforce development, and preventive healthcare programs. The use of SIBs to finance "hard" infrastructure projects have been limited thus far, but they can potentially be used to finance social infrastructure projects (e.g., prisons, public healthcare facilities, affordable housing). The use of SIBs can also present an opportunity to unlock a large pool of funds from philanthropic organizations, foundations, and other non-profit entities. They can also help to tap into the large cash reserve held by major corporations currently sitting on the sidelines. The Indian government, for example, recently passed legislation requiring large companies to spend at least 2% of their annual profits on corporate social responsibility. If significant investments can be unleashed from these socially responsible investors, SIBs can be a powerful tool in the infrastructure financing space with much broader applications and with performance measures that are more meaningful to cities—e.g., reduction in commuting time, reduction in urban pollution levels, decrease in electricity "brownout" times, etc.

Conclusions and Afterthoughts

With infrastructure spending needs almost at 5 percent of gross world product every year from now to 2030, we are facing a global infrastructure financing crisis. This is a big problem that cannot be solved by a small group of experts and stakeholders. More than ever, a collective effort is needed and each stakeholder has an important role to play.

First and foremost, cities and local governments need to become more fiscally self-reliant to the extent feasible. They also need to become smarter and financially savvier. This handbook offers some of the means that can help cities to do so. Instead of relying primarily on national governments and private sector expertise, cities need to be at the forefront in developing their own infrastructure financing solutions. They need to be proactive in involving multiple stakeholders early on, coming up with creative and innovative ideas themselves, designing projects that are bankable, and marketing them actively and globally.

More than any other governments, cities have a direct interface with taxpayers and users. As local infrastructure project sponsors and service providers, they also have a better understanding of the risks involved in delivering infrastructure projects and services on the ground. Likewise, when the private sector is directly involved in financing and delivering infrastructure facilities and services, such as in P3 model, they too have the opportunity to interact closely and directly with the user community, be they individuals or businesses. Where there is a sufficient level of consumerism, together with the private sector, cities must create a new infrastructure value paradigm for users and cultivate the user-paying culture and users' willingness to pay. Ultimately, they need to jointly develop a sustainable financing strategy with the right set of incentives that balances tax revenues with user charges and that address both economic efficiency and social equity issues.

National and state governments need to embrace the global urbanization trend fully. They need to help in establishing coordinated inter-urban growth strategies with specific incentives that are designed to facilitate and encourage decentralization and fiscal self-reliance of their cities. Where appropriate, they should also explore using cities and urban settings as venues to test key national infrastructure financing reform strategies that are more difficult to implement at the national scale.

In addition, national governments should explore brownfield recycling as a viable option to solve their critical infrastructure funding shortage issue, taking into consideration lessons learned and best practices from recent experiences from Australia.

On the private investor side, direct and active engagement of public pensions and other key institutional investors cannot be stressed enough, especially for major strategic infrastructure projects that have larger economic and social impacts. This view is consistent with the current global trend where, instead of going through third-party fund managers, institutional investors, in particular public pensions, are intersecting more directly with local infrastructure financing activities. Shared liabilities in these situations have proven to create inherent synergies between governments and public pensions for the greater benefit of the public, as demonstrated by the N-33 Road Project in the Netherlands discussed in this handbook. Public pensions are also in a better position to mitigate some of the political concerns about private investor involvement because their interests are considered to be better aligned with those of the public.

Collectively, we also need to develop innovative approaches to encourage more socially responsible investments. In particular, we need to identify an effective means to unleash substantive investments

from philanthropic, foundation, and other non-profit organizations. We also need to identify ways to raise corporate social responsibility and unlock some of the corporate cash reserve that is sitting on the sidelines. Social impact financing and crowdfunding are two potential venues identified in this handbook to unlock these funds, but many more innovative ideas need to be developed in the future.

The most critical gap at this juncture, however, is in "development financing," i.e., financing greenfield and new construction projects that stimulate new growth and new developments, which have generally been perceived to be risky in the financial community. Some countries, such as Singapore, have made an effective use of their sovereign wealth funds in the past to carry out their critical national development agenda, but such efforts have been limited. IFIs, national governments, and institutional investors need to work together to streamline this development finance. More specifically, IFIs and national governments need to provide short-term early risk capital, institutional investors need to commit stable low-cost capital for the long-term from the get-go (thus removing the refinancing risks), and together they need to streamline the process to establish formal and substantive development financing. For cities and local project sponsors, such streamlining would reduce overall financing costs significantly.

Finally and most importantly, taxpayers and users need to recognize that, like everything else, they are the ones who will have to pay for infrastructure in the end. They have to recognize the current reality that the choices ultimately come down to these: either they pay taxes or user charges or they will get no service at all. Taxpayers and users thus need to be better informed about the infrastructure financing and funding pictures of their cities. They also need to be actively engaged and become an integral part of the civic decision-making process in the infrastructure space. Their inputs will provide essential ingredients not only in developing efficient and well-functioning infrastructure facilities that are sustainable in the long run but, with the help of emerging technologies, also in envisioning next generation systems that are much more robust and agile that are more aligned with the modern ethos of the day.

Chapter 1 Introduction

1.1 Global Urbanization Context

Urbanization is a well-known phenomenon that has become an integral part of our modern culture. The role of cities and their prominence in the global economy is now at the center of contemporary dialogues, both nationally and internationally. Credible institutions like McKinsey are predicting that 65 percent of the future growth in global productivity will come from the top 600 cities, generating $30 trillion of new wealth for the world by 2025.[2]

The top 25 of these cities are *mega* cities with over 10 million in population. A majority, over 400, are *mid-size* cities with a population between 200,000 to 10 million spread out across 57 countries. Of the top 600, 440 of the cities—the so-called *Emerging 440*—are also from the developing world, with over 60 percent from China. Their growth would be organic in nature, largely propelled by the inevitable rural to urban migration inherent in the development process. It is estimated they would be responsible for 47 percent of future growth, generating $23 trillion in new global wealth by 2025.

With rapid and highly concentrated growth, these 600 cities will undoubtedly face many difficult challenges in the foreseeable future. For the top 25 mega cities, the risk of *hyper*-urbanization and resulting urban blight is always around the corner. They need to be sensitive to when the marginal cost of growth outweighs the marginal benefit. For the rest, opportunities abound, but they come with different challenges for different cities.

In developing countries, with organic growth and latent consumerism on their side, cities need to become much smarter to get better access to the global marketplace. In advanced economies, as organic growth slows inevitably and the demographics become more challenging, cities need to compete harder to maintain their economic and political legitimacy—often without much success as we saw in Detroit and other cities that had to resort to bankruptcy in recent years. For all, however, foremost on their agenda should be the need to balance rapid growth that is economically driven with sustainable and inclusive development plans that are ecologically sound and that ensure social equity for all citizens, including the urban poor.

1.2 Key Urban Infrastructure Challenges

Urbanization cannot happen in a vacuum Cities need to provide basic infrastructure services—clean water, power and

[2] For more detailed discussions on Top 600 cities, see Dobbs et. al. (2012), MGI (2011), MGI (2012), and MGI/MIP (2013).

electricity, telecommunications, roads, public transit, sewage system, schools, hospitals, to name a few—to support the growth and basic livelihood of their citizens and businesses (see Box 1). Unlike the digital world that defines our ethos today, however, infrastructure embodies hard, fixed assets that are least of all agile or robust—and the services do not come cheap.

Box 1: Representative Infrastructure Sectors

Infrastructure encompasses many sectors. The following is a list of infrastructure sectors generally included in infrastructure financing discussions. Broadly, infrastructure assets that are largely in the public sector domain are those in transportation, water/environmental, and social infrastructure sectors; the other sectors in the following list are primarily in the private sector domain. In the financial community, "infrastructure sector" is sometimes narrowly defined to include only transportation and social infrastructure sectors, which, together with the energy/power and oil/gas sectors, make up the three largest sectors included in the infrastructure asset category. Other smaller sectors that are treated separately, but are included in the infrastructure asset category are telecommunications, water/sewage, chemical/petrochemical, mining, and the industrial sector. The term "social" infrastructure that is of public service is used in contrast to "economic" infrastructure that has revenue generating potential. Economic infrastructure generally includes transportation and utilities (energy, renewable energy, water, waste management, etc.).

Transportation Sector:

- *Surface: Roads, Bridges, Tunnels, Railroads, Parking*
- *Public Transit: Urban Rail, Bus Rapid Transit*
- *Air: Airports, Navigation Aid Systems*
- *Sea: Seaports, Canals*

Water/Environmental Sector:

- *Water Supply and Treatment (drinking)*
- *Wastewater Treatment (sewerage)*
- *Solid Waste Treatment*

Social infrastructure Sector:

- *Schools and Educational Facilities*
- *Healthcare Facilities*

- *Prisons and Justice Facilities*
- *Civic and Cultural Buildings/Facilities*
- *Defense/National Security*

Power/Energy Sector:

- *Generation: Hydro Plants, Geothermal Plants, Nuclear Power Plants, Gas/Oil/Coal-Fired Plants, Solar Power Plants, Wind Farms, Biomass*
- *Distribution/Transmission ("Grid"): Towers, Substations, Transformers/Lines, Fiberoptic Network*

Telecommunications Sector:

- *Cable, Fiber Optic Network, Transmission/Receiving Towers, Base Stations, Satellites*

Oil/Gas Sector:

- *Extraction/Refinery: Oil Refinery, LNG/LPG Plants*
- *Storage: Gas/Oil Storage*
- *Distribution: Gas/Oil Pipelines*

Other Sectors:

- *Chemical/Petrochemical: Biodiesel/Petroleum/Chemical/Petrochemical Plants*
- *Mining: Precious Metal Extraction/Smelting/Processing, Mining Operations Facilities*
- *Industrial: Pulp/Paper Mills, Metal Processing Plants, Steel Mills, Cement Plants*

Different infrastructure sectors have different sets of issues on how to provide and pay for their services. For the transport sector, the challenge for cities is providing reasonable alternatives to cars, which, for systems like urban rail transit, require high upfront costs that are hard to recover from fare box revenues alone. For the water/wastewater sector, the upfront costs are lower, but collecting user charges can be mired in political controversy because the services are often viewed as entitlements that should be subsidized. For the social infrastructure sector, such as education, health, justice, and civic facilities with a strong public service component, cities need to rely heavily on public funds because there is no clear user charge potential. The energy sector, on the other hand, is largely privatized with mature financing markets because the *user-pay* culture is well established. A private

operator-government regulator is the model used successfully in many countries for this sector.

With rapid urbanization, we are currently facing a global infrastructure financing crisis. On the demand side, various sources indicate that we need between $57 to $67 trillion in infrastructure spending worldwide—almost 5 percent of gross world product every year from now until 2030.[3] This amount reflects a 60 percent increase over and above historical spending levels. In addition, almost half the total spending needs represent a funding shortage and 75 percent of the total needs is for cities and urban areas. Not all of this spending need is in new construction. In many developed economies with mature but aging infrastructure systems, a significant amount is in operations and maintenance costs needed to barely maintain current levels of service.[4] An added challenge for cities is the shifting of funding responsibility away from national government to local and regional governments, due in part to the declining fiscal health of many national governments in the lingering post-2008 crisis environment.

On the supply side, the irony is there is plenty of money, especially in the private sector. There is currently an oversupply of private capital. There is also an unprecedented appetite for infrastructure assets from the private investment community—in part because the asset class has performed consistently well in recent years often with above-par returns. Institutional investors, such as pension funds that are particularly suited for infrastructure assets with their "long-termism," have been increasing their allocations steadily in infrastructure investment in recent years. Especially in the developing world, international financial institutions and development banks are also becoming much more active in financing infrastructure projects—and, increasingly, their activities are at sub-sovereign, local levels. The issue at hand hence is not a lack of money, but rather insufficient infrastructure projects in the pipeline to keep up with the money supply.

The *real* problem, however, is that the money is not free. According to a recent joint study by the Organization for Economic Co-operation and Development (OECD) and G20 countries,[5] the levers that can reduce the global infrastructure financing gap not only include robust *financing* strategies but, more importantly, sufficient and sustained revenue *funding* sources that can ultimately pay for the financing.

There is an important distinction between *financing* and *funding*. Falling short of direct grants or subsidies, infrastructure financing,

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[3] See MGI/MIP (2013) for more detailed discussion on global infrastructure spending estimates and gap.

[4] See ASCE (2013) and NSTPRSC (2007) for more detailed discussion on the operations and maintenance needs for the U.S.

[5] See WEF (2014) for more detailed description the ongoing efforts by OECD-G20 and the infrastructure and investment task force office of the B20 Australia 2014. For additional discussion on infrastructure financing challenges in general, see World Bank (2014).

in essence, is raising the high upfront costs to build the infrastructure when and where needed by leveraging future revenues that can repay the upfront costs. For a project to be financeable now, it needs clear revenue streams in the future. *Financing* is the raising of this upfront capital to expedite the process. *Funding* is the revenue streams in the future to repay the financing. The lack of projects in the pipeline is due in reality to many projects that are not financeable because of the lack of clear revenue sources. What is in short supply thus is not *financing*, but the revenue *funding* sources. In the end, these revenues come from either taxes or user charges, both of which are generally considered to be in the public and civic domain.

In addition to smart financing and sufficient revenue sources, the OECD-G20 study also identified the need for *smart institutions* as the third important lever in reducing the global infrastructure financing gap. Infrastructure development is a long-term endeavor and getting the financing and revenue streams in place is only part of the equation. Cities need policies, regulations, enabling institutions, processes, resources, and other basic institutional building blocks that ensure that the financing terms are honored so that investors can keep coming back over the long term. Cities must have institutional know-how to secure the best financing deal possible. They must also have management know-how to operate their infrastructure efficiently over the entire project lifecycle to ensure their services are sustainable over the long term.

1.3 Handbook Objective and Organization

In early 2015, New Cities Foundation launched the *Financing Urban Infrastructure Initiative* to address these and other critical infrastructure financing issues facing cities today. This handbook provides a set of practical tools and guidelines that will help cities become smarter in the urban infrastructure finance space. With better knowledge, the handbook is intended to help cities respond more effectively and timely to the basic infrastructure needs of their citizens and businesses.

Chapter 2 of the handbook provides an overview of urban infrastructure *financing* instruments that are available to cities today. Chapter 3 discusses various ways of dealing with the sustainable revenue *funding* issues described above. Chapter 4 provides an overview of *innovations* in urban infrastructure finance observed around the world presently. Chapter 5 concludes with afterthoughts that may have broader policy implications for key stakeholders, including local and national governments, IFIs, and the global investment community. Institutional requisites for cities in infrastructure financing, the third lever identified above, are presented in Appendix A. As smart city concepts are becoming an integral part of modern cities, Appendix B provides financing approaches to several key smart city applications that exist today.

Chapter 2 Urban Infrastructure Financing Instruments

2.1 Basic Concepts and Underlying Issues

Infrastructure financing can be likened to getting a mortgage to buy a house. In countries where the housing market is mature, we can pay a down payment of 20 percent of the total housing cost to get a mortgage loan of the remaining 80 percent. The bank, the financier, provides the loan at a specific interest rate, that is, the financing cost. The interest rate we pay depends on our credit history and the down payment amount, both of which represent the overall credit risk we present to the bank. The mortgage from the bank together with the down payment we raise provide the initial upfront cost needed to purchase the house from the seller. Ultimately, however, we are responsible for paying off the mortgage to the bank over the term of the loan—and at a cost commensurate with the interest rate. In order for us to qualify for the loan, we need to demonstrate a sufficient source of revenue for the repayment, which generally comes from our annual earnings. The amount of the down payment we must provide also depends on our earning capacity and our ability to repay.

Equity and debt are two generic financing instruments that cities can use to secure infrastructure financing. In the housing example, the down payment represents "equity" financing and the mortgage loan represents "debt" financing.

Equity financing entitles us to the ownership of the underlying asset (in this case, the house) and is the leverage we use to raise the debt. It is "at-risk" capital we lose if we default on the debt. In the housing example, the at-risk down payment can come from many different sources. It can come from our own savings or from generous gifts offered by our family members with no repayment obligation. From the infrastructure financing perspective, for cities, such gifts can be likened to a direct grant or subsidy from IFIs and/or higher-tier governments, such as their national or state/provincial governments. The at-risk down payment can also come from a third party source, which sometimes comes with a steep price. Because it is at-risk capital, from a financing perspective, the cost of the equity capital (i.e., the return requirement of the investors that provide equity capital) is generally much higher than the cost of the debt capital.

Debt financing is borrowing money without giving up ownership. It is associated with clear repayment conditions ("covenants") that include, at minimum, paying interest and the principal at specified dates. From the investors' standpoint, compared to

equity financing, it is much less risky and the interest rate (i.e., the return expectations from the debt investors) is generally much lower. Typically, debt financing can take the form of either a bank loan or a bond. A bond, also referred to as "fixed income" security, is a form of loan or IOU. Instead of obtaining a loan from a bank, companies and governments can choose to issue bonds directly to investors (bond buyers) to raise the needed capital. They can use the capital thus raised to finance new projects, maintain ongoing operations, or refinance existing debts. The indebted entity ("the issuer," i.e., a company or a government entity) issues a bond that contractually specifies the interest rate or yield ("coupon") that will be paid and the time at which the loaned funds ("bond principal") must be returned ("maturity date").

Infrastructure can be financed completely by the public sector or can involve the private sector. In most countries in the last several decades, a more traditional approach has been for the governments to assume full financing responsibility. Since the late 1980s, however, the role of the private sector in infrastructure financing has been increasing steadily—but not without controversy.

Public sector financing is almost always 100 percent debt financing (i.e., fully leveraged with no owner equity capital at risk). In general, the cost of debt financing by the public sector is significantly lower than that of the private sector because of governments' ability to borrow cheaply.[6] The cheap borrowing costs are due largely to taxes and other public assets that effectively serve as a collateral on the debt. Taxpayers can thus be considered *de facto* equity holders of government investments.[7] Any risks associated with these investments are ultimately borne by the taxpayers, but are not reflected in public sector financing costs *per se* because they are considered *risk free*. Risk free also implies taxpayers have greater liability—than, say, private equity holders—because they are obligated to make debt holders whole.

Private sector financing becomes attractive when the public sector is fiscally constrained and facing serious debt capacity issues. Infrastructure financing by the private sector is generally perceived to be more expensive because it almost always involves at-risk equity capital.[8] Unlike public sector financing, the underlying risks of investments, represented as a *risk premium*, are fully manifested in the financing cost of both the equity and debt capital.

When private sector financing is involved, it is also generally combined with the delivery of infrastructure projects.[9] Historically, relative to the public sector, it has been shown that the private sector can be much more cost effective in the

[6] See McKinsey (2015) for additional discussion on hidden costs of public sector financing.
[7] For countries where tax revenues are limited, accumulated sovereign wealth would be beholden to the investment risks.
[8] At-risk equity capital represents the private sector's skin in the game and a safety margin for the debt investors.
[9] "Delivery" here can be any combination of design, construction, operations, and maintenance.

delivery, but their financing can be more expensive. Private sector participation thus makes more sense when (a) the overall cost of providing infrastructure is *non-recourse* in nature, i.e., the private sector takes on most of the risks by not adding any significant new debt to the public sector's balance sheet, and (b) financing costs can be minimized, especially to the extent that the cost savings from efficiency gains in the delivery surpass the higher financing costs associated with private financing.

Regardless of whether infrastructure projects are publicly or privately financed, cities should strive to minimize *non-productive*[10] financing costs as much as possible. Reducing financing costs is mostly about reducing the overall project risks through proper risk allocations. When the private sector is involved, it is about sharing the risks through a proper balancing of the risks between the private and public sectors and allocating specific risks to those parties that are best able to bear them. The overall project risks can also be reduced by using various credit enhancement tools—such as guarantees, insurance products, or low-interest subordinated debt—which, for cities, are often provided by IFIs and/or higher-tier governments on their behalf. Providing the right incentives for investors, such as tax-exemptions, can also reduce financing costs. All of these basic financing concepts and issues are further elaborated in the following sections.

2.2 Public Sector Financing

Basic infrastructure financing needs come from either (1) building new infrastructure (often referred to as "greenfield") to support new demand or (2) operating, maintaining, and rehabilitating[11] existing infrastructure (often referred to as "brownfield"[12]) to support existing demand.

Under the traditional approach where the public sector is fully responsible for financing infrastructure projects, the typical delivery model consists of (a) hiring a design team to develop design specifications, (b) procuring a construction team separately to build according to the specifications, and (c) once built, taking on the responsibility of operating and maintaining the facilities themselves. Under this traditional model, the operations and maintenance (O&M) costs are generally embedded within the public sector's operating budget.

For design and construction services provided by outside contractors, the simplest way for the public sector to pay for their services is on a *pay-as-you go* basis. The pay-as-you-go option does not require any special financing arrangements because funding and financing are one

[10] Non-productive financing costs are loosely defined here as those transaction and financing costs that are over and above those that can result from exercising prudent risk allocations.

[11] Rehabilitation involves major reconstruction of existing facilities and is differentiated from routine maintenance activities.

[12] Not to be confused with environmentally contaminated sites.

and the same. Its use, however, is very limited—such as, for example, when public sector funds are plentiful (which is rarely the case nowadays) or if projects can be delayed until sufficient public funds are accumulated (which is not desirable under the rapid growth scenario). For those projects that require large upfront capital expenditures—for example, large-scale greenfield projects or major rehabilitation of existing facilities—cities do need special financing arrangements. Urbanization often necessitates large upfront capital expenditures to keep up with the rapid rise in demand and to provide infrastructure services when and where needed.

2.2.1 Intergovernmental Transfers from National and State/Provincial Governments

For fully publicly financed projects, first and foremost, cities can rely on their national and state/provincial governments for financing. Financing support from higher tier governments are intergovernmental transfers that normally take the form of direct grants, subsidies, low-interest loans, and/or credit enhancements.

Although the terms are often used interchangeably, grants and subsidies are two different types of funding that do not have to be repaid. In general, grants are used for defined purposes whereas subsidies represent special assistance (e.g., tax breaks) over a time period. Relative to direct grants and subsidies, low-interest loans (sometimes referred to as "concessional" or "soft" loans) are used by national and state/provincial governments to further leverage their existing resources while posing less impact on their public budget. These low-interest loans help cities get better access to financing by providing the capital necessary to proceed with a project (for example, a "gap" financing) or by reducing the amount of capital borrowed from other more expensive sources.

Low interest loans are often *subordinated* to other loans on the project and also function as a credit enhancement tool by reducing the risk borne by other debt investors. Subordinated loans are ranked below other debts so that repayments are made after all other debts are paid off. Cities can also receive direct credit enhancement support on a contingent or standby credit basis. Credit enhancements help reduce risk to investors and thus allow project sponsors to borrow at lower interest rates.

These intergovernmental transfers can be made to cities either as direct disbursements or through a *revolving fund*. National and state/provincial governments, for example, can treat the direct grants as an initial capital injection into a revolving fund, which can then be leveraged to issue low-interest loans to cities. Loans are repaid back into the revolving fund, which enable new loans to be issued for new recipients allowing the funds to "revolve" over time. The Clean Water State Revolving Fund (CWSRF) in the U.S. is a good example of an established, well-functioning

revolving fund (see Box 2). In general, revolving funds are not subject to annual appropriations and remain available to finance new projects without any fiscal year limitations. Many so-called *infrastructure banks*, whether at national or state/provincial levels, in effect operate based on the same concept as a revolving fund.

Most intergovernmental transfers come from the fiscal budget of higher tier governments. In many countries, the primary source of these budgets are direct tax revenues at the national and state/provincial levels.[13] National and state/provincial governments can also choose to issue their own bonds to raise additional capital for infrastructure-related purposes, which can then be passed onto cities and local governments as grants or loans. Many such bonds are designed to serve specific policy goals, such as clean energy or other green initiatives. These bonds represent additional debt accrued to national and state/provincial governments secured ultimately with their own tax revenues.

Box 2: The Clean Water State Revolving Fund (CWSRF) Program[14]

The Clean Water State Revolving Fund (CWSRF) program is a federal-state partnership program in the U.S. that provides cities and local communities a permanent, independent source of low-cost financing for a wide range of water quality infrastructure projects. Under this program, the U.S. Environmental Protection Agency (EPA) provides direct grants to all U.S. states, which are used to capitalize and establish state-level CWSRF loan programs. The states contribute an additional 20 percent to match the federal grants. The CWSRF programs function like environmental infrastructure banks by providing low interest loans to eligible recipients for water infrastructure projects. Repayments of loan principal and interest earnings are paid back into individual state CWSRF programs to finance new projects that allow the funds to "revolve" at the state level over time. States are responsible for the operation of their CWSRF program. Under the CWSRF, states may provide various types of assistance, including loans, refinancing, purchasing, or guaranteeing local debt and purchasing bond insurance. States may also set

[13] As a point of reference, for example, the U.S. federal tax receipts consist of personal income tax (46 percent), payroll tax (34 percent), corporate income tax (11 percent), and other taxes such as excise and estate taxes (9 percent).

[14] Source: http://www.epa.gov/cwsrf

specific loan terms, including interest rates from zero percent to market rate and repayment periods of up to 30 years. States have the flexibility to target financial resources to their specific community and environmental needs. States may also customize loan terms to meet the needs of small and disadvantaged communities, or to provide incentives for certain types of projects.

2.2.2 Municipal Financing Instruments[15]

In conjunction with higher tier government support, cities can seek their own financing options. Most city governments around the world are well informed of the local funding situations that pertain to grants, subsidies, intergovernmental transfers, and other subsidy-like funding. In this handbook, we focus less on these subsidy-like funding and more on financing instruments that help cities become more self-sustainable in the long run. Because most of these financing instruments are more developed in the advanced economies, the case examples we present in the following tend to weigh in their favor.

In most countries, together with higher tier government support, cities commonly rely on short or long-term notes and loans to finance their activities, including infrastructure projects, either through commercial banks or public banks—e.g., *landesbanks* or *sparkassen* in Germany or the Public Works Loan Board in the U.K.—that serve local needs. One of the most robust financing instrument available at city level, however, is municipal bond financing—variably referred to as municipal bond, local authority bond, or public (or public sector issued) bond.

In general, a municipal bond (more simply *muni bond*) is issued by a public entity at a lower level of government than the sovereign. Potential issuers of muni bonds can include states/provinces, counties, cities, redevelopment agencies, districts (such as school, public utility, or special purpose or assessment districts), publicly owned airports or seaports, or any other non-sovereign governmental entities or a group of entities.[16] Typically, the issuing entity holds one or more of the following powers: taxation, eminent domain, or policing.

The U.S. has by far the largest and the most mature muni bond markets in the

[15] For more general discussion about various financing tools available at city level, see OECD (2007b).

[16] In the U.S., for example, there are over 80,000 issuers of municipal bonds (see http://www.municipalbonds.com/education/read/67/understanding-bond-ratings/).

world.[17] For state and local governments in the U.S., for example, muni bonds have played a critical role in their ability to self-finance major infrastructure projects, either partially or fully. For the bond buyers, the interest income earned from muni bonds is exempt from federal tax and, if issued in the bond buyer's state of residence, from state and local taxes as well. These tax savings—coupled with very low default rates associated with muni bonds—have afforded low interest coupon rates on the bonds, allowing the government issuers to borrow very cheaply. For state and local governments, issuing bonds yields immediate capital they need for timely construction of infrastructure while their repayments can be spread out over a long period.

There are many different types of muni bonds. They can be short or long-term, ranging from a few months to 40 years. Most importantly, muni bonds can vary depending on how the debt service on the bond is secured, whether by the full-faith-and-credit of the issuer or only from specific project revenues or special tax assessments. Some require full voter approval whereas others only require an establishment of a special agency with well-defined authority. They can also have various tax incentives that benefit issuers and investors differently. Muni bonds also vary in terms of their prevalent use, whether by sector or type of projects.

Exhibit 1 provides a summary of major categories of muni bonds and their key characteristics. Although the nomenclature used in Exhibit 1 is U.S.-specific, many different variations of muni bonds that exist today or that can be developed in the future fall into one or more of the following categories:

General obligation (GO) bond is an all-purpose debt instrument that cities can use for general purposes. For infrastructure, GO bonds can be issued for projects that do not generate revenues. For investors, they are backed by the full-faith-and-credit of the issuer and also often come with the added security that the issuer can raise property taxes to assure repayment. This guarantee is of an unlimited nature. If the property tax is not paid, the property can be sold at auction giving the bondholder a superior claim above mortgages and other liens and encumbrances. For fiscally constrained cities, issuing GO bonds to pay for infrastructure could impact their overall debt capacity and credit rating, which could potentially make future borrowing more difficult and expensive. For these and other reasons, GO bonds often require full voter approval.

[17] In the U.S., for example, municipal bonds have been around since early 1800s. Its market size in 2014 was estimated at $3.7 trillion (see http://www.reuters.com/article/us-usa-municipals-idUSKBN0JP24R20141211).

Exhibit 1: Major Municipal Bond Categories and Key Characteristics

Category	Debt service secured by	Special requirements	Tax incentive	General uses/ specific case examples
General Obligation (GO) Bonds	Full faith credit of issuer, unlimited guarantee with tax revenue	Voter approval	Tax-exemption on interest income to investors	Any projects that do not generate revenues (e.g., city hall, library, public school, park, prison)
Revenue Bonds	Revenues from service charges; savings from efficiency upgrades	Creation of special entity with authority to levy service charges	Tax-exemption on interest income to investors	Any projects that generate revenues (e.g., toll roads, airports, parking garages, energy efficiency upgrades)
Special or Limited Tax Bonds	Limited to specific tax proceeds (e.g., gas tax, special assessment, incremental sales, ad valorem property tax)	Special enabling legislation	Tax-exemption on interest income to investors	Los Angeles Country Metropolitan Transportation Authority (LA Metro) Measure R (half-cent 30-year incremental sales tax)
Anticipated Notes (e.g., GARVEE bonds)	Anticipated proceeds, e.g., expected future federal grant disbursements	Special enabling legislation; eligible for tax-exempt investors	Tax-exemption on interest income to investors	Grant Anticipation Revenue Vehicle (GARVEE, highways), Grant Anticipation Notes (GAN, transit)
Tax Credit Bonds (e.g., BAB bonds)	Full faith credit of issuer, guaranteed with tax revenue	Special enabling legislation; allows tax-exempt investors	Direct tax credit to investors or direct payment to state/local governments	School modernization program, renewable energy, surface transportation, and other infrastructure projects
Certificates of Participation (COP)	Revenues from leasing facilities or equipment	Creation of special entity with authority to collect lease revenues	Tax-exemption on interest income to investors	Public transit, water/ wastewater treatment, prisons, office buildings, parks

Revenue bonds have historically been the key debt instrument available for cities to finance major infrastructure projects, especially those that generate revenues. Revenues generally come from direct sources, such as tolls on highways or passenger charges in airports, but can also come from more indirect sources,

such as savings that can be derived from energy efficiency upgrades in schools.[18] These revenues are the primary means to make interest and principal payments to the bondholders. Often, these bonds require the creation of a special agency that is given the authority to levy charges and fees on facilities and manage them. Because taxes that secure GO bonds are less risky than most project revenue sources that secure revenue bonds, their yield is higher for investors and thus more expensive for issuers than GO bonds. When the government's fiscal health is sound, revenue bonds are the best financing instrument available all around for revenue-generating infrastructure.[19]

Special or limited tax bonds are another debt instrument that can be used successfully in infrastructure. These bonds are secured with the proceeds against a specific tax, which can include gasoline tax, a special assessment, incremental sales tax, or *ad valorem* property tax levied at a fixed level. Unlike GO bonds with unlimited tax liability, under these bonds, the issuer is limited by the specific tax revenue source. In the U.S., for example, sales tax bonds have been issued by several local transportation authorities in recent years, which differed from a more traditional approach that relied on transportation revenues. This type of financing may require special enabling legislation, which facilitates the direct disbursement of tax revenues from the general tax collecting entity to the trustee of the bond issuance. Such legislation ensures the proper pledge of the specific tax revenue sources for infrastructure use.

Anticipation notes can come from different sources, but their general revenue sources are anticipated public grants. In the U.S., for example, the Grant Anticipation Revenue Vehicle (or GARVEE bond) is a debt financing instrument that has a pledge of future federal-aid grant. This type of bond is authorized to use federal reimbursement for debt service and related financing costs. GARVEE bonds generate upfront capital for major highway projects that state or local governments may not be able to construct in a timely manner using traditional pay-as-you-go funding approaches. Likewise, Grant Anticipation Notes (GANs), similar to GARVEE for highways, are used by public transit agencies in the U.S. to borrow against future federal grant funding.

Certificates of Participation (COPs) are tax-exempt bonds issued by a specially purposed public entity to raise capital for their equipment or facilities. COPs are secured by revenues from leasing the equipment or facilities. The bonds generally have maturities that match the lease term of underlying assets (whether equipment

[18] New Mexico, for example, schools raised $20 million for energy efficiency upgrades through revenue bonds that were secured with expected energy savings. See Smart Cities Council (2014) for additional discussion of this case.

[19] This is also true for privately financed projects. Revenue generation through user charges is one of the keys to attracting private sector financing.

or facilities), which are purchased with the bond proceeds. In the case of transit assets such as rolling stocks, for example, the special purpose entity can then lease the equipment to one or more local transit agencies. The underlying lease or installation sale agreement furnishes the revenue stream necessary to secure the bond. The resulting lease payments, often made in combination with grants and local matching share, are then passed through to the bondholders by the special purpose entity. COPs enable the government to finance capital projects without technically issuing long-term debt that are subject to voter approval and other constitutional and statutory requirements. Municipalities have used COPs to pay for transit vehicles, water/wastewater treatment facilities, prisons, office buildings, and even parks.

Most muni bonds are tax-exempt bonds. The yields bondholders earn from tax-exempt bonds are not subject to federal or state income taxes. They reduce the issuer's borrowing costs because bond buyers are willing to accept a lower rate of interest (yield) in exchange for the tax relief. Several recent studies[20] indicate that a tax-exempt bond subsidy is less efficient because the foregone federal tax revenues in most cases exceed the value of the subsidy passed on to state and local governments.

Tax credit bonds are taxable bonds where the tax subsidy (of the amount equivalent to tax-exempt bonds) is disbursed directly, either to the investors (bond buyers) as a tax credit or to state/local governments (issuers/borrowers) as a direct subsidy. Tax credit bonds are considered more cost effective because every dollar of government revenue foregone as a result of tax subsidy is transferred directly to borrowers. In the U.S., tax credit bonds were first authorized in 1997 to subsidize a school modernization program, but have since been expanded to support renewable energy projects and the Hurricane Katrina recovery program. More recently, as part of the American Recovery and Reinvestment Act passed in February 2009, tax credit bonds called Build American Bonds (BABs) became available to surface transportation projects.[21] BABs provided wider capital market access for state/local governments and became quite successful as an effective infrastructure financing tool. Being taxable bonds, they also appealed to investors that have no in-country tax liability, such as pension funds and foreign investors, who do not benefit from the tax-exempt bond market. For them, BABs provided a better alternative to taxable corporate bonds with higher yields, lower default rates, and an opportunity to diversify.[22]

[20] For more detailed discussions, see U.S. Treasury (2011), CBO/JCT (2009), and JCT (2012).

[21] BAB bonds were only effective through 2010.

[22] For more detailed discussions on the comparison between BABs and corporate bonds, see Minred et al. (2014) and BlackRock (2009).

2.2.3 Other Public Sector Financing Considerations

There are many other public sector debt financing instruments with varying forms of bank loans, revolving credits, and variations of publicly issued bonds, including those issued at national and state/provincial levels for the benefit of cities and local governments. Some financing instruments, such as industrial revenue bonds or energy efficiency loans, are public sector sponsored small-scale debt instruments that benefit individual businesses or homeowners directly. Many others, such as green bonds or social impact bonds, are innovative variations of publicly issued bonds intended to have greater impacts with specific public policy goals in mind, be they clean power, carbon reduction, energy efficiency/conservation, or social benefit/equity concerns. Where municipal bonding capability does not exist, many cities are getting together to form a joint financing authority to issue bonds jointly. For these and other more innovative urban financing instruments, more detailed discussion will be provided in Chapter 4 of this handbook.

Municipal bonds are a robust urban financing instrument that have proven to be effective for cities in gaining some degree of fiscal self-reliance. Although the municipal bond market is not yet well developed outside the U.S., many cities around the world are beginning to explore it as a viable financing option. Some cities have already issued bonds, e.g. Ahmedabad and Bangalore in India and Johannesburg and Kigali in Africa. Others that are new to the municipal bond market, however, must ensure basic building blocks are in place before they venture into this new territory. For cities in the developing world, these building blocks should include, among others, basic institutional requisites (discussed in Appendix A), support of one or more IFIs, establishment of their own credit rating where possible, and full buy-in of the higher tier governments. As experienced recently by the City of Dakar in Senegal,[23] the national versus city government dichotomy can be particularly sensitive in issuing municipal bonds in some cases. This sensitivity can stem from politically driven motivations but, more substantively, from the real concern that the national government may ultimately be held responsible for the city's bond obligations in case of default. In this regard, cities must ensure their infrastructure programs are fully integrated and coordinated with the overall infrastructure development plans at the national and state/provincial levels—which, surprisingly, is often not the case.

2.3 Private Sector Financing

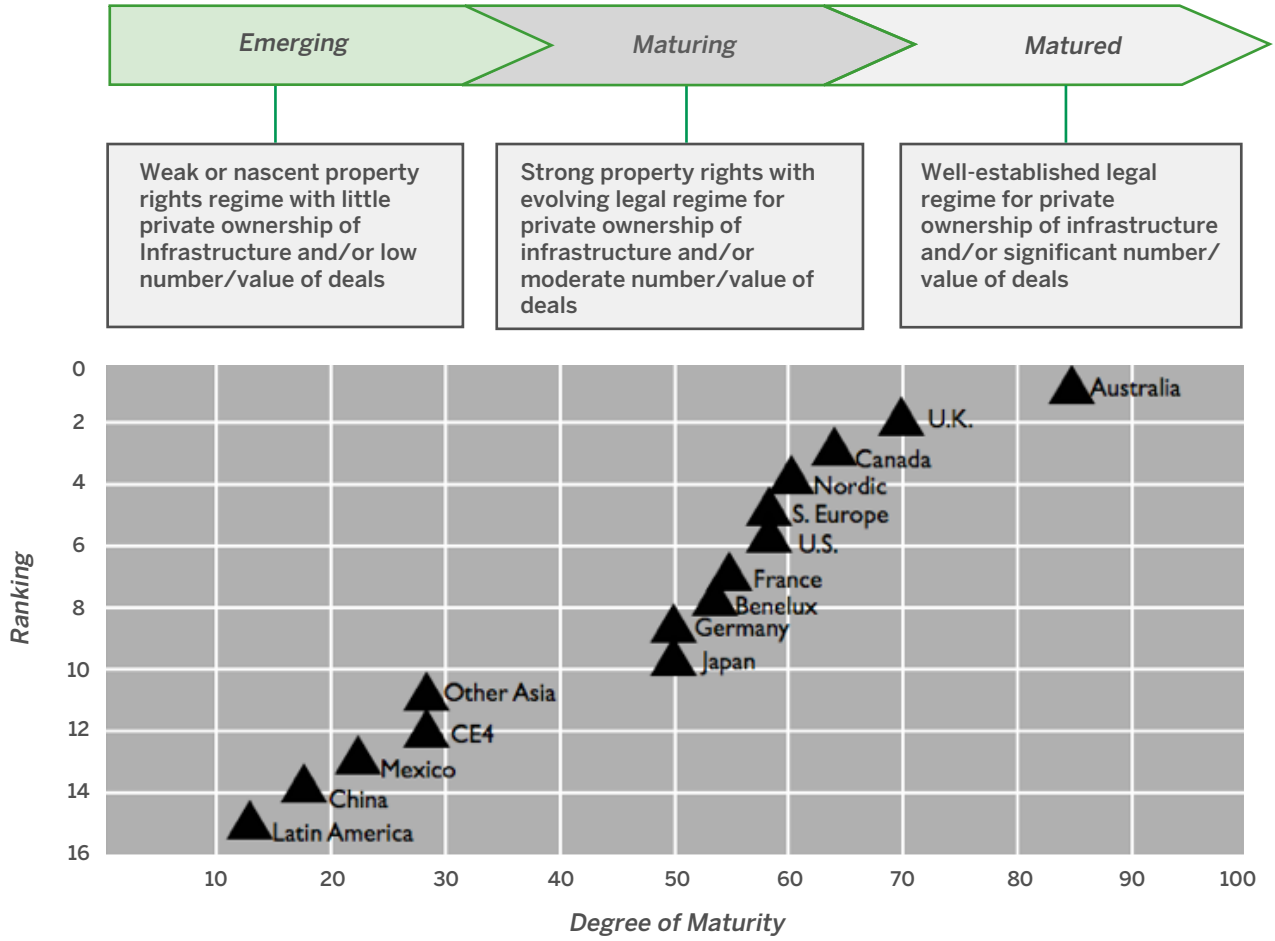
Although the concept has been around for a long time, there was a distinct shift in the mid-1980s towards private sector participation in infrastructure delivery and

[23] See Swope (2015): http://citiscope.org/story/2015/how-dakar-almost-got-its-first-municipal-bond-market

financing.[24] Exhibit 2 provides a current picture of private sector participation in the infrastructure space globally and the corresponding level of maturity as presented in a recent OECD study. According to the study, Australia, the U.K. and Canada have been the leaders in this space, well ahead of other advanced and emerging economies. In general, the level of maturity would have material bearing on the effectiveness of private sector financing as a viable and sustainable infrastructure financing solution.

Generally, private sector participation in infrastructure can be defined as the act of reducing the traditional role of government and increasing the role of private institutions in providing the necessary infrastructure to serve the public interest. There are numerous forms of private participation in infrastructure with varying financing implications, but they generally fall into two major categories: *delegation* and *divestment*.

Exhibit 2: Degree of Maturity in Private Sector Participation in Infrastructure by Country



Source: OECD (2007); includes power and telecomm sectors. Maturity based on country risk (legal, regulatory, political, economic, and financial) and a measure of funded projects as a percentage of GDP.

[24] See, for example, Kessides (2004), Kikeri et. al. (2004), and OECD (2007a) for an overview of global experience in private sector participation since mid-1980s.

Under *delegation*, the government continues to own its infrastructure assets and play an active oversight role, but delegates its service delivery responsibilities, in part or in whole, to the private sector. There are two basic ways to delegate: (1) *outsourcing* of the O&M responsibilities, which have traditionally resided with the public sector[25] and (2) *public-private partnership* (P3) through a long-term concession where all delivery responsibilities over the infrastructure lifecycle is delegated.

Divestment (also referred to as *privatization*), is the most complete form of private sector participation. It involves the sale of state-owned enterprises and/or assets to the private sector in whole or in part. Most divestments are one-time transactions in which the government relinquishes its responsibility to the private sector commensurate with the shares sold.

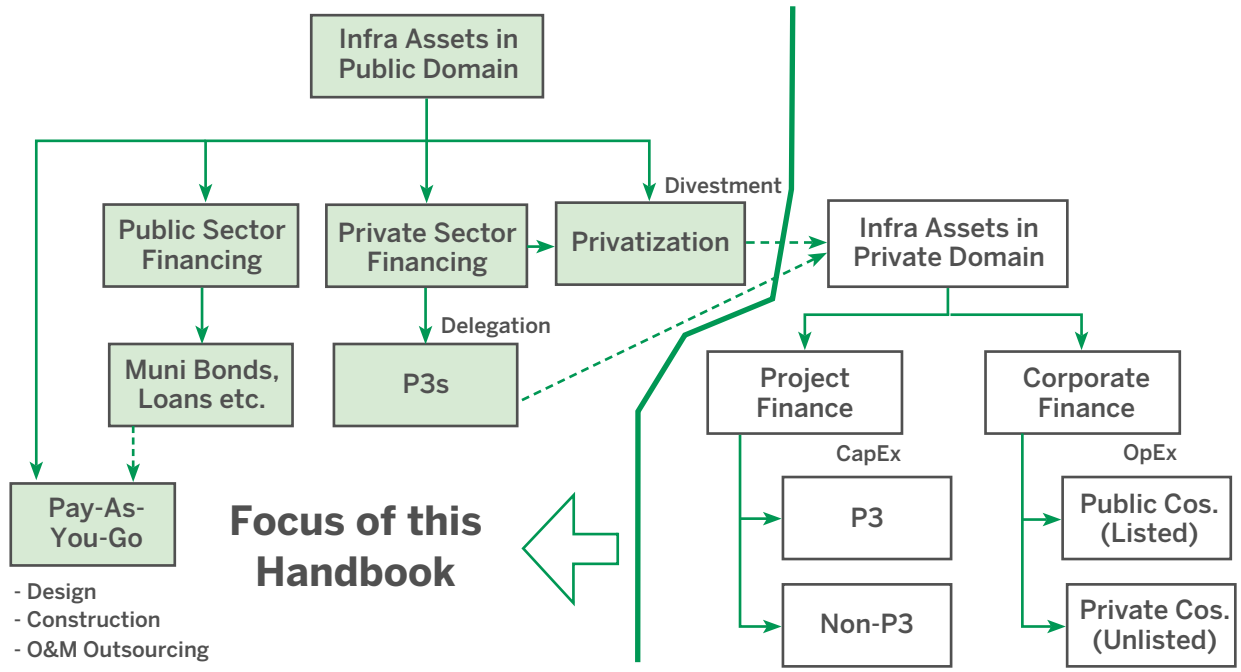
As shown in Exhibit 3, infrastructure assets can either be in the public domain where the public sector is responsible for owning and operating the assets or in the private domain where the private sector owns and operates the assets. For those assets in the public domain, an infrastructure project is *publicly financed* when the public sector is ultimately responsible for financing the project undertaking (public sector financing as discussed in Section 2.2). Although private sector businesses are involved, outsourcing O&M services or procuring design/construction contracts in the traditional delivery described earlier is *publicly financed* because the public sector is responsible for paying for their services/contracts. An infrastructure project is *privately financed* when the private sector is *directly and actively* responsible for financing the projects (private sector financing), as is the case for *P*3 and *privatization*. The discussion on private sector financing in this section focuses on P3 and privatization financing models.

Much of the existing discussion about infrastructure financing pertains to infrastructure assets in the private domain. This handbook focuses primarily on infrastructure assets that currently belong in the **public** domain, where infrastructure financing challenges are most critical (see Exhibit 3). It also focuses on infrastructure financing challenges from the perspective of cities and local governments that are facing rapid urbanization and growth.

Although not covered in this handbook, a brief overview of infrastructure assets in the private domain is helpful (see Exhibit 3). Infrastructure assets in the private domain are generally those that belonged to the public domain previously, but were transferred to the private sector either by privatization through direct sales or by P3 through long-term leases or concessions (dotted line in Exhibit 3). Energy utilities

[25] Except for limited circumstances, many governments already contract out most of the design and construction work to the private sector.

Exhibit 3: Infrastructure Assets in Public and Private Domains



or privatized airports are examples of private domain assets that are divested whereas major P3 developers who own a portfolio of P3 concessions (e.g., toll road concessions owned worldwide by Spanish company, Ferrovial) are examples of private domain assets that are long-term leases. These assets in the private domain can belong to either unlisted private companies or public companies listed in the stock market that can obtain their operating capital through traditional corporate finance mechanisms. When major capital expenditure is required on their assets, they can also obtain the needed investments through project finance, where their capital expansion projects are delivered as P3 or through other means. We will cover the project finance topic further in this handbook as a part of the P3 discussion.

2.3.1 Private Sector Financing vs. Private Capital

In considering infrastructure assets that are in the *public domain*, it is important to distinguish between *private sector financing* (i.e. when the private sector is responsible for financing the projects) and *private capital*. Private capital can be used whether an infrastructure project is publicly or privately financed. A municipal bond, for example, is a financing instrument used by the public sector for publicly financed infrastructure projects, but private capital from bond buyers, whether retail or institutional investors from the private investment community, is involved in the financing. A common pool of private capital can be tapped for both publicly and privately financed projects, but the difference is the underlying risk-return profile of the project

and the project sponsor. The key is matching the risk-return profile of the project/project sponsor with the risk-return appetite of the investors.

In general, private capital, whether equity or debt, can be obtained through several channels depending on different investment vehicles and financing instruments (see Exhibit 4). An investment vehicle can be either direct or indirect. Indirect vehicles generally pertain to funds managed by a third party.[26] Under direct investment vehicles, businesses can obtain equity capital either publicly through trading stocks that are listed in the stock market or privately through direct investments into their companies or projects. Direct vehicles for debt capital can be either bonds or loans.

Exhibit 4: Equity and Debt Capital in Infrastructure Financing[27]

Capital Type	Financing Instrument	Investment Vehicle	
		Direct	Indirect
Equity	Public	Listed infrastructure and utility stocks	Listed infrastructure equity funds, index funds
	Private	Direct equity investment in infrastructure companies or projects	Unlisted infrastructure equity funds
Debt	Bonds	Corporate bonds of infrastructure companies, municipal bonds, other publicly or privately issued project bonds	Infrastructure bond funds
	Loans	Direct loans to companies or projects, asset-backed financing	Infrastructure debt funds/loans

2.3.2 Equity Capital Sources

Equity capital plays an important role in private sector financing. It is used as a leverage to raise the debt capital needed for infrastructure projects. For privately financed projects in the public domain, *infrastructure funds* have been the critical source of equity capital. Infrastructure funds are third-party managed funds established specifically for infrastructure investments. They can be either listed or

[26] Third-party managed funds are based on performance fee (also referred to as carried interest) business model, where fund managers are general partners (GP) and investors are limited partners (LP).

[27] For more detailed discussions on these financing instruments and investment vehicles, see Inderst (2013)

unlisted and have dedicated staff that has the expertise and knowledge in investing in infrastructure assets. Especially since the 2008 financial crisis, these funds have enjoyed significant success in raising capital from the global investment community. As a point of reference, Exhibit 5 provides the top 20 infrastructure funds that exist today ranked in the order of capital raised over the last 5-year period.

By some measure, it is estimated that infrastructure funds collectively have raised about $300 billion of equity capital over the decade ending in 2014.[28] Equity capital is typically leveraged to secure larger debt

Exhibit 5: Top 20 Infrastructure Funds for Equity Capital

Rank	Infrastructure Fund	Headquarters	5-Year Capital Raised ($B)
1	Macquarie Infrastructure and Real Assets	Australia	$27.4
2	Brookfield Asset Management	Canada	$12.9
3	Global Infrastructure Partners	United States	$10.8
4	Energy Capital Partners	United States	$9.9
5	IFM Investors	Australia	$8.2
6	Borealis Infrastructure	Canada	$6.9
7	Colonial First State Global Asset Management	Australia	$6.4
8	Korea Infrastructure Investments	South Korea	$5.3
9	Caixa Economica Federal	Brazil	$4.9
10	InfraRed Capital Partners	United Kingdom	$4.6
11	Alinda Capital Partners	United States	$4.4
12	Antin Infrastructure Partners	France	$4.2
13	First Reserve	United States	$3.8
14	Goldman Sachs Infrastructure Investment Group	United States	$3.7
15	EnerVest	United States	$3.5
16	Hastings Fund Management	Australia	$3.3
17	Kohlberg Kravis Roberts (KKR)	United States	$3.3
18	Meridiam Infrastructure	France	$2.9
19	Ardian	France	$2.9
20	EQT	Sweden	$2.6

Source: Infrastructure Investor, November 2014.

[28] See Poole (2015) for more detailed discussion on infrastructure equity and debt funds and their recent trends.

financing. As an example, on a privately financed infrastructure project in the public domain, equity capital normally represents about 20 to 30 percent of the overall project cost (depending on the perceived risks), which is leveraged to raise the remaining 70 to 80 percent of the cost as debt capital. Based on this leveraging, the $300 billion in equity capital could potentially mean $1 to $1.5 trillion of financing available to support infrastructure projects. Historically, these infrastructure funds have shown strong interest in projects that are in energy and power, transportation, water and waste management, and renewable energy sectors.

The sources of equity capital for infrastructure funds are largely *institutional investors*. Institutional investors are long-term asset owners that include, for example, pension funds, sovereign wealth funds, insurance companies, endowments, and family offices. According to the latest estimate by OECD, they oversee over $100 trillion in investment assets globally.[29]

Institutional investors provide long-term patient capital. Their risk-return appetite matches well with the risk-return profile of infrastructure assets—i.e., long-term low-risk investment opportunities with a reasonable return and stable cash flow that provides an inflation hedge. For these investors, other characteristics of infrastructure assets are also in their favor because of the size of the assets they manage and their ability to engage outside expertise. For example, the infrastructure market is monopolistic and there are high barriers to entry due to the very high initial fixed cost and significant expertise requirements, which many investors cannot meet. Infrastructure assets are considered hybrid in nature providing natural opportunities to diversify within the asset class. For example, the infrastructure asset class currently includes many different assets with traits that can be aligned with fixed income (e.g., utility), real estate (e.g., greenfield project), and private equity (e.g., airport).

Despite these aligned interests, the level of investment in infrastructure by institutional investors has been slow in growing. According to OECD, large pension funds worldwide currently allocate less than one percent of their portfolios in infrastructure on average.[30] Nevertheless, several Australian and Canadian pension funds more experienced in the infrastructure space allocate as much as 5 percent in infrastructure—and their allocations are growing. The asset class is also getting more visibility. Over half of institutional investors now have separate allocations for infrastructure. A recent study by S&P Rating Service[31] highlights the growing trend and critical role of institutional investors in

[29] See, for example, Swiss Re (2014) and Wyman (2013) for discussion on infrastructure investing by insurance companies.

[30] For a recent survey of pension funds and their infrastructure investments, see OECD (2011).

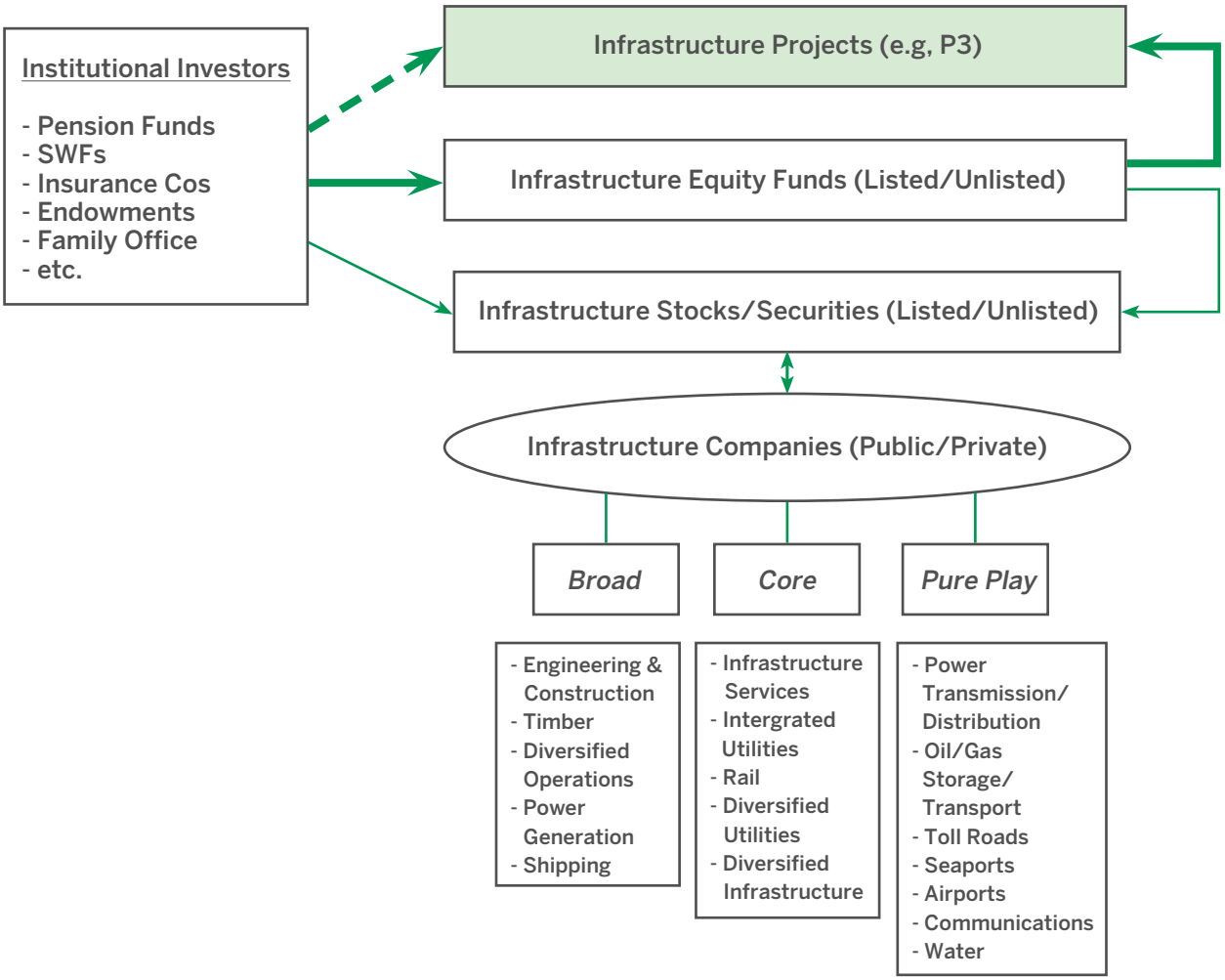
[31] See Poole (2015) for additional discussion on S&P study.

helping to close the global infrastructure financing gap by as much as 20 percent.

As equity investors, both institutional investors and infrastructure funds have access to different infrastructure investment opportunities. Exhibit 6 depicts a somewhat simplified version of how they access different infrastructure assets and how their equity capitals flow in the infrastructure investment space in general. For cities and local governments, their direct interface with these sources of equity capital would be through *infrastructure projects* that are privately financed.

Institutional investors are the primary originators of infrastructure equity capital. Traditionally, they have relied primarily on the expertise of their fund managers to invest in infrastructure assets. On behalf of institutional investors, infrastructure equity funds (both listed and unlisted) have provided direct equity capital to infrastructure projects that are privately financed.

Exhibit 6: Equity Capital Flow from Institutional Investors and Infrastructure Funds



The long-term interest of institutional investors, however, has sometimes been at odds with the more short-term, high turnover, and high return interest of their fund managers. As shown by the dotted line in Exhibit 6, for those institutional investors with high infrastructure allocations, more have been shifting to direct investing in infrastructure projects through *in-sourcing* and building their own in-house capabilities as opposed to relying on fund managers.[32] For others, as their infrastructure allocations increase, more are choosing to co-invest by collaborating directly with their peers using a common investment platform.[33] For cities and public sector sponsors, these trends essentially mean more direct interface with institutional investors, which help to reduce overall financing costs. When institutions such as public pension funds are involved, these trends help mitigate political resistance to private sector involvement.

A significant part of institutional investor capital also gets invested into *infrastructure securities* through their fund managers for infrastructure companies (public or private) whose primary business is infrastructure. These companies and securities fall into three basic categories: *broad* (e.g., construction and engineering companies), *core* (e.g., utilities), and *pure play* (e.g., toll roads, airports, and seaports).[34] Collectively representing about $3 trillion in market capitalization, Exhibit 6 shows those companies and securities that are listed and publicly traded.

Investing in *infrastructure projects* provides *direct* financing for designing, building, operating and maintaining infrastructure facilities that enable cities to provide basic infrastructure services for their citizens and businesses. Investing in *infrastructure securities* provides financing of ongoing operations and management of companies that are in the infrastructure business, be they construction companies, regulated utilities, or privatized airports.

From the perspective of cities and local governments, investments in infrastructure securities can represent direct and indirect benefits for their citizens and businesses in providing needed services. For privatized airports and regulated utilities, for example, although the assets belong in the private domain, the capital raised through the infrastructure securities market can be used directly to improve their services—whether for day-to-day operations or major capital expansions—thus providing *direct*

[32] See Knight et. al. (2013) for more information on in-sourcing.

[33] For example, Borealis, ranked 6th in Exhibit 5, is an infrastructure fund established in 1999 in Canada to invest in infrastructure assets on behalf of OMERS, one of Canada's largest pension plans. OMERS investment strategy since 2003 has been to increase its infrastructure allocation to 15 percent. In 2012, Borealis helped to form a new infrastructure investment platform called the Global Strategic Investment Alliance (GSIA) to bring together like-minded, long term, global institutional investors. GSIA have been able to raise $12.8 billion in 2014, the largest single amount raised that year.

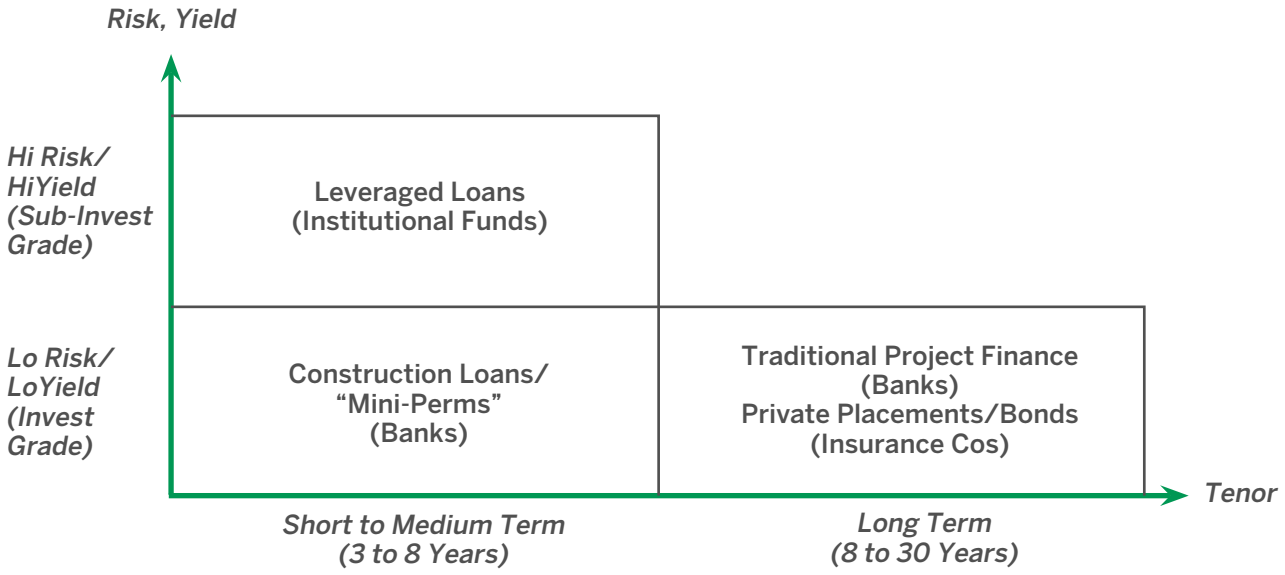
[34] See Mansour et. al. (2006, 2007) and RREEF (2011) for more discussion on various infrastructure security types.

benefits to local citizens and businesses. For construction companies, on the other hand, the capital raised can be used as their own working capital to minimize potential default situations on their construction work, thereby maximizing the probability of successful construction completions and providing *indirect* benefits.

2.3.3 Debt Capital Sources

Until recently, the long-term debt capital for private sector financing in the public infrastructure domain was secured through syndicated commercial bank loans or issuing project bonds through private placements (see Exhibit 7).[35] For brownfield projects, long-term debt capital was generally secured at project inception. For greenfield projects, to get the best long-term financing possible, construction work and the ramp-up phase were financed first through short- to medium-term loans (sometimes referred to as *mini-perms*) and subsequently refinanced and replaced with cheaper long-term debt capital for the project after early phase risks were eliminated. In addition, there were a handful of infrastructure funds that specialized in debt, targeting sub-investment grade assets and taking up the slack left by the demise of monoline insurance companies.[36] Using institutional investors as the primary capital source, these debt funds tried to exploit the lower default rates and higher recovery rates of infrastructure debts relative to corporate bonds and private loans in the non-infrastructure space.

Exhibit 7: Infrastructure Debt Space, Privately Financed Projects Funds



[35] See, for example, EPEC (2012) for issuing project bonds for P3 projects in Europe.

[36] Monoline insurers who provided guarantees on municipal bonds' debt obligations that impact the bond ratings collapsed with the 2007 financial crisis because of their investments in subprime mortgages and other derivative markets. See, for example, WFAF (2008) for more detailed discussion.

The 2008 global financial crisis triggered major reforms in international financial regulatory standards—e.g., Basel II/III Accord and Solvency II Directive—resulting in more stringent liquidity and leveraging requirements for banking and insurance industries. For infrastructure financing, these reforms have left a void in the long-term debt market. Banks have been less willing to provide long-term lending and insurance companies' desire for investments that tie up their capital for the long term has also been dwindling.

As a result, a new infrastructure debt market took off in 2012. There has been increasing interest from institutional investors, especially pension funds and sovereign wealth funds, to fill the void left by commercial banks and insurance companies in the low-risk, long-term infrastructure debt space. In addition, they have been accessing the debt space through infrastructure debt funds. Since 2012, the number of infrastructure debt funds has been increasing significantly with several major ones emerging in 2014. Products offered in the debt fund space have also been wide ranging, from bond-oriented to subordinated debt, with varying terms and risk-return profiles. Whether through managed debt funds or working jointly with banks and insurance companies, institutional investors are positioned to be important players in the overall infrastructure debt space.

2.3.4 Public-Private Partnership Models

The term "public-private partnership" is often used to describe many different forms of partnership between the public and the private sector, whether contractually or otherwise. Outsourcing of municipal services described earlier, for example, is sometimes considered as a form of public-private partnership. Outsourcing is often used by government to contract with private firms, sometimes in a deliberate effort to introduce competition and reduce the costs of ongoing O&M services such as solid-waste collection, street repair and cleaning, snow removal, tree maintenance, day-to-day operations of prisons, etc.[37] *Managed competition* is an alternative to outsourcing and sometimes used by cities as a means to introduce competition by encouraging government's own workers to compete for contracts with the private sector. Under the threat of private participation, managed competition has proven to be a powerful incentive for public agencies to improve their performance. Regardless, it is the public sector that finances and pays for these outsourced and managed competition contracts.

Public-private partnerships or P3 discussed in this section is a specific infrastructure delivery model where the primary financing responsibility resides with the private sector. Under P3, the government awards a private entity (called a *concessionaire*) an exclusive right in the

[37] In the U.S., for example, local governments outsource well above a quarter of their ongoing O&M services to the private sector.

form of a long-term franchise or a lease (called a *concession*) to provide specific infrastructure services to the public. The private sector arranges financing in exchange for the use of the public property (for example, airwaves, airspace, streets, right-of-ways, or underground) for their own commercial purposes (respectively, broadcasting, airline flights, bus/taxi services, tolled roads, or utilities such as electricity, water, gas, or telephone).

Because a P3 preplanning and procurement process can be long, complex, and costly regardless of project size, the private sector's preference for P3 is generally for large-scale, capital intensive, and long-term projects. In addition to financing, P3 offers a number of advantages over the traditional approach to delivering infrastructure.[38] First and foremost, in addition to direct financing, the greatest value P3 brings is the opportunities for the public sector to transfer some or all of the risks, financial or otherwise, inherent in infrastructure projects to the private sector. It offers opportunities for innovations and for achieving cost and operational efficiencies over the entire project lifecycle. It also enables accelerated implementation of critical infrastructure projects and bundling of multiple projects across multiple jurisdictions to gain economies of scale.

In general, the private sector can take on some or all of the risks associated with designing (D), building (B), financing (F), operating (O) and/or maintaining (M) infrastructure facilities in exchange for a future revenue stream. Many P3 models exist that represent different combinations of D, B, F, O, and M. **This handbook focuses on those where the private sector takes on a significant role in financing (F).**

P3 models can be categorized into three basic types: (1) *demand-risk*, (2) *availability payment* (AP), and (3) *shadow-price* (or more specifically to the U.K. market, *Private Finance Initiative or PFI*). Broadly, the private sector takes on the brunt of the overall financial risks under the demand risk model, whereas the public sector has the ultimate financial liability in the long run under the AP and PFI models. The demand-risk model (also referred to as *revenue-risk* model) represents the case where P3 financing is secured with the future revenue streams from user charges and where the private concessionaire takes on the overall financial risks associated with potential fluctuations in future user demand. Demand-risk P3s are typically used when there is sufficient revenue stream from user charges—and where, preferably, a user-pay culture already exists.

From the investor standpoint, because the private concessionaire takes on the demand—and hence future revenue—risk, the overall project risk is perceived to be high. For this reason, the equity requirement

[38] See, for example ACG (2007) for a comparison between P3 and traditional delivery approach in Australia.

on a demand risk model (i.e., the private concessionaire's skin in the game) is significantly higher (say, 30 to 40 percent of overall project cost) than that of AP or PFI model (say, around 15 to 20 percent). As a result, the overall financing costs are higher under this model. It is important to note, however, because most of the financial risks are borne by the private concessionaire, very little is passed on to the public sector as additional financial obligations. Most private concessionaires shy away from participating in demand risk P3 because of the higher risks, while those few[39] who are experienced in risk management prefer it because of their high-return potential.

Compared to demand-risk, the AP or PFI P3 model is less risky and the overall financing costs are generally cheaper because the public sector effectively takes on the long-term financial liability. Under AP and PFI, the private concessionaire provides the P3 financing initially, but it is secured with annual payment commitments from the public sector over the concession term. These payments can come from either taxes or user charges, but the long-term financial liability effectively resides with the public sector. For both, the annual payments by the government are conditional upon the private sector meeting pre-specified performance requirements. For AP, the payments are conditional upon the *availability* of facilities at pre-agreed service levels whereas, for PFI, they are conditional upon achieving a pre-specified user demand level.

Because of the private sector's reluctance to take on the higher risks under a new market situation, the demand-risk model never really took off in the early P3 years. PFI, for example, has been the predominant P3 model used in the U.K. and many other countries for a long time.[40] However, the AP and PFI P3 liabilities are no longer considered *non-recourse* and they are seeping into the public sector's balance sheets. In several U.S. states such as Florida and North Carolina, for example, the AP P3 liabilities now count against the states' bonding capacity and are treated no differently than direct public debt. Many governments are also questioning the merits of the AP or PFI P3 model in its *raw* form in solving their fundamental infrastructure *funding* and *debt capacity* problems.

Whether it is the demand-risk, AP, or PFI model, the basic financing instrument underlying P3 is one of *project finance*, where the financing for the long-term P3

[39] In the U.S., for example, there has been general preference for AP-based P3s by P3 developers in recent years because of their fixed-income like characteristics. Cintra, one of the largest P3 developers of transport infrastructure in the world whose parent organization is Ferrovial, however, has been targeting demand-risk P3 projects and committing high at-risk capital (as much as 40% in some cases) with innovative financing approaches. Such at-risk commitment has often been matched by the public sector with large subordinated low-interest federal loans and guarantees from the local government sponsors.

[40] See, for example, HMT (2003, 2006, 2008, 2011) for PFI experience in the U.K.

concession is arranged through a special purpose vehicle (SPV). As assured by the underlying SPV structure, the project finance is based on a *non-recourse* or *limited recourse* financing structure, where the debt and equity capitals used to finance the project are secured only by the cash flow generated by the project rather than the balance sheets of its project owners and investors. The financial obligations of the SPV are thus walled off from general assets of the project owners and investors.

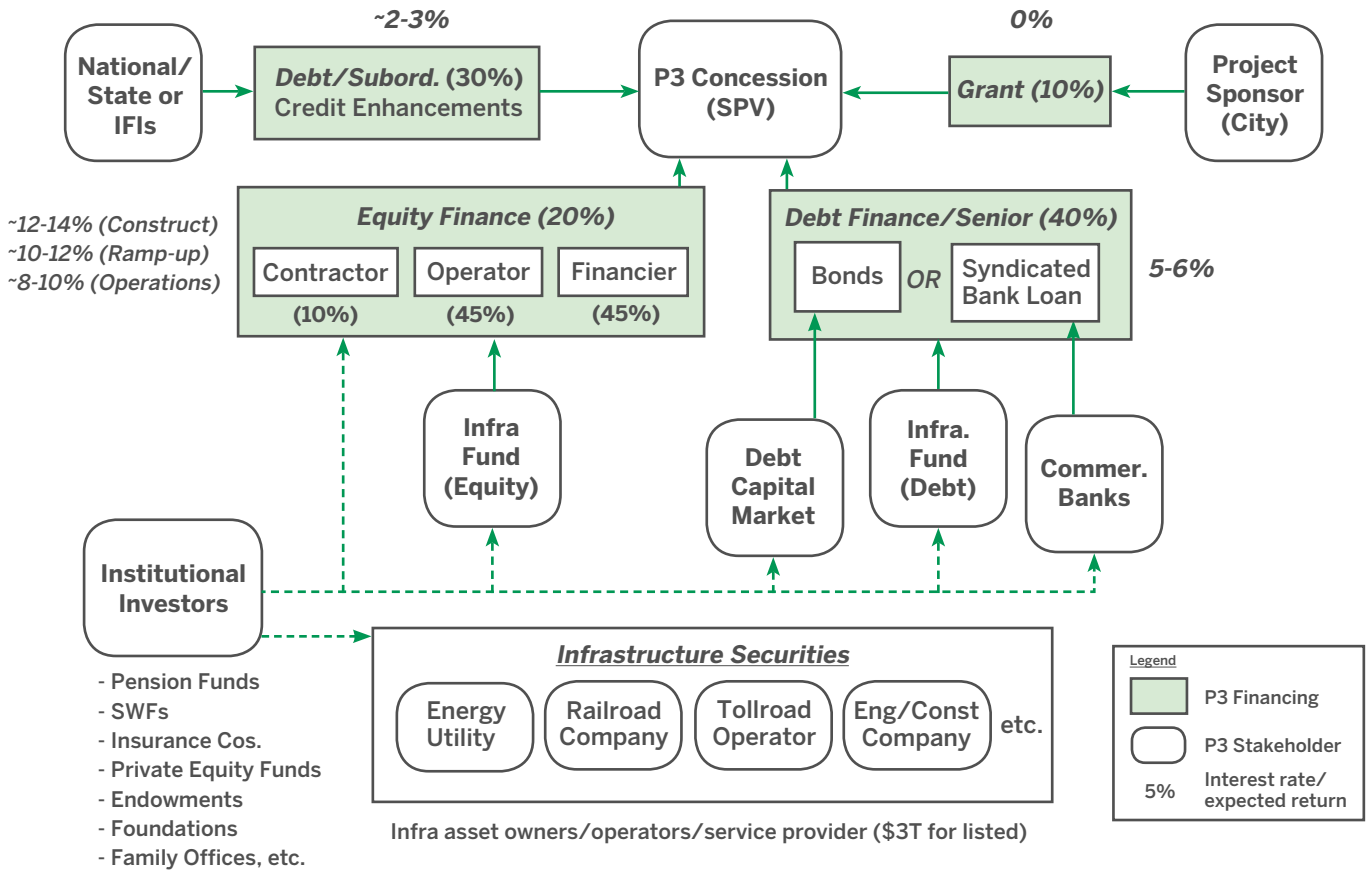
The expected rate of return on P3 project investments is generally determined through the competitive P3 procurement bid practice prevalent in the industry. In general, significant efforts are made by the public sector sponsors throughout the procurement process to determine the merits of P3 as compared to traditional and other alternative financing/delivery methods. By far, the most common analytical approach used to compare various alternatives is *Value-for-Money* (VfM). VfM, a globally accepted decision support tool used by the industry, allows the comparative analyses based on net present value of different alternatives.

P3 project finance can be quite complex with many different investors and stakeholders. For a better understanding, Exhibit 8 presents notionally the basic structure of SPVs, how equity and debt capital flow into the SPV, and the role of various investors and stakeholders in securing the overall financing. The diagram is also intended to help demonstrate the basic private sector financing and P3 concepts described above.

A P3 project is carried out by a private concessionaire through an SPV. This SPV can be made up of two or more private companies that are "equity owners" of the project. These owners have an inherent stake in the project and often include companies that specialize in construction, operation, and/or financing.[41] Through the SPV, these companies own the long-term concession and they are responsible for securing the at-risk equity finance (shown notionally in Exhibit 8 as 20 percent of the total project costs). Each owner's equity contribution would determine their respective ownership levels (shown notionally here as 10, 45, and 45 percent, respectively, for the construction contractor, operator and financier). These equity owners (collectively, the P3 concessionaire) can choose to provide their share of equity capital either from their own sources or seek equity financing from, for example, infrastructure funds.

[41] Over the course of the project lifecycle, the equity ownership structure generally changes, especially around key project milestones. During construction and ramp-up phases, there may be strong construction contractor participation, which may be replaced by strong operator participation during initial operations phase. Over the long run once the operations are stabilized, long-term investors such as pension funds may step in to relieve the remaining equity shares from operators and contractors.

Exhibit 8: P3 SPV Structure and Capital Flow (Notional)



With this equity as a collateral, and using the SPV and expected cash flow from the P3 project, the concessionaire can then secure the remaining 80 percent as debt. The debt financing can be secured generally by issuing long-term bonds in the capital market through private placements (typically used for the AP or PFI P3 model) or getting syndicated loans from commercial banks (usually used for the demand-risk P3 model). Managed infrastructure funds play an increasingly important role and the concessionaire can look to them as a potential source of debt financing as well.

When the project does not have sufficient revenues sources, IFIs and/or governments can provide additional financial support, which is shown in Exhibit 8 as a low-interest loan (notionally 30 percent) subordinated to other senior debt on the project. These loans can be further supplemented by additional public sector support to fill the remaining financing gap. In Exhibit 8, this gap financing is shown as a direct grant (notionally 10 percent) coming from the government sponsor, which could be the city itself.

Investor returns expectations (or financing costs) are different depending on the

underlying risks. The percentages shown in italics in Exhibit 8 represent nominal return/interest rates intended to demonstrate notionally the relative scale. Because of its risky nature, equity capital is more expensive compared to debt, and there is a significant difference before and after construction because of the perceived risk (shown notionally as 12-14 percent for construction, 10-12 percent during the ramp-up phase following the construction, and 8-10 percent once operations are stabilized). Greenfield projects are often refinanced after construction is complete with cheaper long-term financing for this reason.

In the end, most of the money is sourced from institutional investors. They invest in managed infrastructure funds (equity and debt), capital markets, commercial banks, and, increasingly, invest directly into the projects as an equity owner. For cities, a basic understanding of these investors and their risk-return expectations would help them navigate the complex private sector financing space. It would also help in better preparing and designing bankable projects.

2.3.5 Privatization through Divestments

Privatization, also referred to as *asset sale* or *asset transfer*, is another way where private sector financing can play a critical role in providing basic infrastructure services. Privatization is generally achieved by divesting—i.e., transfer of the ownership by selling—fully operating infrastructure assets that are in the public domain to the private sector. There are four common ways for privatization to take place:

- One-time private sale to a single buyer or a consortium of buyers (also referred to as a *trade sale*)
- Issuing and selling shares publicly in the stock market through an IPO (also referred to as *flotation*)
- Selling to employees[42]
- Selling to users or customers[43]

The most recent wave of privatization of public infrastructure started as early as the mid-1980s. The real momentum, however, was not built up until the mid-1990s when the *EU Convergence Criteria* imposed a significant limit on the public debt carried by its member countries. This limit triggered many governments to target and sell off their infrastructure assets and remove them from their balance sheets as quickly as possible.[44] This trend spread outside the EU in countries such as Australia and Canada. In part because initial motivations were driven by these short-term fixes, privatization transactions have often been mired in political controversy. Selling to

[42] As was the case for the sale of Associated British Ports (ABP) in the U.K. in the early 1980s under the Thatcher administration, where 3 percent of the total shares were sold to their employees and the remaining shares were sold to the public through the stock market.

[43] As is often done with rural electricity or water systems sold to a cooperative of local users.

[44] See, for example, Baird et. al. (2007) for divestments of seaport assets in U.K. and the resulting impacts.

employees or users/customers are options that can sometimes mitigate the political sensitivity.

Privatization is essentially a *brownfield* transaction where the public sector receives capital from the sales proceeds of existing facilities. Unlike P3, there are no repayment obligations associated with such capital. From a purely financing perspective, these proceeds can be considered as close to *free* unencumbered money as possible for the public sector with no repayment burdens attached.[45] Privatization transactions have the dual benefit of the private sector taking over all the upkeep associated with the existing facilities and providing additional capital for the public sector's disposal. In general, the size of the proceeds tend to be quite high and, coupled with no repayment obligations, privatization is one of few potential options that can begin to address the sheer magnitude of the infrastructure funding gap discussed earlier.

For these and other reasons, there has been a significant increase in privatization activities in recent years, particularly in Australia. Australia has enjoyed more success with privatization with less political controversy in part because the government has been able to engage major public pension funds on the private investor side. The government has been able to establish a clear objective of using the proceeds from brownfield privatization to fund new greenfield projects (referred to as "brownfield recycling"). The use of brownfield recycling as a potential infrastructure funding revenue source is discussed in Chapter 3 as part of the *funding* discussion.

Often, the first step in privatization involves *corporatization* where, from fully operating infrastructure assets (say, a major airport), the operations and/or assets to be privatized (say, a terminal building within the airport) are separated out and an independent state-owned enterprise (SOE) is established in the process with a separate balance sheet. Privatization is the sale of such an SOE in part or in whole. In the eyes of the private investment community, this step allows transparency in the financial and operational performance of the SOE to be privatized. In many countries, there are already well-established SOEs in the public infrastructure domain under government oversight with proven performance track records. These SOEs represent prime candidates for potential privatization.

The first step in privatization can also involve the *decoupling* of vertically integrated sectors such as utilities or railroads. For energy utilities, for example, distribution and retailing are often privatized first by decoupling from power generation (power stations/plants) and transmission.

[45] One obvious caveat is the loss of future revenues if privatization was carried out for assets that are already generating revenues for the public sector, such as utilities. The privatization proceeds have often exceeded the government's expected retention value and, when coupled with the private sector efficiency gains, they have more often than not made up for the potential revenue loss.

Likewise, for water utilities, distribution and retailing (pipeline network) are generally decoupled from bulk water supply and treatment (reservoirs, water/wastewater treatment plants) with different privatization approaches. For railroads, decoupling "above" rail assets (trains) from "below" rail assets (tracks) enables the privatization of above-rail train operations.

Decoupling generally helps to separate out those operations/assets that are more amenable to competition (and thus benefit from privatization) from those that are more monopolistic in nature better left in public hands. The amenability is also related to *user proximity* and the ability to tie specific *usage* to specific *users* who would ultimately benefit and pay for the services. Decoupling also helps defray the conflict of interest situation often facing vertically integrated sectors, where the government plays both the owner and regulator roles. For those assets/operations that are privatized through decoupling, the private sector can take on the service provider role subject to regulatory oversight by the public sector.

The transfer of ownership can be either *partial* or *full*. Under partial transfer, the resulting *ownership structure* can become an important issue. For example, the private sector can take on either a minority stake (in which government has the controlling interest) or a majority stake (in which the private sector has the controlling interest). There have been conflicting conclusions about the impact of ownership structure on infrastructure performance. For cases involving airport privatization, for example, one study found that little de facto difference exists between different ownership models because: (a) private sector participants can bring an entrepreneurial and commercial orientation whether or not they had majority ownership and (b) through regulation and oversight, governments can also exercise significant influence and impose constraint, whether or not they have majority ownership.[46] Another study, however, concluded there is about an 80 percent probability that airports in which the private sector has the majority controlling interest achieve higher efficiency than those in which government has the majority controlling interest.[47] Regardless, it has been found that the political climate of local jurisdiction generally has significant bearing on the overall performance of privatized airports.

Another important aspect to privatization is *asset valuation*, which has been evolving in recent years. Most recently in 2012, the Australian government performed a comprehensive assessment of the potential value of transferring the ownership of their remaining infrastructure assets to the

[46] See Gillen (2008) and Gillen et. al. (2006) for additional discussions on global airport privatization experience and the effect of regulation.

[47] Oum et. al. (2008) for additional discussions on the impact of ownership structure on the effectiveness of privatization.

private sector. Their approach reflected generally accepted market-based valuation metrics that varied with different type of assets—a multiple of asset base for regulated assets (e.g., energy transmission and water), a multiple of *earnings* for non-regulated assets (e.g., energy retail, airports, ports), and *discounted cash flow* on annual accounts for others (e.g., freight rail, forestry).[48] The multiples and discount rates were based on comparable listed assets in the private sector. These approaches are proving to be on the underestimated side judging from the recent transactions in Australia where the actual bids consistently exceeded valuations based on these methods.

Sometimes it is difficult to distinguish between privatization and brownfield P3 concessions, especially if the term of the P3 concession is very long (for example, 99 years). From a financing standpoint, the fundamental difference is that P3 is based on project finance with specific time frame and performance specifications, whereas privatization is based on corporate finance of an operating entity in perpetuity (likened to private equity investment). In this regard, certain sectors are more amenable to privatization than P3. For example, P3 has been the primary private sector financing model for roads whereas divestment (either partial or full) has been generally adopted for airports by many governments around the world.

In many countries, such as the U.S., privatization is not a viable solution currently due to strong political opposition. A major political issue for privatization is the loss of control and genuine public concerns about the private sector controlling assets that have long been in public hands. Privatization can be more acceptable politically when the public is informed of the rationale behind the sale, there is early and clear delineation of the specific uses of the proceeds (preferably, reinvesting in infrastructure), and an effective regulatory regime is established to protect broader social objectives. A set of effective regulations has sometimes proved to be as good as owning the assets themselves and the key to serving the best interests of both the general public and private sector businesses. Given that many governments are seriously resource-constrained, many cities may need to explore the privatization option while finding ways to deal with underlying political sensitivities.

2.3.6 Other Private Sector Financing Considerations

It is now generally recognized that the biggest potential threat to private sector participation in infrastructure financing may be not financial, but political. Public

[48] See, for example, NSW State (2011) and Infrastructure Australia (2012, 2013) for current infrastructure asset valuation practices in Australia. More general discussion of public sector asset valuation, see Brealey et. al. (1997), FER (2012), Lucas (2012, 2014), and Lucas et. al. (2010a, 2010b).

discontent is fueled by price increases, job losses, and perceived high profits for the private sector firms, but also by macroeconomic and political events that are not directly attributed to the private sector. Historically, for example, global financial crises have tended to further trigger high levels of public, political, and media scrutiny and opposition to private sector involvement.[49]

Some of the underlying causes, political or otherwise, that have made private sector financing less than effective in the past have included: (a) industry-wide misconceptions about private sector investments and financing, (b) poor understanding of risk factors across different sectors, (c) misaligned incentives and interests of major stakeholders, (d) public expectation for below-cost prices and government subsidies, (e) increased mobilization of civil society and interest groups, (f) lack of credibility in government commitments, often resulting from the lack of consensus within governments, (g) corruption and imbalance in deal structure and equity distribution, often in favor of the private investor, and (h) inflated needs assessment for new infrastructure ("white elephant syndrome"). Cities who are exploring private sector financing should be sensitive to these and other potential pitfalls.

In the past when private sector financing was involved, there was a strong preference for brownfield rather than greenfield projects. This is because brownfield represents mature operating assets where the investors can (a) forego the construction risks associated with large initial capital injection, (b) focus on O&M with less extensive capital requirements, and (c) also have the advantage of steady cash flow from ongoing operations. Brownfield projects have also been prone to public criticisms—especially when the government's motivations stem primarily from solving its fiscal problems—because they often do not add new infrastructure capacity. In recent years, a majority of large infrastructure funds have started to seek a mix of both brownfield and greenfield projects. This is a positive trend given most of the critical infrastructure needs associated with rapid urbanization are in the new greenfield space.

There are important sources of private sector financing that seek more socially responsible investments and address some of the shortfalls associated with private sector financing, including the political and greenfield issues discussed above. There is a growing interest among philanthropic organizations, private foundations, and a range of non-profit organizations to participate in investments that help achieve more sustainable cities. In addition, crowdfunding is emerging as an important source of funding, especially for smaller scale infrastructure projects such as bike paths or local parks, where citizen

[49] See, for example, Kim (2012) and Orr et. al. (2005) for additional discussions on political risks associated with private sector financing.

participation is essential and encouraged. All these sources can supplement the private sector financing sources identified earlier and used to address social equity, environmental, and other larger public policy issues beyond those that are purely economically motivated.

2.4 Financing Support from International Financial Institutions[50]

International financial institutions and development banks, collectively known as IFIs, are public sector development banks and development finance institutions that are owned by one or more national governments. The fundamental role of IFIs is to provide long-term, large-scale development finance, of which infrastructure plays a large part, to meet national or international economic, developmental, and social priorities. Operating at international, regional, and national levels, IFIs provide a critical nexus between the public policy goals of governments and the international capital markets that allocate financial resources on a global scale. Collectively, IFIs provide both mobilization of significant capital and, perhaps as importantly, knowledge on institution-building, policy development, and the blending of financial instruments for investing in urban infrastructure.

Broadly, IFIs can be categorized into:

- *Multilateral development banks (MDBs)* that are created by multiple countries for the purpose of development in both OECD and non-OECD countries. The capital is provided through multi-year donor cycles agreed upon by the member nations. MDBs fund their operating costs from money earned on non-concessional loans to borrowers, where the capital for the loans themselves are obtained by borrowing money from international capital markets. MDBs tend to have a separate Board of Governors and Board of Directors that represent members in decision-making.

- *Regional and sub-regional multilateral development banks* whose membership is usually limited to borrowing nations in the local region. Lending is typically made possible by borrowing on international capital markets, for which members effectively share repayment responsibility and associated risks. These regional banks tend to be more flexible because the decision-making committee generally

[50] This handbook focuses on IFI programs at sub-sovereign level. In general, IFI websites provide a wealth of information on lessons learned, best practices, and other policy discussions, especially at the sovereign level. For an excellent overview of the role of IFIs in urban investment, see Future Cities Catapult (2014). In addition to direct interviews with IFI representatives, this section relied largely on that report.

consists of national ministers rather than separate boards.

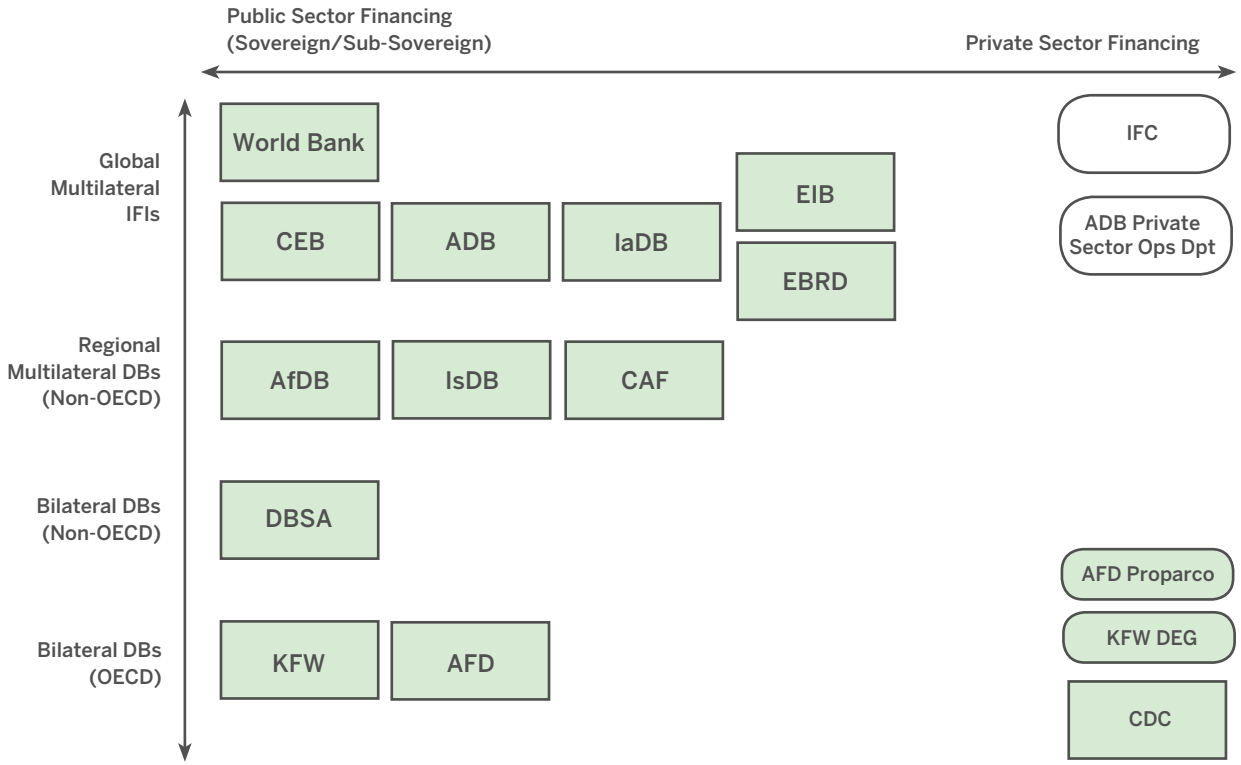
- *Bilateral development banks, development finance institutions, and agencies* that are established by one OECD country to help finance development projects in non-OECD partner countries, that often include private sector development. As national organizations, these institutions are, in effect, a branch of national development policy and their activity takes the form of bilateral partnerships or projects with public or private sector partners.

A select list of representative IFIs within each category is provided in the following along with their head office locations. Exhibit 9 also depicts the respective scope of these IFIs along the public and private sector financing spectrum.

Global Multilateral Development Banks/ IFIs:

- Asian Development Bank (ADB, Manila)
- Council of Europe Development Bank (CEB, Paris)
- European Bank of Reconstruction and Development (EBRD, London)
- European Investment Bank (EIB, Luxembourg)

Exhibit 9: IFI Typology along Public vs. Private Sector Financing



Source: Future Cities Catapult (2014)

- Inter-American Development Bank (IaDB, Washington DC)
- World Bank (WB, Washington DC); International Finance Corporation (IFC)

Regional Multilateral Development Banks:

- African Development Bank (AfDB, Abidjan)
- Islamic Development Bank (IsDB, Jeddah)
- Development Bank of Latin America (CAF, Caracas)

Bilateral Development Banks/Institutions:

- Agence Francaise de Developpement (AFD, Paris)
- CDC Group (formerly Commonwealth Development Group, London)
- Development Bank of South Africa (DBSA, Midrand)
- KfW Bankengruppe (KfW, Frankfurt)

Although IFIs vary in their regional focus, they all adhere to sound banking practice and have high credit rating. Secured by sovereign guarantees, they can borrow at very low rates rarely achievable with commercial loans. Many IFIs have been able to catalyze long-term finance to help draw in private capital into infrastructure projects in locations and sectors where the perceived risks are higher.

Many IFIs have also developed new instruments to specifically address urban infrastructure investment challenges. Though limited, some IFIs can now supply capital to municipal governments directly without a state guarantee. They have also developed other investment mechanisms such as municipal funds, risk-sharing facilities, or specialized financial instruments that support urban development rather than national development processes.[51]

The pace of urban investments has picked up in nearly all IFIs. It is estimated that total annual direct urban lending by all 13 institutions identified above is $25 to 30 billion, with an additional $100 billion in indirect funding from non-urban lending programs. Today, IFIs typically earmark 10 to 15 percent of their total portfolio for urban programs. Much more is earmarked for infrastructure projects that ultimately impact cities. By some estimates, as much as 60 percent of total IFI lending has some impact on cities and urban areas around the world.

Exhibit 10 provides a summary of urban infrastructure programs for those IFIs identified in Exhibit 9, including their organizational capacity, direct and indirect funding levels, overall credit rating, regions of focus, and engagement levels in different infrastructure sectors.

[51] See, for example, ADB (2013) for a comprehensive urban investment strategy established by ADB.

IFIs provide financing to city infrastructure projects in numerous ways, which generally include:

- *Debt capital to sovereign states.*
  IFIs allocate loan financing to national governments on the basis of an agreement to disburse to local authorities according to specified conditions. It is common for projects to be delegated to the city authority while the funds are managed by the central government. Cities in low-income countries often receive non-repayable grants via their national governments. For cities in creditworthy middle-income countries, IFIs offer a wide range of sovereign loans tailor-made for each project.

- *Municipal lending.*
  Several IFIs are working on offering sub-sovereign loans directly to municipalities. Direct municipal loans have become harder since the global financial crisis. ADB, for example, has seen a 10 percent decrease in their direct sub-sovereign lending since 2008. For most IFIs, sub-sovereign lending is relatively low compared to the overall lending portfolio in part because most cities in non-OECD countries are not creditworthy.[52] Municipal lending can also be provided by helping local banks to take and manage municipal credit risk or by creating intermediary municipal development funds. These are useful for smaller and mid-sized cities, which otherwise would have limited access to commercial bank funding for their infrastructure projects. Often such intermediated loans are combined with local capacity building programs.

- *Private sector lending for Public-Private Partnerships (P3s).*
  P3s form an important part of the urban investment strategy for IFIs. Although P3s are not yet used as a matter of course in all development contexts, many IFIs have P3-specific departments to manage the role of the private sector in municipal service delivery. Since 2011, a range of new strategies led by national governments and supported by IFIs have been developed to strengthen the financial viability of P3s in African, Asian and Latin American cities. P3 support is provided by IFIs in a number of ways, including (a) helping improve the legal/regulatory framework and political/business environment

[52] Only 4 and 20 percent, respectively, of the largest cities in non-OECD countries are creditworthy in international and local financial markets.

Exhibit 10: IFI Urban Division, Spending Estimates, and Sector Coverage (2013)[53]

IFI	Own Urban Division ?	Department Overseeing Urban Agenda	Direct Urban Lending ($B)	Add. Indirect Lending ($B)	Credit Rating	Priority Region	Sector Engagement Level in Urban Areas					
							WS	WA	EP	PT	HE	ICT
AfDB	No	Operations in Infrastructure, Private Sector and Regional Integration (OIVP)	0	2	AAA	Africa	med		low	low	med	med
ADB	Yes	Urban Development and Water Division (Southeast Asia, South Asia, Central and West Asia); Urban and Social Sectors Division (East Asia); Urban, Social Development and Public Management Division (Pacific); Private Sector Operations Dept.	1.9	10-12	AAA	Asia-Pacific	low	low	low	med		
AFD	Yes	Local Authorities and Urban Development (CLD)	3.2	5	AAA	Africa MENA	low	med	low	med		
CAF	No	Office of the VP of Infrastructure; Office of the VP of Social/Environmental Development; Office of the VP of Development Strategies/Public Policy	0.5	4-6	AA-	Latin Amer.	low	low	low	med		low
CDC	No	Development Impact	0	0.1	-	Africa S. Asia	low	low	low	low	low	low
CEB	Yes	Housing and Urban Development	0	1	AA+	Eur.			low	low	med	
	Yes	South Africa Financing Division	0.1	1	BBB	Africa	low	low	med	med	low	low
	Yes	Municipal and Environmental Infrastructure	0.8	3-4	AAA	E. Eur. MENA	med	med	med	med	low	low
EIB	Yes	Regional and Urban Development	13	20-30	AAA	Eur. Global		low	med	med		low
IaDB	Yes	Urban Development and Housing; Fiscal and Municipal Management Division within Institutions for Development Department	0.5	8-9	AAA	Latin Amer.	low	low	low	med		
IsDB	Yes	Urban Development & Services Division, Infrastructure Department	0.8	1.5-2.5	AAA	Asia MENA Africa	high	high	high	med	med	low
KfW	No	Sector Policy Unit	4	-	AAA	Global	high	low	high	low	med	

WS - wastewater/solid waste; **WA** - water supply; **EP** - energy/power; **PT** - public transport; **HE** - health/education; **ICT** - ICT/Broadband

[53] This table is a compilation of several tables presented in Future Cities Catapult (2014).

to demonstrate the city or country is P3-ready, (b) helping understand the P3 process within the city or municipal government, including aspects of risk allocation and incentive structures, (c) playing an advisory/brokerage role on individual P3 projects, identifying potential equity investors and technical partners, developing clear project specifications, and making them more bankable, and (d) leading the structuring, negotiation, and implementation to ensure that the P3s meet local industry best practices.

IFIs work closely with local and regional banks and financial intermediaries for urban investments. To further stimulate the flow of capital, IFIs also work in close partnership with sovereign wealth funds (SWFs), including China-Africa Development Fund (CAD Fund; a subsidiary of the China Development Bank), Norway's Norfund, Qatar Investment Authority, Abu Dhabi Investment Authority, and Angola's Fundo Soberano Angolano.

IFIs such as ADB work closely with large multinational corporations to address their growing interest to invest in inclusive economic and social development in cities. For example, in 2013, Goldman Sachs launched a $250 million social impact fund[54] with returns indexed to the success of projects in American cities. Morgan Stanley has also established the Morgan Stanley Institute for Sustainable Investing with an aspiration for $10 billion of client funds. IFIs offer technical assistance and share their knowledge in urban investments with these corporate investors to explore different forms of co-investment and collaboration to solve shared concerns.

2.5 Credit Enhancements and Other Financial Leveraging Tools

Whether public or private sector financing, the basic goal of infrastructure financing is to get as much money as cheaply as possible. There are many credit enhancement and other financial leveraging tools that help to achieve this goal, especially on the debt financing side. Most of these tools are intended to decrease the risk and increase the liquidity on the overall investments.

Low-interest subordinated loans and standby contingent credits are often provided by national and state/provincial governments or by IFIs to help reduce risks to investors and allow cities and project sponsors to borrow at lower interest rates. In the U.S., for example, the Transport Infrastructure Finance and Innovation Act (TIFIA) enabled the federal government to provide subordinated loans to state and local agencies charged with implementing P3 projects. The Project Bond Credit Enhancement Facility, provided jointly by the EU and EIB, is a similar program designed to support private financing in infrastructure projects in emerging countries. These subordinated debts have been targeted for large strategic infrastructure projects to

[54] More detailed discussion of social impact bonds and related financing activities are provided in Chapter 4.

leverage significant private sector financing in the form of senior debt.

Subordinate debt financing (sometimes called *mezzanine* financing) refers to capital that sits in-between senior debt and equity. Subordinated debt helps to generate liquidity and reduce risk to senior debt lenders, ultimately helping to improve the project credit rating. Normally, this type of capital is provided directly by insurance companies, subordinated debt funds, or specialized finance companies.[55]

Tax exemptions and other tax incentives are another leveraging tool that enables higher-tier governments to engage private capital and help reduce borrowing costs for cities. These tools sometimes play a critical role in raising the necessary capital for infrastructure. In the case of muni bonds, for example, tax incentives were the primary reasons why the muni bond market took off in the U.S., allowing states and local governments to raise the money they needed. As a result, muni bonds have now become one of the most versatile financing tools available for cities.

Credit enhancements can also be provided as various forms of insurance products and guarantees. For example, the Multilateral Investment Guarantee Agency (MIGA), a member of the World Bank group, helps to attract infrastructure investments in emerging markets by providing political risk insurance products. These products help protect investors and lenders against potential losses from risks relating to currency convertibility/transfer, expropriation, war, terrorism and civil disturbances, breach of contract, and financial obligations that are not honored. This is an important tool for cities in the developing world where basic institutional requisites are lacking.

Often, national governments sponsor guarantees as a way to support investment in infrastructure (e.g. HM Treasury Guarantee in the U.K.) or at the request of MDBs on sub-sovereign loans. Public guarantees add risks to government balance sheets and should be targeted where they can most effectively support private sector financing of infrastructure projects.

For P3, there are a number of government guarantees that, when used appropriately, can serve as an effective tool to improve the P3 financing structure.[56] These guarantees, for example, can help to avoid potential defaults on debt financing for demand-risk P3 models. The guarantees can be provided directly to P3 concessionaires (e.g., as minimum demand, revenue, or availability payment guarantees, or guarantees to assume debt obligations or residual values upon contract termination or expiration) or aimed directly at P3 lenders (e.g., as loan guarantees or refinancing guarantees if P3 concessionaires fail to service the debt or cannot refinance it close to its maturity).
The P3 guarantees can be provided at a

[55] See Long Finance (2015) for more additional discussion on subordinated debt, credit enhancements, and other financial leveraging tools.
[56] See, for example, EPEC (2011) for examples of P3 guarantees provided in European countries.

programmatic level as was the case, for example, for the Loan Guarantee Instrument for the Trans-European Transport Network Projects (LGTT) established jointly by the EIB and the EC. LGTT was set up as a stand-by credit line to be drawn by P3 concessionaires in the event of unexpected situations such as traffic revenues shortfalls. The LGTT credit line proceeds can be used to service P3 senior debts to prevent potential default situations. These guarantees are especially useful in weathering major macro-economic fluctuations that can occur on long-term projects that are often beyond the control of project stakeholders.

There are endless opportunities to improve the project capital efficiency over the project lifecycle by recapitalization through refinancing. This is one of the important lessons learned from private sector involvement in infrastructure delivery in the last three decades. Refinancing and recapitalization through secondary equity and debt markets involves replacing short-term, high risk, expensive capital with longer term, lower risk, lower cost capital, thus improving the overall cost of capital on the project. On the equity side, an example of interest was the deep and competitive secondary equity market that developed in the U.K. PFI market, where investors were willing to pay a premium for projects that passed a risk-reduction threshold, i.e., successful construction completion. On the debt side, various post-construction refinancing instruments have emerged in recent years in the form of securitized debt—in particular asset-backed securities (ABS) in the energy sector—with long-term, low-volatility yields that match well with institutional investors' portfolio criteria.

In general, debt-refinancing instruments are important mechanisms to generate additional liquidity for infrastructure assets over long-term life cycles. These refinancing instruments are primarily used in developed countries and emerging economies with advanced financial system and institutions. Debt refinancing consists of pooling of illiquid infrastructure assets and securitizing these assets into ABS that can be issued and traded on capital markets. Securitization differs from other debt instruments in that the original loans are sold to a third party (typically an SPV) which in turn issues debt instruments (e.g. bonds), whose interest and principal payments are dependent on the cash flows coming from the pooled assets collectively.[57]

These secondary refinancing markets provide additional liquidity for early-phase investors to further leverage their investments into new project opportunities, thus improving the overall infrastructure funding picture. Through secondary markets, the overall private sector investments in infrastructure can be expanded with more diversified portfolios and reduced risks.[58]

[57] See Long Finance (2015) for additional discussion on ABS and recapitalizations.

[58] ABS is a derivative product which includes mortgage-backed securities that received much attention in 2007-financial crisis. It is generally perceived to be risky in the current climate but can be an effective tool in infrastructure financing space if used correctly.

Chapter 3 Funding Considerations and Sustainable Revenue Sources

There is an important distinction between *funding* and *financing*. *Financing* is the leveraging of future funding (i.e., revenue) sources to raise the high level of upfront capital needed to expedite and deliver infrastructure when and where needed. In one form or another, *financing* is always tied to repayment obligations and does not address per se the fundamental problem of reducing the infrastructure *funding* gap. To effectively reduce the funding gap, we need to address the *revenue* issue and make more transparent where the buck really stops.

Historically, many cities around the world have relied on direct grants and subsidies from IFIs and/or their national and state/provincial governments as the primary funding sources. These funds in turn come from taxes that are levied at national and state/provincial levels and, where available, from sovereign wealth reserves tied directly to publicly owned commodities and assets. Although limited, direct grants and subsidies from philanthropic sources can also be an important funding source for cities. These direct grants and subsidies have no repayment obligations and can be leveraged to secure additional infrastructure financing.

Outside direct grants and subsidies, the two prevalent funding sources available currently for infrastructure are taxes and user charges. Compared to taxes, user charges are still limited as a significant funding source for infrastructure, especially for non-utility sectors where the user-pay culture is yet to be established. Increasingly, however, taxes need to be supplemented with user charges and striking the right balance between the two sources will be critical in addressing the impending infrastructure funding crisis.

In addition to national and state/provincial taxes, cities can increase their self-reliance by enhancing their own local taxing authority. Regardless of who levies the taxes, the basic approach to taxing for infrastructure should be closely tied to the wear-and-tear of facilities and the actual cost of producing infrastructure services to make funding more sustainable in the long run. For cities specifically, the value capture approach has proven a particularly effective tool where the value of improved infrastructure is captured by monetizing the resulting increase in property values through various taxing schemes.

Compared to taxes, it is generally easier to tie user charges directly to the cost of producing services so the perpetual funding shortage can be avoided. They are

thus more self-sustaining sources in the long run. Imposing user charges can be politically sensitive, especially for sectors such as water supply where the services are often viewed as entitlements that should be subsidized.[59] Despite potential public hostility, user charges can be the key to unlocking private sector capital and attracting innovative, self-sustaining financing solutions in the long run.

In addition to taxes and user charges, an *indirect* approach to dealing with the infrastructure funding issue is by reducing overall funding needs. Several indirect options are currently available to reduce the funding needs. One option is to increase the overall project efficiency and minimize the total project costs through a lifecycle approach that integrates design and construction with operations and maintenance (O&M). The P3 delivery model is the primary mechanism that utilizes this lifecycle approach. Because O&M costs are often a large part of infrastructure funding needs, another way is to increase O&M efficiency through various conservation and efficiency measures, demand management, and congestion pricing strategies that are aimed at maximizing the use of existing facilities. Most sustainability initiatives and smart city concepts serve this purpose. Reducing *non-productive* financing costs is another indirect way to reduce funding needs, which can be achieved by various credit enhancements tools that ultimately reduce overall project risks.

Given the sheer size of the funding needs, business-as-usual will not solve the problem. We need *big* ideas to tackle the problem. The brownfield recycling approach used in Australia can potentially offer one big idea that can provide a substantial funding source for new infrastructure spending needs. Although brownfield transactions can often be mired in political controversy, there is sufficient evidence to prove that wider public acceptance is possible if the transactions are well managed and effectively communicated, and credible institutions such as public pensions are involved on the private investor side.

3.1 Taxes and Other Related Revenue Sources

Where user-pay culture is not well established, such as in some transportation and social infrastructure sectors, most infrastructure funding generally comes from tax revenues. In the U.S., for example, more than 90 percent of the annual funding for the surface transportation sector (roads and bridges) comes from various taxes and other public funding sources at the federal, state and local levels. Due in part to global urbanization coupled with the declining fiscal health of national governments, infrastructure funding responsibilities

[59] See Pigeon et. al. (2012) for political sensitivities associated with water sector.

have also been shifting from national to state/provincial and local governments.

Cities can sometimes expand their local tax revenues within the current tax regime. In most cases, however, cities must be formally empowered by their national and/or state/provincial governments for the enhanced taxing authority. Exhibit 11 summarizes a representative list of infrastructure funding sources for cities that are derived from tax revenues and other funding sources.

Tax revenues can come from general tax bases, such as income, sales, or property tax, or from those bases designated specifically for infrastructure purposes such as, for example, motor fuel taxes or vehicle registration fees in the case of the surface transportation sector. All levels of governments can draw from these sources for infrastructure funding needs.

For local governments, sales and property taxes are two primary taxing mechanisms used to generate local tax revenues. Authorized by state/provincial governments, cities can levy local options sales taxes, which are becoming increasingly important local revenue sources, especially for urban transit projects. In many cases, imposing a sales tax surcharge for infrastructure purposes may also require local voter approval. Other than sales tax, many local tax revenues are generated by levying various forms of property taxes for the value capture option.

In many countries, motor fuel taxes—per gallon excise tax on the sale of fuels—and vehicle registration fees are the two most common infrastructure specific tax revenue sources for surface transportation. Cities can levy their own local option fuel taxes and vehicles fees, as authorized by their higher-tier governments, which are often used to supplement other funding sources. Due to increasing fuel efficiency, per gallon fuel tax revenues have been decreasing steadily in recent years. To overcome this trend, vehicle-miles-traveled (VMT) taxes have been emerging as a new taxing regime to either replace or supplement fuel taxes in several countries.[60] VMT taxes are mileage-based fees that can be levied either as a flat fee (e.g., a fixed fee per mile, regardless of where or when) or a variable fee (e.g., based on time of travel, congestion levels, type of road, type and weight of the vehicle, emission levels, or a combination thereof). Compared to the flat fee, variable fees are closely tied to wear-and-tear of facilities and designed to make the VMT a more sustainable funding source in the long run.

Value capture and developer exaction in Exhibit 11 are robust and substantive funding tools available at the city level. Although both concepts are based on

[60] For example, Germany, Austria, Slovakia, the Czech Republic, Poland, Hungary, Switzerland and New Zealand have implemented various forms of VMT fees, but they have largely been limited to trucks, heavy vehicles and/or diesel-powered cars. Truck based VMT systems are also under development in France, Belgium and Russia.

Exhibit 11: Taxes and Other Related Infrastructure Funding Revenue Sources

Funding Category	Representa-tive Funding Instrument	One time or Long-Term	Description	Sector Application
General	Income Tax	LT	National, state/provincial, and/or local income taxes can be used by cities as general fund appropriations for infrastructure use	Various
	Sales Tax	LT	Cities can be authorized for local option sales tax dedicated to specific infrastructure projects; requires voter approval	Various
	Property Tax	LT	Property tax is cities' primary tool for obtaining infrastructure related tax revenues, including value capture approach	Various
Infra-structure Specific	Motor Fuel Tax	LT	Per gallon excise tax levied on motor fuels collected at national, state/provincial, and local levels; administered through escrow account	Transport
	Vehicle Fees	LT	Vehicle registration fee levied as a flat fee, by weight, by age, and/or by value generally collected at state/provincial or local levels	Transport
	Vehicle-Mile-Traveled (VMT)	LT	Mileage-based fees levied either as a flat or variable fee; tied more to wear-&-tear compared to per gallon fuel tax	Transport
Value Capture	Tax Increment Financing (TIF)	LT	Income, property, or sales tax increments from infrastructure improvements into a separate escrow account to retire existing debt, fund improvements, or use as a pledge to secure a new debt	Transit/ Housing/ Urban Dev.
	Special Assessments	LT	Property tax increase applied only to specific districts that benefit from infrastructure investments	Roads/Public Transit
	Land Value Tax	LT	Tax assessed on land value rather than property value (e.g., building); better incentive for development than property tax	Various
	Betterment Tax	LT	Benefit assessment or betterment levy imposed on beneficiaries of infrastructure investments	Water/ Sewer/ Transport
	Joint Developments	LT	Cost sharing between public operator (e.g., rail transit) and private developer; both benefit from property value increases	Rail/Public Transit
Lease or Sale	Land Lease or Sale	OT/LT	Publicly-owned land with enhanced value can be leased or sold with proceeds that can be reinvested into infrastructure	Various
	Air Rights Lease or Sale	OT/LT	Air rights above/below the permitted land use (e.g., increased FAR) can be leased or sold as monetized development rights	Various
Developer Exaction	Impact Fees	OT	Impact fees on developers to fund additional service capacity; can be conditioned on project approval	Roads/ Safety/ Schools
	Negotiated Exactions	OT	Developers donate land or build facilities for public use as condition for development approval	Sidewalk/ Park & Open Space
	Tap Fees	OT	Utility connection fees on developers to recover cost of integrating new development with existing infrastructure	Water/ Sewage
	Linkage Fees	OT	Fees on developers for secondary effects, e.g., traffic increases	Road/ Housing
Utility Surcharge	Public Benefit Funds (PBF)	LT	Funds are collected either through a small surcharge on electric bills or through contributions from utilities	Renewable Energy/R&D

capitalizing on the incremental value that infrastructure enhancements provide, value capture is targeted at property owners drawing primarily from property and other taxes whereas developer exaction is targeted at developers paying one time fees to mitigate development impacts.

Extensive evidence since the 1980s indicates that investment in transportation infrastructure—especially heavy urban rail, light rail, and rapid bus transit—can bring measurable increases in property values in surrounding areas.[61] As demonstrated by numerous examples from Europe, North America, and East Asia, the increase in property values is manifested as positive impacts on residential property prices, office rents and retailing, number of shoppers in city centers, retail structures, parking requirements, and other building and development patterns that result from urban metro systems.

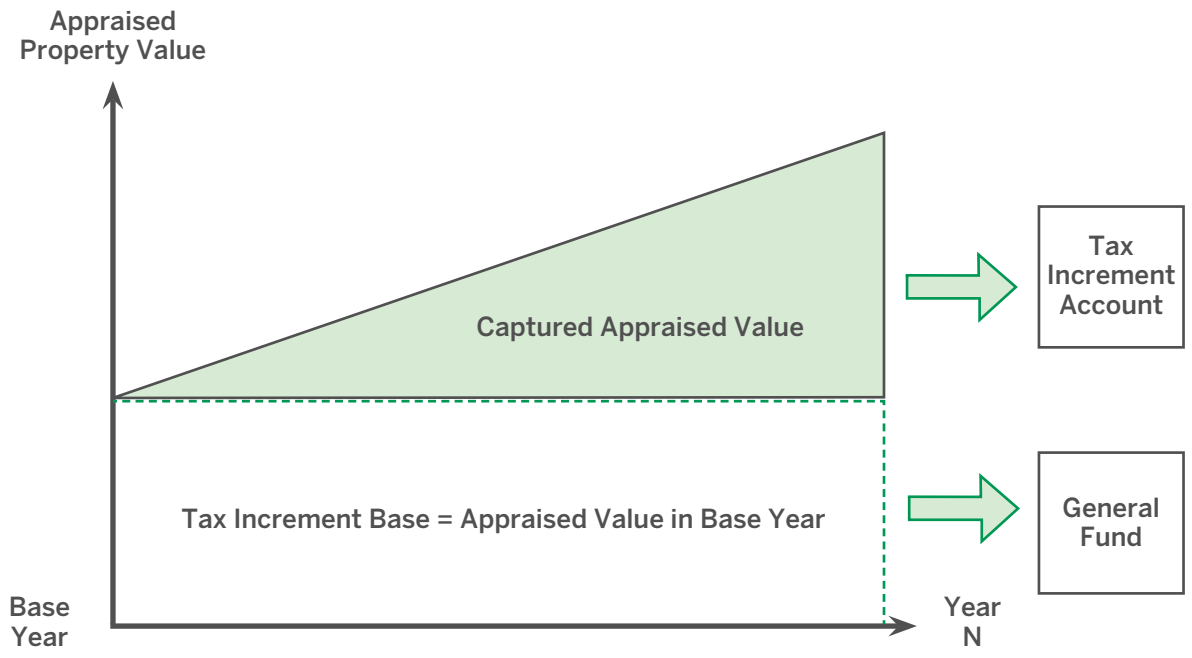
As shown in Exhibit 11, several value capture (VC) tools are currently available. Tax increment financing (TIF) and special assessments are the two most common VC approaches. Used extensively in the U.S., TIF allows cities to create special redevelopment districts (e.g., transportation reinvestment zone) and make public improvements in those areas to spur further development. Using TIF, cities can capture value by earmarking any increase in property tax revenues over the "base" attributable to new developments into an escrow account separate from general fund revenues (see Exhibit 12). These revenues can be used to retire existing infrastructure debts or provide improvements associated with the new development. These revenues can also be further leveraged to secure new debt by using them as a pledge to issue bonds. In addition to property tax, potential increases in local sales and income tax revenues can be also used for TIF value capture.

Special assessments are based on creating special tax districts to finance infrastructure improvements. Unlike TIF where there is no change in tax rate, special assessments levy a tax surcharge on businesses and property owners within the designated district who are the beneficiaries of the improvements. The surcharge can be used to finance bonds that pay for the improvements. Where there is shortfall especially in early years, the debt service on the bonds can sometimes be supported by financial support from the national and state/provincial governments. This approach is fast becoming a critical tool for many cities to finance their urban public transit systems including, for example, London's new CrossRail line.

Land value and betterment tax systems represent a more generalized value capture taxing concept. Land value tax (LVT), sometimes proposed as a better alternative to property tax, is an assessment based on land value rather than property value

[61] See WEF (2014) and Rybeck (2015) for additional discussion on value capture approach.

Exhibit 12: Tax Increment Financing Value Capture Mechanism[62]



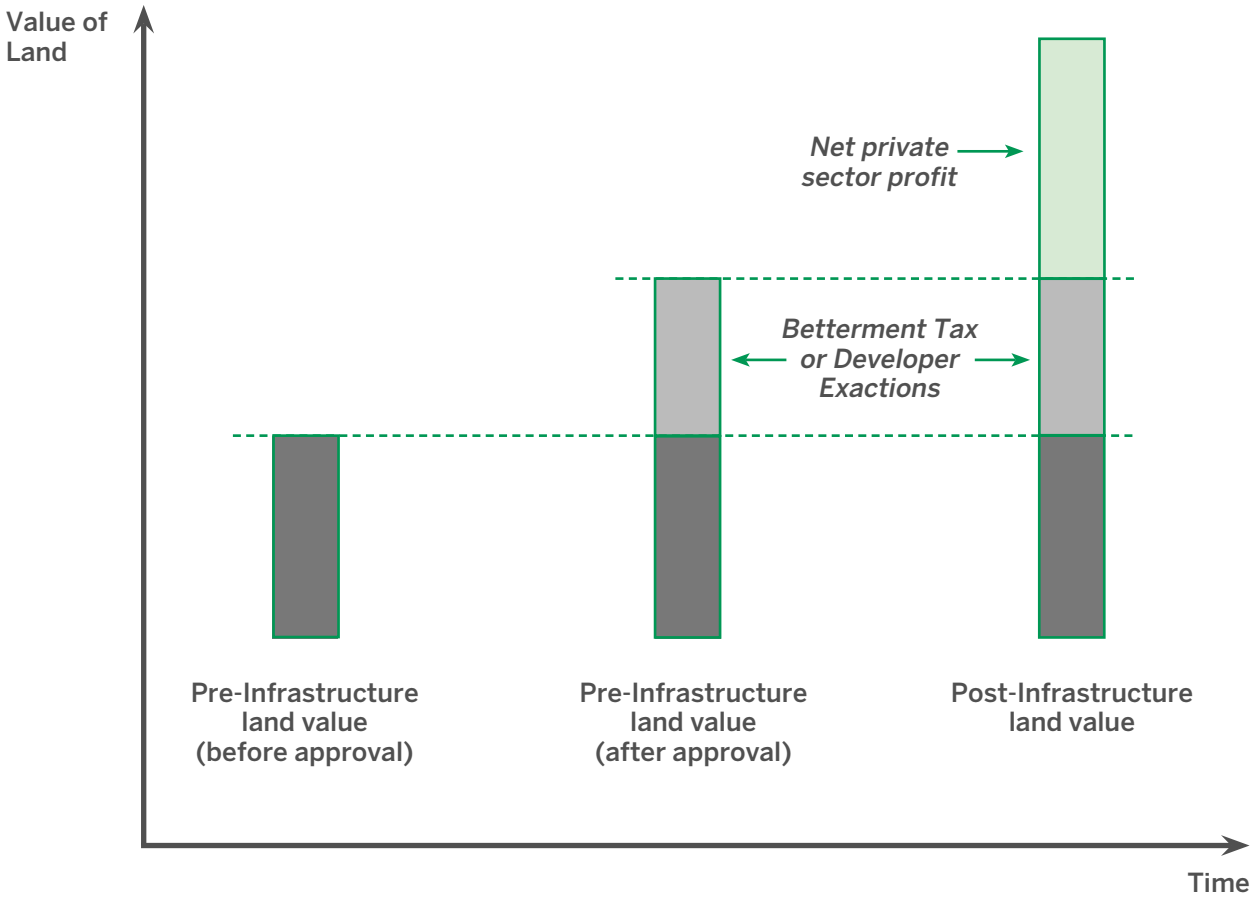
that includes buildings and other property improvements on the land. Property tax is considered inefficient because it taxes the value of improvements and penalizes development whereas LVT provides an incentive for development. Betterment tax, also referred to as benefit assessment or betterment levy, is a one-time assessment imposed on the beneficiary of the land value gain resulting from infrastructure improvements. Compared to the other VC tools, betterment tax allows early capture of the value created from the development through a one-time assessment upfront (see Exhibit 13).

The joint development approach is a form of public-private partnership that has been used most successfully by Hong Kong's Mass Transit Railway Corporation (MTR).[63] At no cost to the public purse, the funding mechanism here is through a cost-sharing arrangement between the public operator and private developer to pay for initial infrastructure improvements—a riskier part of investments that is critical for property developments, but that has resided traditionally with the public sector. Ultimately, private developers benefit from better accessibility, more customers, and increase in property value and the public operator benefits from the sharing of construction costs while securing increased patronage for their transit system.

Long-term lease or sale of land or air rights is another way for cities to capture value. One-time proceeds can be obtained by

[62] See TxDOT (2013) and Farmer (2015) for specific value capture experience in Texas and Virginia, U.S.
[63] See WEF (2014) for more detailed description of HKG MTR's joint venture experience.

Exhibit 13: One-Time Value Capture (Betterment Tax and Developer Exactions)



selling publicly owned land whose value has been enhanced by infrastructure investments. The same land can also be leased for revenues over a long term. Both one-time proceeds or long-term lease revenues can be used as funding sources for infrastructure. Likewise, air rights can be sold or leased as development rights. These rights can either be above the current land control (e.g., increased floor area ratios of buildings) or below the infrastructure improvements (e.g., shop area below a rail station). In addition to the proceeds from the sale or lease of the development rights, additional revenue (e.g., property tax) can be captured from the increase in land value that result from these further developments.

Developer exactions are one-time burdens or requirements that cities can place on a developer to cover the costs of infrastructure improvements as a condition for development approval. Unlike value captures that capitalize on the positive impact of increase in property value, in developer exactions, cities in essence capitalize on negative impacts associated with developments. Similar to value capture, however, the incentive for the developer to pay exactions come from the

potential increase in the property value. Like the betterment tax, developer exactions also force upfront payment and enable cities to capture early on the value created from the use of the exactions (Exhibit 13). As listed in Exhibit 11, several developer exactions tools are currently available.

Initially designed to offset environmental costs associated with new development, impact fees impose a fee on developers to pay for additional service capacity—e.g., sewer capacity, storm water runoff—required by the development. Over time, their use has been expanded to cover non-environmental costs such as new roads, schools, affordable housing, etc.[64] Negotiated exactions, variously referred to as developer dedication or contribution, are often required by city ordinances on land use or zoning regulations for new developments. These ordinances require developers to donate land and/or facilities for public use or provide cash in lieu of the costs, which can include, for example, a new park, dedicated open space, sidewalks, etc. Cash-in-lieu payments can also be used for other infrastructure needs for the new development.

Used primarily for water and sewer facilities, tap fees are utility connection fees used to recover the cost of integrating new development into existing infrastructure or fund other infrastructure improvements. For example, the fees can cover the cost of tying water meters for new connections to existing lines or sewer line inspections. Linkage fees, usually associated with large-scale commercial, industrial, and multi-family housing developments, are designed to cover secondary effects of development, e.g., traffic increase resulting from housing developments or lack of affordable housing for workers from commercial developments.

Originating from the restructuring of the electric power industry in the U.S. in the late 1990s, public benefit funds (PBF) are a dedicated fund designed to support energy efficiency and renewable energy programs. The funds are collected either through a small charge on the electricity bill of all customers or through specified contributions from utilities themselves. Sometimes referred to as a system benefits charge (SBC), PBFs are state-level programs that can be passed onto cities through rebate programs that support renewable energy systems, loan programs, research and development, and energy education programs. The utility surcharge is a concept that can be used outside the utility sector. Transportation utility fees, for example, combine value capture with utility surcharge where fees are imposed based on increased number of trips generated from the development rather than the resulting increase in property value.

[64] See Smart Cities Council (2014) for additional discussion on developer impact fees.

There are many tax revenue generating tools available for cities' perusal. The use of these tools is not without its challenges. Value capture methods, for example, must be anchored in well functioning and transparent property markets, a mature approach to taxation, and the ability to measure and use property value improvements. These requisites are in addition to obtaining necessary political approval from the government and the property owners. Similarly, PBFs have suffered in the past from raids by state legislators and governors who used the funds to fill their budget gaps unrelated to infrastructure. There are no standard models for these tools. Cities must consider a full range of options before deciding on a specific tool most appropriate for their city or the specific project at hand.

3.2 User Charges

User charges are fees that are paid by users who are individual people and businesses that use infrastructure facilities and services provided by cities that are distinct from taxes. Depending on the infrastructure sector, user charges can take many different forms. In the utility sector, for example, user charges are the monthly bills people and businesses pay for their electricity, TV, telephone, and water. In transportation, user charges can be manifested variously in airline landing fees, airport passenger facility charges (PFC), parking fees, highway tolls, fares paid for bus or rail public transit, or shipping service charges paid by shipping lines or terminal operators for ports. For the social infrastructure sector, user charges may be limited to, for example, entrance fees for public museums or fees patients pay for health care services in public clinics.

Compared to taxes, it is generally easier to tie user charges directly to the cost of producing infrastructure services and avoid perpetual funding shortages. They are thus more sustainable funding sources in the long run. Utility sectors—i.e., electricity, telecommunications, water—are more amenable to user charges because it is easier to assign specific benefits and costs to specific users. Where the degree of *externality*[65] is greater, such as in major highways, user charges are more difficult to implement, except for situations like toll roads where the effective user area can be defined with clear physical boundaries. Ironically, if political sensitivity about user charges can be overcome, the water sector can deploy a more sustainable financial model compared to the transportation sector.

In most utility sectors, user charge regimes are well established through a public regulator-private operator model. Using various pricing strategies, constant refinements can be made to make funding more sustainable in the long run.

[65] In economics, *externality* is associated with public goods and services and defined as the cost or benefit that affects a party who did not choose to incur that cost or benefit.

User charges can potentially add most value in surface transportation and other sectors that currently rely heavily on taxes, subsidies, and other public funds. There has been an ongoing debate about the viability of user fees in these sectors as a legitimate and substantive solution to the infrastructure funding problem. Estimates have varied widely, but for the U.S. surface transportation sector, for example, the most optimistic forecasts project that revenues from user charges would make up less than 10 percent of the total investments needed nationally in the future.[66]

Two notable shifts in the infrastructure industry at this juncture, however, may trigger a more user charge-friendly funding regime in the future. First, as the funding responsibility shifts from federal to state/provincial and local governments and as infrastructure facility provisions become more localized, it could become easier to assign specific benefits to specific users. For example, in the case of toll roads, because toll facilities are by nature local, public acceptance of tolling can vary widely by location and national tolling policy can have limited local impact. Decisions about tolling thus could be made more effectively at the local level. Second, as the role of private sector capital continues to feature prominently, it is important to recognize that the user charge funding regime is the preferred and more sustainable model in the long run to engage the private sector more effectively.

User charges can attract P3 and other private sector financing opportunities that are innovative and self-sustaining. User charges often represent new revenue sources and, especially under the demand-risk P3 model, the financing can be non-recourse with no future liability or repayment obligations to the public sector. The private sector is considered to be better positioned for a user charge funding regime because their incentives are better aligned to achieve higher operational efficiency that specifically cater to user needs. Finally, user charges and rate increases implemented by the private sector are sometimes less likely to be subject to political pressures because they are viewed as a legitimate business undertaking rather than having public service goals.

The full potential for user charges has yet to be explored. Our collective challenge is to unleash this source of funding by creating a new value paradigm for infrastructure that incentivizes users and their willingness to pay. Working jointly with the public sector, the private sector can add significant value in this regard. The key would be to create a new value paradigm by providing quality service and convenience for users with more service options, and targeting different user groups with innovative fee structures. Users also need to be directly incentivized

[66] See Kirk et. al. (2013) and Samuel (2007) for more detailed discussion on user charge as a viable and substantive funding source for surface transportation.

to increase their willingness to pay. For toll road P3 concessions, for example, some level of government subsidies should be set aside for user vouchers that can benefit users directly. These vouchers can be used toward paying user charges during the interim period for users to get used to paying tolls until charges catch up to the required level. Relative to a one-time, lump-sum subsidy to the private concessionaire, this type of subsidy could be more effective in generating a steady stream of revenues over the long term and also overcoming the initial resistance to user charges.

It has been proven that user charge collection mechanisms can sometimes be as important as the charges themselves. As evidenced by experiences from utility bills and airport PFCs embedded in airline tickets, it is easier to mitigate the general public's resistance to user charges if the collection system provides user convenience. For example, a collection system that is more automated and embedded within the legacy collection system has a higher chance of being accepted by users.

There can be significant political obstacles and public hostility surrounding user charges. The public hostility is built around two main concerns: (a) perception of double taxation where users pay both taxes and user charges for infrastructure improvements and (b) inadequate provision for charge-free facilities for those who are unwilling or cannot pay the user charges. When the private sector gets involved, there is concern about the need to pay back the sunken investments already made by the public sector on the existing facilities. There is also a community of stakeholders, e.g., labor unions, who are negatively impacted or whose interests are misaligned with private sector involvement and a user charge regime.

It is essential to overcome these political challenges associated with user charges. Many view user charges as unnecessary, whereas others view them as a necessary evil. The choice ultimately comes down to the following: in the absence of new funding sources, if we cannot impose user charges, then we must impose additional taxes, or no infrastructure service can be provided. Taxes have the advantage of being able to spread out the cost to many, but the benefits are confined to a few and non-benefiting taxpayers are unfairly penalized. With user charges, in contrast, only those who benefit pay, but the burden on users (and thus on local communities) is much higher compared to the paying regime that is largely subsidized by national and state/provincial governments. User charges can also create social inequity situations for the poor who cannot afford to pay.

The challenge is to reach a proper balance between these two sources—with the

broad view that, effectively, taxes can help address the broad social equity issues and user charges address the efficiency and financial sustainability issues. Instead of being viewed as an additional burden, with the help of the private sector, user charges can be viewed as providing a natural opportunity to monetize the beneficial side of externality. They can help recover some of the past investments made with the public tax money for more efficient future use. With proper asset valuation, brownfield recycling could potentially present one way to recover the sunken public sector investments.

3.3 Revenues from Brownfield Recycling

There is a limit to how much taxpayers and users can take on to pay for infrastructure. Brownfield recycling is one of a few options that begins to address the sheer magnitude of the funding gap at hand.[67] Currently, several converging circumstances are placing brownfield recycling in a favorable light:

- There is unprecedented private-sector appetite for infrastructure assets from a global investment community with more money than could be handled by the current project pipeline.

- Institutional investors—with over $100 trillion of assets under management and particularly suited for infrastructure investments—are continuing to increase their infrastructure asset allocations, some choosing to invest directly and/or co-invest with their peers.

- Recent infrastructure brownfield transactions indicate a strong seller's market climate with valuations consistently exceeding expectations, many also involving major public pension funds and achieving political buy-in from local communities.

- Many governments in the developed world with public pension systems are facing rising costs of unfunded pension liabilities (UPL) and other post-employment benefits, which are crowding out critical infrastructure spending needs.[68] Brownfield transactions involving public pension funds have been shown to successfully solve both the UPL and infrastructure funding issues.

Brownfield recycling, alternatively referred to as *social privatization*, has already had a healthy set of successful precedents in recent years, especially in Australia. Recent transactions involving several

[67] In the U.S., for example, a conservative estimate indicates that the potential value of brownfield recycling can be more than a half-trillion dollars if we consider existing publicly operated airports, ports, and toll roads and bridges. See Schmidt (2015) for additional discussion.

[68] See Pew (2014) for increasing public sector liability resulting from UPL.

ports in New South Wales and a major toll road in Queensland are notable examples where public sponsors were able to fetch brownfield proceeds that far exceeded their expectations, sometimes by as much as A$2 billion (see Box 3).[69] These state-level transactions were supported by additional incentives by the Australian government to enhance the states' ability to recycle assets to pay for new infrastructure demands. These federal incentives included A$5 billion in asset recycling funds to pay the states direct incentives for selling their existing assets and reinvesting the sales proceeds into new infrastructure. Furthermore, additional tax incentives were introduced whereby the corporate tax charged to the private buyers went back to the state rather than federal government.

Box 3: Brownfield Recycling—The Australia Case

Australia has been leading the charge in successful brownfield recycling involving major public pension funds. Most notable recent examples included the transactions in New South Wales (NSW) and Queensland. In 2013, NSW closed a 99-year lease on Ports of Botany and Kembla in Sydney at A$5.1 billion—much higher than the budgeted A$3 billion. The lease was awarded to a private consortium led by Industry Fund Management (IFM; a global infrastructure fund manager owned by Australian public pension funds), AustraliaSuper (AusSuper; Australia's biggest pension fund), and Abu Dhabi Investment Authority (ADIA; a major sovereign wealth fund). NSW repeated their success in 2014 with the 98-year lease of Port of New Castle at A$1.75 billion—again far exceeding the budgeted A$0.7 billion. In both cases, the proceeds were reinvested to revitalize statewide infrastructure.

Queensland followed suit in 2014 with the sale of Queensland Motorways to a private consortium made up of Transurban (the largest Australian toll road developer), AusSuper, and ADIA. The asset was sold for A$7.1 billion, compared with the pre-sale estimate of A$5 to 6.5 billion. Earlier in 2011, the Queensland state government provided in-kind ownership transfer of the motorway to Queensland Investment Corporation (QIC), a government-owned enterprise and Australia's

[69] See three IIWIR articles in 2014 and SMH (2015) for additional information on brownfield recycling experience in Australia.

second largest pension fund manager responsible for the state's Defined Benefit Fund (DBF). The net proceeds from the 2014 sale were a significant growth from the market value of A$3.1B in 2011 when QIC took over. The 2014 proceeds are to remain in the DBF to meet the public pension liabilities to existing members.

In addition to ports and motorways, there were successful examples involving other sectors. In December 2007, for example, Hobart Airport in Tasmania was sold to a consortium of Macquarie Bank and the Tasmanian Retirement Benefits Fund for over A$350 million. The high sale price, much above the state's expectations, was due in part to the large parcel of land attached to the airport to be redeveloped with retail projects for additional revenues. It was unlikely that the state could have undertaken such major retail developments themselves had the airport remained in their hands. Similarly, in May 2012, NSW entered into a 50-year water supply agreement for the Sydney Desalination Plant with a consortium of Ontario Teachers Pension Plan and a Hastings-managed infrastructure fund. Part of the agreement was for water prices to be regulated by the Independent Pricing and Regulatory Tribunal (IPART). The transaction raised A$2.3 billion, A$300 million more than the cost of constructing the plant. After repaying the debt incurred in building the plant, the increment was put aside for new infrastructure projects, including roads, hospitals, and schools across the state.

Despite these successes, however, brownfield recycling in Australia has not been without political controversies. The government of Victoria, for example, has been facing significant political resistance on the proposed sale of Port of Melbourne, currently valued at A$5 to 6 billion. The opposition has been primarily from the Labor Party members, labor unions, and incumbent port operators. The underlying issues have included concerns over selling off the publicly owned assets, job losses, and potential hikes in port facility rental rates. NSW also faced staunch resistance initially with their much-touted sale of NSW's electricity networks, currently valued at A$20 billion. NSW received a green light recently from its legislature despite the strong initial voter oppositions to the proposed privatization.

Infrastructure Australia, a federal government agency responsible for planning and coordinating infrastructure projects across Australia, recently developed a set of criteria to identify a number of infrastructure asset classes appropriate for brownfield recycling.[70] These criteria, listed in the following, serve as useful guidelines for cities interested in exploring brownfield recycling options with their national and state/provincial governments:

- Appropriate asset classes include those in energy, water, and transport sectors
- Assets must be owned, or partly owned, by federal, state or local governments
- Assets must be applying or have the potential to apply a user-pay framework, or already have a non-government earnings stream with the potential to cover operating costs
- Assets have limited or defined public policy benefits, which can be obtained by way of regulation, sale conditions, or community service obligations.

Further, Infrastructure Australia designated the asset classes according to the following categories for potential implementation and phasing considerations:

- Those that already have competitive markets where the remaining publicly owned assets are suitable candidates for transfer to the private sector.
- Those that are not competitive or have significant non-competitive segments, but in which current regulatory frameworks apply, making them suitable candidates for transfer to the private sector.
- Those that are not competitive or have significant non-competitive segments and where the regulatory framework is not yet suitably developed to allow privatization, but where this can be achieved with structural and/or regulatory changes.
- Those that are unsuitable for transfer to the private sector, either because of significant structural or regulatory impediments, or sectors that are unlikely to yield upfront revenues because they do not have sufficient non-government earnings and/or they carry a very large community service obligation component.

[70] See Infrastructure Australia (2012, 2013) for more detailed discussion.

Many publicly owned infrastructure assets are monopolies or have monopoly characteristics. Historically, the rationale behind government ownership has stemmed from concerns that private ownership would increase prices and earn monopoly profits. Experience has shown that regulatory regimes can provide protection against the misuse of such monopoly power.[71] In particular, independent regulators setting prices based on efficient costs and market returns provide similar incentives to deliver the outcomes achieved in competitive markets. In order for regulation to continue to drive efficient outcomes, it is important for the regulatory framework to evolve over time where important lessons learned are continuously incorporated into developing an effective regulatory regime.

In addition to pricing, governments also need to be mindful of protecting the public's interest on a range of issues, including, for example, maintenance of service quality standards, provision for a range of non-commercial services which may have been undertaken under public sector ownership, environmental protection, public safety and noise management. These additional issues can be handled through general industry-level regulatory compliance or asset-specific requirements that the new owner must comply with, whether through their management plans or licensing requirements. For a range of non-commercial activities, an explicit community service obligation contract has proven effective, where the private sector owner is compensated for undertaking these activities.

The suitability of these assets for brownfield recycling would vary depending on different governments, their regulatory and governance structures, and the overall commitment to user-pay principles. Brownfield recycling should also only occur where the proceeds from the transactions exceed the retention value of the asset.

[71] See Infrastructure Australia (2012, 2013) for more detailed discussion.

Chapter 4 Innovations in Urban Infrastructure Funding and Financing

Dealing with the magnitude of infrastructure spending needs in the coming decades is daunting, but the issue is much more serious for cities that must take on the brunt of the responsibilities. Innovations in urban infrastructure financing are thus much needed, especially along the dimensions that can mitigate the critical funding and financing challenges discussed earlier in this handbook.

On the funding side, tax revenues will continue to be the primary funding sources in the foreseeable future and innovative approaches to draw upon these sources, whether from value capture or developer exactions, will be especially beneficial. In addition, because user charges will play an increasingly important role to supplement tax revenues, cities need to rethink innovative ways to engage users more effectively in both defining and financing the infrastructure needs. On the financing side, the critical role of institutional investors is now generally recognized and we need innovative financing models to involve them more directly and actively, especially in greenfield projects. For smaller mid-sized cities, their financing challenge will be in establishing their own credibility in the global marketplace. Their added challenge would also be having projects of sufficient size to warrant and attract substantive investments. For them, working jointly with other like-minded cities across multiple jurisdictions will help build the credibility they need. At a larger public policy level, we also need innovative financing approaches that are not all about financial returns, but also address important issues such as sustainability and social equity.

Innovative urban infrastructure financing approaches identified below are case examples that address each of the above dimensions:

- Innovative value capture/developer revenue approach: CEPAC bonds (Brazil)
- User participation and user-investor approach: Crowdfunding (various)
- Direct institutional investor engagement in a greenfield project: N-33 Road Project (Netherlands)
- Multi-jurisdictional and pooled approach for mid-size cities: Local Government Funding Agencies (LGFA) (Scandinavian and other countries)
- Socially responsible financing approach: Green Bonds, Social Impact Bonds, Carbon Tax/Cap-and-Trade (various)

4.1 CEPAC Bonds: Additional Revenue Source[72]

CEPAC (*Certificados de Potencial Adicional de Construção*, or Certificates for Additional Construction Potential) is an innovative urban financing instrument with features that combine value capture, development exaction, and air right sale approaches. CEPACs are bonds that are issued by municipal governments for a specific area within their cities designated for redevelopment. The bonds are targeted at developers (bond buyers) and provide additional development rights that entitle them to build above the density limit specified by the current zoning regulations (sometimes referred to as "*up-zoning*") for the designated area.

For cities, the proceeds from the bond sales provide upfront funding to build specific improvements, generally in the transportation and affordable housing sectors, in the designated area without creating additional public debt. For developers, CEPAC bonds provide additional building licenses with guaranteed improvements and flexibility to launch their individual development projects according to their own perception of the market. Master planning for the designated area is used to determine the improvements needed and establish the upper limit of the additional development density, e.g., in terms of floor area ratio (FAR), for both residential and non-residential uses. Each designated area is also subdivided into smaller zones with their own FAR ceilings.

Offered in the stock market, CEPACs are sold electronically through public auctions. For a designated area, the number of CEPACs offered has a maximum limit commensurate with the upper limit on the additional development density. On a given auction, CEPACs have the same minimum face value initially, but the final price is largely determined by the supply and demand of the market at the time of the auction. CEPAC bonds are also tradable openly in secondary markets as dictated by market demand.

CEPACs can be sold in private auctions, which are targeted at contractors and vendors in transportation, affordable housing, and other infrastructure service sectors. Effectively, the bonds sold privately are used by cities as non-budgetary funding to pay for contractors and vendors that provide goods and services associated with the improvements in designated areas, be they to build or renew infrastructure or build affordable housing to remove or urbanize slums.

Because of the smaller subdivisions with their own FAR ceilings, each purchased CEPAC must be designated to a specific plot of land where the additional building right will be used. Once the FAR ceiling is reached within the subdivision, a developer

[72] For additional discussions on CEPAC bonds, see Sandroni (2010), Serva (2014), and WEF (2014).

cannot use their CEPACs in that zone even if they are entitled to additional development rights in the larger area. The unit area of development associated with each CEPAC bond may also vary depending on the value of the land in each subdivision. For example, where the land is cheaper, a CEPAC may correspond to 3 square meters whereas, in more expensive areas, it may be 1.5 square meters.

The concept behind CEPAC was developed as early as in 1995 in Sao Paulo, Brazil, but its use as a formal municipal infrastructure funding tool was delayed until appropriate federal law was passed in 2004. The tool has since been used successfully by the municipal governments of Sao Paulo, Rio de Janeiro, and Curitiba. Over the last decade, these three cities have been able to raise almost $4 billion in bond proceeds to pay for their urban redevelopment projects.

In Sao Paulo, CEPACs are tied to urban redevelopment areas known as "urban operations" or "UO." A UO is a tool used by the city government to effect a structural transformation of a large urban area within the city through a partnership between public authorities and private developers. It also involves the participation of landowners, investors, residents, and other stakeholders and has to be approved by the city council. A critical element of UO is incentive payments, established in the city statute, that are directly tied to changes in zoning indices, such as FAR, land use, and footprints. These incentive payments are used to pay for the needed infrastructure and other public "interventions" that trigger the transformation in the UO.

In 2004, the city government in Sao Paulo approved the use of CEPAC bonds as the incentive payment mechanism for two of the five approved UOs, Faria Lima and Agua Espraiada. Through multiple public and private CEPAC auctions, these two UOs were able to raise over R$1.6 billion (US $800 million) in the first five years (see Exhibit 14).[73] The CEPAC revenues from the two UOs were almost 60 percent of the annual property tax revenues for the city as a whole. The new residential and commercial developments built with the rights provided by CEPACs also contributed to additional increment in property revenue taxes for the city. Preliminary estimates indicated that, in some cases, the property tax revenue increment could be as much as 4.4 times per square meter when compared to the base case.

Building institutional capacity to administer CEPAC bonds more efficiently was critical to their success. For the two Sao Paulo UOs, CEPACs were issued by a city agency called EMURB (Empresa Municipal de Urbanização). EMURB was in charge of the overall management inside the UOs, including setting the priorities for investments in infrastructure and affordable

[73] See Sandroni (2010) for more detailed discussion on Sao Paolo CEPAC auctions.

Exhibit 14: CEPAC Auction Results for Faria Lima and Agua Espraida UOs

Year	*Faria Lima UO*				*Agua Espraiada UO*			
	Offered (No. CEPACs)	Sold (R$)	Price (R$)	Revenue (R$)	Offered (No. CEPACs)	Sold (R$)	Price (R$)	Revenue (R$)
2004								
-Public	90,000	9,091	1,100	10,000,100	100,000	100,000	300	30,000,000
-Private	-	24,991	1,100	27,490,100	70,000	16,899	310	5,238,690
2005								
-Public	n.o.	n.o.	n.o.	n.o.	56,500	56,500	371	20,961,500
-Private	-	9,778	1,100	10,755,800	n.o.	n.o.	n.o.	n.o.
2006								
-Public	10,000	2,729	1,100	3,001,900	180,000	152,969	370	56,598,530
-Private	-	6,241	1,100	6,865,100	-	22,657	371	8,405,747
2007								
-Public(1)	156,730	156,730	1,240	194,345,200	50,000	50,000	411	20,550,000
-Public(2)	n.o.	n.o.	n.o.	n.o.	100,000	100,000	411	41,100,000
-Public(3)	n.o.	n.o.	n.o.	n.o.	167,781	158,773	411	65,255,703
-Private	-	72,942	1,240	90,448,080	-	77,330	411	31,782,630
2008								
-Public(1)	83,788	83,788	1,538	128,865,944	186,740	186,740	1,100	205,414,000
-Public(2)	n.o.	n.o.	n.o.	n.o.	650,000	379,650	535	203,112,750
-Private	-	2,500	1,725	4,312,500	-	36,113	411	14,842,443
2009								
-Public(1)	100,000	55,612	1,700	94,540,400	73,500	73,500	616	45,239,250
-Public(2)	30,000	1,521	1,715	2,608,515	175,000	72,270	700	50,589,000
-Public(3)	120,000	120,000	2,100	252,000,000	n.o.	n.o.	n.o.	n.o.
-Private	n.o.	n.o.	n.o.	n.o.	n.o.	n.o.	n.o.	n.o.
Total		545,923		825,233,639		1,483,401		799,090,243

n.o.: not offered.

housing linked to each CEPAC auction. Banco do Brasil and Caixa Economia Federal, the two largest federal banks in Brazil, were in charge of preparing and executing the auctions. Because CEPAC was a new financial instrument, the involvement of these two federal institutions made the auctions more reliable and credible in the marketplace.

For cities that are interested in exploring CEPAC as a potential funding instrument, the actual CEPAC bond experience from Faria Lima and Agua Espraiada UOs could be useful. As shown in Exhibit 14, for example, the success of CEPAC auctions varied widely in issues sold in comparison to issues offered. The timing of the auctions and the amount auctioned have strategic significance and a close examination of real estate market conditions is important to extract the maximum value from each auction. In the first 5 years, the management of the CEPAC auctions did not appear to have been following a general strategic plan as shown, for example, by an excessive amount of bonds in the 2004 Faria Lima auctions or by too few in the 2008 auctions for both UOs. Although the initial prices for CEPAC were fixed by law for each auction, the prices also varied widely according to the supply and demand at the time of the auctions. These variations were due to reasons that ranged from initial market adjustments to a new product to fluctuations in the real estate business cycle.

4.2 Crowdfunding: Small Projects and P3 Equity Capital[74]

Coined by Michael Sullivan in 2006, the term "crowdfunding" has evolved to refer to the act of raising capital for a project from individual investors (the crowd) through an intermediary online platform. It is a concept at the intersection of *crowdsourcing*[75] and *microfinance*.[76] Crowdsourcing enables firms to solicit the collective interests of the crowd through an open call over the Internet and utilize this wisdom to achieve solutions to problems or outsource work. Microfinancing instruments issue small, unsecured loans to individuals for starting or expanding businesses. Combining aspects of these two concepts yields *crowdfunding*—a method to establish the connection between entrepreneurs, who aim to raise capital, and novel investors, who form an emerging source of capital and are willing to invest small amounts, through Internet-based intermediaries. While concepts may differ slightly, all crowdfunding models incorporate three basic components: (1) the entrepreneurs (the fundraisers), (2) the investors (the crowd), and (3) the intermediaries (the online platforms).

[74] For overview and more detailed discussions on crowdfunding, see, for example, Gasparro (2015) and Farrajian et. al. (2015).

[75] See Brabham (2008) for an overview and case examples of crowdsourcing.

[76] See Manchanda et. al. for additional discussion on use of microfinance and crowdfunding for start-up financing (2014).

Crowdfunding platforms vary greatly and offer different opportunities. Whereas more established platforms such as *Kickstarter* and *Indiegogo* cater to a broad range of projects, many new platforms, such as *ioby, Citizinvestor, Spacehive,* and *neighbor.ly,* are focused on crowdfunding initiatives in the civic domain that cater to serving the broader public good, including such projects as parks, gardens, transportation infrastructure, waste management, etc.[77] Other platforms, such as *Propellr, CityShares*, and *Fundrise*, cater to real estate developments. All these platforms vary greatly in their functionality, from those that allow open posting to others that are restricted to government entities. Some provide flexible funding options while others enforce stringent funding requirements.

For small municipal infrastructure projects, civic crowdfunding platforms have been especially useful as demonstrated by the following examples:

- Transformation of an abandoned train station into an underground public park in New York ($150,000 raised on Kickstarter)
- Replacement of a community center in Glyncoch, Wales ($66,000 raised on SpaceHive)
- Downtown bicycle-sharing program in Kansas City, MO (over $400,000 raised on Neighbor.ly)
- Arapahoe Protected Bike Lane project in City of Denver, CO ($36,100 raised on Ioby)
- The Hampline bike lane project in Memphis, TN ($68,600 raised on Ioby)
- The Liverpool Flyover urban park in Liverpool, England (£44,000 raised on Spacehive)

In the U.S., for example, more than 1200 civic crowdfunding campaigns have been launched since 2010, raising over $10.5 million. Of the campaigns that were launched, 63 percent have been successful at reaching or exceeding their target amount. A majority of these projects have been small with almost 80 percent being under $10,000. Due to their small size, these civic crowdfunding initiatives have been most effective as a *strategic* financing option for infrastructure projects. For example, they have often been used as a "last mile funding" for helping a mature initiative reach its implementation stage. Other strategic uses have included serving as seed funding to create momentum for the remaining fund to be secured or as a matching fund to fulfill specific grant requirements. For the City of Denver, for example, crowdfunding was used as seed funding to kick-start a mini-bond initiative, which became a significant funding source for over 300 projects in the city (see Box 4).[78] For this initiative, the city built its own online platform to administer the bond sales.

[77] See Davies (2014) for more discussion on civic crowdfunding.

[78] See, for example, Reed (2014) and Stephens (2014) for additional discussion on mini bonds.

Box 4: Denver's Mini-Bonds Initiative and Crowdfunding Platform

Denver caught the attention of the municipal funding world in 2014 when a $12 million public offering of "mini-bonds" were sold out within a single hour. The sale was supposed to run for 5 days. The demand was so high and the cap was reached so quickly that the city had to refund 375 orders.

The mini-bonds were tied to the $550 million municipal bond program called "Better Denver." The Better Denver Bond Program was passed by Denver citizens as a ballot initiative in 2007 to invest in over 319 infrastructure projects that improve, preserve, renovate, and build new roads, libraries, parks, city offices, and other facilities related to health and human services, public safety, and culture. The remaining $538 million in bonds was sold through traditional markets.

Recent financial policies have made it more difficult for banks to buy and sell municipal bonds. In the U.S., FDIC regulations have been requiring big banks to increase liquidity making them move away from municipal bonds in favor of more liquid assets. As banking and financial regulations became more stringent for buying and selling municipal bonds, Denver decided to offer a new type of bond to attract investors.

Municipal bonds have traditionally been sold for $20,000, but Denver decided to sell mini-bonds for $500 each. Two types of mini-bonds were sold: a 9-year bond with a 50% maturity rate to yield $750 (4.26% return) and a 14-year bond with a 100% maturity rate to yield $1,000 (4.8% return). Although the city is paying more interest on these mini-bonds than traditional bonds by providing returns at three times the typical bank rate (1.5%), the goal was to involve more residents in infrastructure development, generate community enthusiasm about infrastructure improvements, and demonstrate to the market that there is demand.

The sale of mini-bonds was limited to Colorado residents and, though the bonds could be transferred to other owners, they could not be resold on other financial markets. These measures were to ensure that the bonds, instead of going to bankers on Wall Street, would be purchased by members of the community, keeping the business local to the project.

This was not the first time that Denver used crowdfunding. Outside the Better Denver program, the city had used crowdfunding platforms previously to fund small infrastructure projects such as the Araphoe protected bike lane project. Also, the sale of the mini-bonds in 2014 was not the first time for Denver. When Better Denver passed in 2007, the city sold $8 million in mini-bonds over the course of a week. In 2007, there was no on-line capacity and people had to visit their banks or mail in their orders. The feverish excitement of the 2014 sales had to do with the online ordering platform set up by the city. People were sitting at home on their computer from 8 a.m. and the orders were processed very quickly.

Denver is also not the first city to offer mini-bonds, but the practice is still very rare. Whereas other cities have used similar mechanisms to raise funds, the Better Denver program is specific to public-focused assets. The 2014 mini-bond program has been especially successful because local publicity and new financial policies are forcing cities to think differently about traditional municipal bonds, which was further enhanced by an efficient crowdfunding platform. The success experienced by Denver demonstrate that mini-bonds through crowdfunding are ripe to be replicated elsewhere.

Crowdfunding business models vary widely from being a philanthropic source of capital on one end of the spectrum to a securities-based equity and debt source of fundraising on the other. A diverse range of funding and financing techniques have been employed for different platforms, including patronage donations, reward based donations, pre-sales, traditional lending, social-lending (lending without interest), peer-to-peer lending (lower interest rate), peer-to-business lending, and equity crowdfunding (business angels).[79] Thus far, the predominant model has been a patronage model, where individuals donate into specific projects without a financial return expectation. For the most part, this model has been successful in attracting larger donors and political support for municipal projects, but it is not necessarily a sustainable model.

A more sustainable alternative to the patronage model is to implement a peer-to-business model for both debt and equity (similar to the Denver mini-bond initiative on the debt side). In this case, the crowd becomes a conglomerate of investors

[79] See De Freitas et. al. for additional discussion on alternative crowdfunding platforms (2013).

and can reap the benefits of being an equity or debt investor throughout project implementation.[80] Under this model, crowdfunding can be an important source of P3 equity capital that can help broaden the pool of potential P3 equity investors. In addition to the social and political benefits of using crowdfunding, it allows the P3 concessionaires to increase their return by reducing their common equity contribution, which would free up their equity capital to deploy across a broader portfolio of projects.

There are several other advantages associated with using crowdfunded P3 equity. Because the crowdfunding is provided by investors with social as well as financial motivations, they may be willing to accept a slightly lower rate of return than institutional sources of capital. Also, depending on the method of crowdfunding employed, the securities offered would not be restricted for re-sale, removing liquidity risk and further reducing the rate of return required on the equity. Because crowdfunding offers investment to a broad base of retail and small institutional investors, the increased competition puts further downward pressure on the return required. These factors combine to lower the overall cost of capital for the P3 developer, which can then be passed on to the public sponsor in the form of lower availability payments or to the public with reduced toll/fee structures.

One of the essential ingredients to make crowdfunding successful in the P3 space is the online platform that serves as the key intermediary. *Infrashares* is an example of such a P3 platform that exists today.[81] An online P3 crowdfunding platform must be capable of managing all the transactions accurately and efficiently, including pre-qualifying investors, sharing project information, performing transactions, and keeping track of investment documents. In addition to these basic functions, as dictated by the new crowdfunding regime, the online platform can be used to disclose additional information beyond what is currently necessary including Public Offering Statements, Official Statements for bonds, traffic and revenue studies, audited financial statements, and quarterly performance reports. The online platform can also help facilitate various offering strategies, including multi-stage offerings—for example, first to people who are users of the asset followed by progressive offers to people locally, nationally, and internationally.

Whether it is a small project or P3 equity, the success of crowdfunding depends on the timing and extent of citizen participation. Crowdfunding has extensive reach because it depends upon community engagement and participation during the early stages of infrastructure development. In a politically stagnant environment, crowdfunding has

[80] This approach is sometimes referred to as crowd-financing to distinguish from the patronage model.

[81] See: https://www.infrashares.com. Also, see Ross (2015) for more detailed discussion on using crowdfunding platform for securing P3 equity capital.

the potential to increase political will to support infrastructure development. Time and again, citizen participation has been used as a means to increase sustainable civic decision-making. Individuals who provide initial funding are in some ways "voting with their dollar." Also, because the majority of funders are located within close vicinity to the project, they have a vested interest in the project as future users, thus helping reduce the demand risks. Crowdfunding can be used to engage and educate local constituents throughout the infrastructure development process. In short, social media has created a new platform for individuals and groups to communicate and organize around causes. Capturing this collective energy effectively would help implement policies, strategies, and tools that can achieve long term sustainable solutions for the infrastructure funding problem.

4.3 Pension Funds in the Greenfield Space: N-33 Project in the Netherlands[82]

Infrastructure assets are well suited to match long-term liabilities of institutional investors, such as pension funds and insurance companies. Once operational stability is achieved, most infrastructure assets generate stable, long-term cash flows—some even inflation-linked[83]—which are particularly attractive in meeting their long dated liabilities. Brownfield assets are often considered to be more attractive than greenfield assets because their maturity and operational track record reduce many of the uncertainties and key risks associated with greenfield investments. Many of the greenfield risks are perceived to be construction related—for example, cost overruns and delays and the political and regulatory risks associated with new construction. The risk of construction cost overruns and delays has been widely documented and researched for publicly financed projects, but similar research has not been available for privately financed projects. A recent study, however, found statistically lower risk of construction cost overruns for P3 projects than for traditional procurement.[84]

There is an abundance of greenfield projects in the marketplace because what governments really need is new, growth-stage, and major rehabilitation projects involving new construction work. The supply of brownfield projects, however, is much more limited. The mismatch between limited brownfield projects and the high demand for brownfield assets has been driving up brownfield prices, exerting pressure on the returns available for brownfield investors.

[82] See Bennon et. al. (2015) for more detailed description of the N-33 case example.

[83] For example, rates on toll road concessions are often indexed to inflation and regulated electrical utility returns are often inflation-linked.

[84] See Blanc-Brude et. al. for additional discussion on construction risks associated with P3 projects (2013).

While greenfield investments mean higher risks, they also offer the potential for higher growth and return. As with construction risks, increasingly, additional research and performance records in greenfield investments are becoming available, which can help investors more accurately assess the risks and reduce uncertainty. Recognizing the need to attract additional private capital to new infrastructure development, governments globally are experimenting with policies to reduce uncertainty and make investors more comfortable with greenfield projects—and many are targeting institutional investors in particular.[85]

A case in point is a recent P3 project in Netherlands that involved two large Dutch pension funds, PGGM and APG, which provided both the equity and debt capital for a greenfield/growth infrastructure project—and they did so directly without going through financial intermediaries. The project, called the N-33 road-widening project, was specifically designed by the Dutch government to be a pilot project for institutional investors to provide senior debt financing for an infrastructure project.

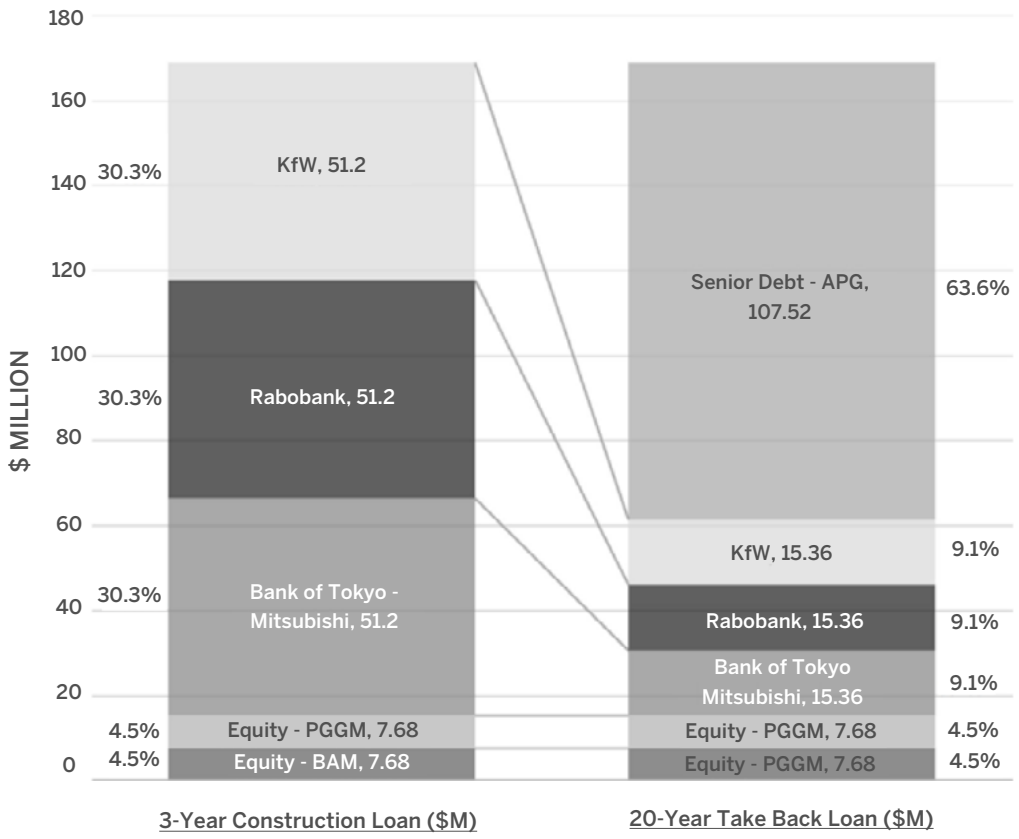
Dutch pension funds are among the largest in the world. Today, there are 382 Dutch pension funds with a total invested capital of €950 billion, close to 170% of the Dutch GDP. A large part of this amount is under the oversight of only a few large pension funds. In 2013, the Netherlands was the fourth largest P3 market in Europe with a total value of €1.2 billion. After having weathered numerous elections and changes in government, its P3 market now enjoys broad political support and P3 is seen as a viable infrastructure delivery tool.

A joint venture (JV) between Dutch construction company, BAM, and Dutch pension fund, PGGM, was awarded the N-33 P3 concession in August 2012, to design, build, finance, and maintain the project through an SPV. With €120 million (US$170 million) of capital value, the concession was allowed for 2.5 years of construction and 20 years of operation. The project achieved financial close in November 2012.

The project was highly leveraged, with a 91:9 debt–to-equity ratio. BAM and PGGM together brought 9% of equity. The remaining 91% was a construction loan divided equally among three commercial banks: Rabobank, KfW, and Bank of Tokyo-Mitsubishi UFJ (BMTU). The construction loan, however, was to be refinanced after approximately three years, with the Dutch pension fund, APG, buying 70% of the long-term debt and the three banks retaining 30% of the debt refinanced as a long-term project loan. The capital structure of the N-33 project during and post-construction are depicted in Exhibit 15.

[85] See Della Croce et. al. for additional discussion on investment trends of large pension funds (2011).

Exhibit 15: Capital Structure of N-33 P3 Project



Source: Bennon et al.

The N-33 P3 concession was unique in the sense that, in close coordination with the government, pension funds were directly and actively engaged in both the equity and debt financing from the get-go. The pension funds were the main driver in securing the overall financing package for the project. Their active engagement had direct bearing on improving the overall efficiency of the capital used on the project. In addition, there were three key aspects of the P3 transaction that contributed to its success.

First, on the equity side, success was attributed to the unique synergy between BAM and PGGM. The BAM-PGGM JV was formally created in 2011 as a longer-term endeavor specifically to pursue P3 infrastructure projects in Europe. The JV brought together the financing power of PGGM and BAM's expertise in building and managing P3 projects in Europe. As of March 2014, the JV held investments in 10 P3 projects, including 4 in the Netherlands. The forming of the JV was facilitated by BAM's lack of equity capital that was hindering the growth of their P3 construction business and PGGM's ability to provide a stable source of equity. For PGGM, the JV provided a platform for direct project investments that aligned with the environmental, social, and governance (ESG) criteria of

their investment policy, while mitigating construction risks by making BAM financially responsible for construction delays and overruns. The overall ownership structure of the JV was 50-50 between BAM and PGGM, but the revenues from projects transferred to the JV were shared 80% PGGM and 20% BAM. Additional revenues BAM receives from the construction on the projects are to counterbalance BAM's lower share of concession revenues.

Second, on the debt side, APG's early involvement helped streamline both the short-term and long-term capital structure of the project. In the project-shaping phase long before the procurement phase started, the *Rijkswaterstaat* (executive agency of the Dutch Ministry of Infrastructure and the Environment in charge of roads and waterways) closely coordinated several Dutch pension funds, including APG, to define terms that would incentivize them to provide debt for an infrastructure project. Among others, APG's term included that the availability payment from the Dutch government be indexed to the country's CPI over the 20-year concession term.[86] This essentially meant that the debt service for APG's long-term loan was inflation linked, which helped APG to bypass using such tools as interest-rate swap with very high transaction costs. This term afforded APG to offer long-term debt at a fixed rate that was much lower than those offered by commercial banks. In addition, APG's early commitment eliminated refinancing risks, further reducing the interest rate.

Finally, all of these factors combined effectively helped formulate an optimal risk allocation strategy where specific risks were allocated to those that were best able to bear them. For example, APG took away the refinancing risk from commercial banks, the government took away the inflation risk from APG, BAM took away the construction risks, PGGM took away the early equity risks, and commercial banks took away greenfield risk through equity bridge loans. In the end, such risk allocations had the effect of reducing overall project risk and hence the total project costs, ultimately easing the burden on taxpayers.

4.4 Local Government Funding Agencies: Multi-City Pooled Approach[87]

With urbanization and the declining fiscal conditions of many national governments, some level of decentralization in infrastructure financing is necessary and perhaps inevitable. For local governments, there are several real challenges to this decentralization. Local governments are small entities and a large part of the financial markets are closed to them. Many cities lack financial expertise and discipline in financial management. They also lack

[86] The remaining 30% debt financing retained by the three commercial banks post-construction and the equity payments were not inflation-linked.

[87] For more detailed discussions of LGFA, see Andersson (2014a, 2014b, 2014c).

creditworthiness because they have very limited power to introduce and maintain their own source of revenues, be they taxes, user charges, or otherwise. In many countries, the system of collecting local taxes and charges are inefficient and in need of improvement. There are also issues of long-term predictability and stability when it comes to transfers from their national and state/provincial governments, which is becoming increasingly serious in many countries.

A Local Government Funding Agency (LGFA) is an emerging concept that addresses all of the above challenges. An LGFA is a conduit for financial cooperation between local governments. It is an agency jointly owned by member cities, sometimes with a minority ownership stake by the national government. An LGFA's primary mission is to pool the borrowing needs of local authorities and to issue bonds in the capital markets. The proceeds of these bonds are then *on-lent* to member cities' local governments. An LGFA is in essence a public benefit corporation created to benefit member cities, and does not seek to make profits. The process leading to the creation of an LGFA supports the building of local creditworthiness, helps create local markets, and increases transparency in local decision-making. It has the potential to reduce financing costs, transaction costs, and also risk exposure resulting from increased diversification. An LGFA is furthermore a self-regulating entity in that it prohibits the individual members from excessive borrowing. LGFA is a proven concept in Scandinavian countries and the Netherlands. The idea is now spreading in other parts of Europe and a growing number of countries outside Europe are exploring its applicability to their own needs.

Examples of existing LGFAs include:

- *Kommunekredit* in Denmark, created in 1898, which all local authorities have now voluntarily joined, issues bonds routinely in various capital markets and now dominates the local government credit market

- *Kommuninvest* in Sweden, created in 1986 and in which over 90% of all regional and local authorities are members, has radically changed the loan market for local authorities, transforming it from the former oligopoly system of the past that was largely ineffective

- *Munifin* in Finland, created in 1990 and guaranteed by the Municipal Guarantee Board (MGB) representing 99.95% of the population, is a joint-stock company where member municipalities hold the majority ownership with other shareholders that include a local pension fund (31%) and the national government (16%)

- *Bank Nederlandse Gemeenten (BNG)* in the Netherlands, established

in 1914 as a specialized financial institution owned by 406 municipalities (with 46.4% stake), has 60% market share of the Dutch municipal sector

Most of these existing LGFAs operate with joint guarantee from its members, but such guarantee has never been invoked to date. In addition, all of them are AAA-rated. In 2012, collectively, they were able to issue bonds in a total amount of over €70 billion in various capital.

In a number of countries in Europe and elsewhere, the establishment of LGFAs is in varying stages of development. In France, *Agence France Locale* was created in late 2014 and the first bond issuance has been planned since. In the U.K., the English Local Government Association (LGA), together with the Welsh LGA, is currently studying the possibility of establishing an LGFA. Beyond Europe, the *New Zealand Local Government Funding Agency* (NZLGFA) was established following a proposal at the 2009 Jobs Summit for a collective borrowing vehicle for the local government sector. With the enactment of the Local Government Borrowing Act 2011, the NZLGFA has since been incorporated as a limited liability company with an ownership structure comprising the New Zealand Government (20%) and 30 local councils (80%). In Australia, the Municipal Association of Victoria has taken an initiative to create a funding vehicle for cities and local governments within the state of Victoria. A *Local Government Funding Vehicle (LGFV)* has since been established with the participation of 30 local councils. The IFC has recently commissioned a pre-feasibility study for similar pooled local financing mechanisms in South Africa.

Local authorities lack financial expertise in many countries because their primary focus is often on providing basic services to the public. In addition to direct financing benefits, an LGFA can play an important role in the transfer of knowledge in the areas of financing, legal matters, and other general administrative issues related to financing and financial management. Communication is one of the most important functions of an LGFA because of its role as the interpreter between international financial markets and local authorities. Knowledge transfer can often be accomplished effectively through the LGFA's governance structure that combines financial expertise with a thorough understanding of the local governments and their political culture.

For both *Kommuninvest* in Sweden and *Agence France Locale* in France, the governance structure is organized in two separate levels. The upper level represents the parent company where local authorities are shareholders and where local politicians serve on the Board. The lower level is structured as a limited company where all financial transactions are carried out and where professionals with financial and public sector experience sit on the Board. To encourage knowledge

transfer, continuous dialogues between the two levels are carried out through both formal and informal means. *Kommuninvest*, for example, works actively to promote knowledge transfer using training programs for local politicians, annual seminars, member consultation conferences, and other events and activities designed for exchange of information about financial market conditions and trends, best market practices, etc. *Kommuninvest* also has a Credit Research & Financial Committee responsible not only for monitoring the financial status of member municipalities, but also for spreading awareness of critical urban financing issues of the day.

The establishment of an LGFA can occur over time and can be formulated in multiple, progressive stages. As a start, a group of cities can coordinate their borrowing activities and exchange best practices. This can include using similar procurement processes in relation to banks and other creditors or having a joint head of finance to further coordinate their financial activities. The next step, which was used prior to the creation of *Agence France Locale in France*, can be a "club" deal where a bond is issued jointly by two or more cities without a formal vehicle where each participating city is responsible for their part of the payment. Finally, the last step is to formally create a special purpose vehicle (SPV) to serve as an intermediary between the cities and the capital market. The SPV can employ financial experts to run operations and further reduce risk. The big advantage with an SPV is that it can reach sufficient volumes to diversify its funding operations and achieve cost-efficient pricing in the capital markets, not relying on one source of funding or one market. To be effective and credible in the marketplace, such SPVs must have the financial strength and creditworthiness supported by capitalization and reinforced by guarantees. The guarantors can either be the participating cities, central government, a third party (e.g. public sector pension funds), or any combination of these entities. The advantage of having a guarantee from the participating cities is that it reinforces the local responsibility for the SPV.

For those cities interested in exploring the LGFA concept, especially in the developing world, consideration should be given to the following factors that are vital to creating a well-functioning LGFA:

- Relationship between local authorities and national government, both legally and financially
- Flow of income (e.g., taxes) and issues related to stability, predictability, diversification, trends, system for collection, collection rates, and possibilities to tap into new local taxes
- Local budget and cost structure and issues related to management and control

- Current debt level, interest payments, maturities, payment record, and national government restrictions
- Institutional considerations such as responsible organizations, accounting system, audit, and level of knowledge and skills

4.5 Socially Responsible Financing

4.5.1 Green Bonds[88]

A green bond, like any other bond, is a fixed income debt instrument where capital is raised through the debt capital market. The key difference between a "green" bond and a regular bond is that the issuer publicly states that the bond proceeds are used to fund "green" projects, assets, or business activities with an environmental benefit, be it renewable energy, low carbon transport, forestry, or others that mitigate climate change.

The first green bond was issued as the *Climate Awareness Bond* in 2007 by EIB, followed closely by the World Bank's Green Bond in 2008. From 2007 to 2012, all green bonds issued were by IFIs or national governments in the public sector, which collectively raised US $10.4 billion over that period. The green bond market more than tripled between 2013 and 2014 from $11 billion to almost $37 billion, in part due to the sharp increase in private sector issuers. In 2014, corporate green bonds issued by companies in energy and utilities, consumer goods, and real estate sectors accounted for a third of the market. The market size was projected to increase even further to $100 billion in 2015.

Green bonds offer a number of benefits. They can give issuers access to a broader range of investors than regular bonds or other asset classes, including institutional and other investors with ESG investment policy requirements. The repayment of the bonds is tied to the issuer rather than the success of the green projects, which may be perceived to have higher risk of non-repayment. Increasing demand for the bonds is also likely to drive increasingly favorable terms and a better price for the issuer, compared to a regular bond. Green bonds can enhance an issuer's reputation and can serve as an effective way to demonstrate its commitment to the environment and to improve its own environmental performance.

These benefits need to be weighed against potential drawbacks. The processing and other administrative costs associated with a green bond could be greater, which could include additional tracking, monitoring and reporting processes, as well as up-front cost to define the bond's green criteria and sustainability

[88] For more detailed discussion of green bonds, see KPMG International (2015) and Smart City Council (2014). In addition, see Long Finance (2015) and Von Gutten et. al. (2014) for discussions focused on sustainable financing approaches.

objectives. Investors may also seek penalties for a default, whereby a bond is paid in full, but the issuer breaks agreed-upon green clauses. Because there are currently no standardized criteria for what makes a bond "green" and no strict requirements for tracking or reporting on proceeds, many issuers are subjected to criticism for "greenwashing" and accessing the green bond market without proper credentials.

In the public sector, green bonds have been used predominantly by IFIs and national governments, where bond proceeds are passed onto finance projects at state/provincial and local government levels. The World Bank, for example, has thus far issued about $8.5 billion, some of which are used to support local projects that address climate change. The State of California purchased $300 million of World Bank green bonds in 2009 not only to support its commitment to climate change, but also as a sound investment strategy for the state.

Although still rare, some state/provincial and local governments are beginning to issue green bonds to secure the financing they need, including infrastructure. In 2013, for example, the State of Massachusetts became the first U.S. state to issue green bonds to fund many of their energy efficiency projects. Interestingly, the state issued both regular and green bonds at the same time with the same price, yet the green bond was oversubscribed by 30% whereas the regular bond was undersubscribed.

At the local level, Gothenburg, the second largest city in Sweden, became the first city in 2013 to pioneer the use of green bonds in the Nordic region to support various environmental projects in public transport, water management, energy, and waste management sectors. The city was supported by *Skandinaviska Enskilda Banken (SEB)*, which facilitated the bond issuance. SEB also helped design the World Bank Green Bond. More recently, the City of Johannesburg issued the first green bond in South Africa to raise R1.5 billion (US$143 million).[89] The bond was priced higher than their regular bond and was oversubscribed by 50%. The proceeds are to be used to fund their Bio Gas to Energy project, Solar Geyser Initiative, dual-fuel buses, and many other projects that are critical to reducing the city's greenhouse gas emissions.

4.5.2 Social Impact Bonds[90]

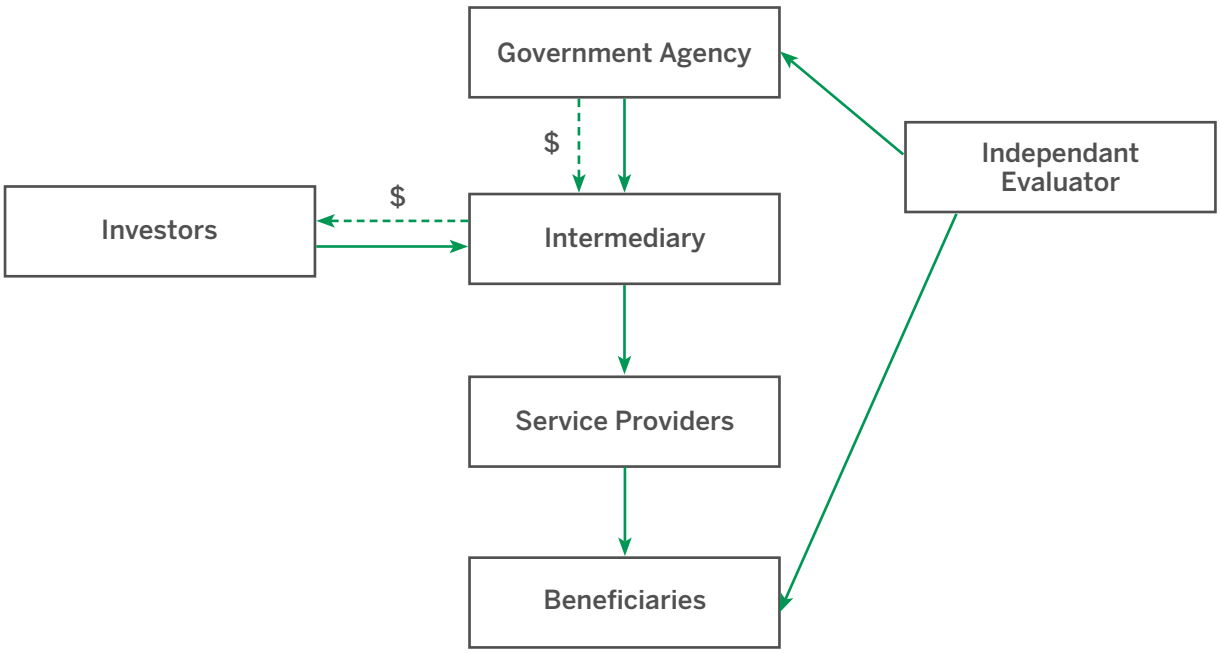
A social impact bond (SIB), also referred to as *Pay for Success* or *Social Benefit Bond*, is an innovative performance-based financing tool that enables governments to pay for only those programs that deliver. In an SIB agreement, the government sets a specific, measurable outcome that it wants achieved (typically of social benefits in nature)

[89] See, for example, Kidney (2014) and C40 Cities (June 12, 2014 blog) for additional information on Johannesburg green bond issuance.

[90] For additional discussion of social impact bonds or pay-for-success approach, see Macomber (2016), Smart Cities Council (2014), and social impact bond series by Center for American Progress available at: https://www.americanprogress.org/series/social-impact-bonds/view/.

for a given population (beneficiary) and promises to pay an external organization (intermediary) if, and only if, the organization delivers the outcome. Investors provide the working capital for the intermediary to hire and manage service providers. A third-party independent evaluator determines whether the beneficiary population has achieved the outcome. If the performance outcome is achieved as agreed, the government releases an agreed-upon sum of money to the intermediary, which then repays its investors with a return for taking on the upfront risk. If the outcome is not met, the government is not on the hook, and the investors do not get repaid (see Exhibit 16).

Exhibit 16: Social Impact Bond Structure



SIBs are a type of bond that is not a fixed-income debt instrument like a regular bond because they do not offer a fixed rate of return even though they operate over a fixed period of time. Because the repayment to investors is "at risk" contingent upon specific outcomes being achieved, they work more as an equity instrument. A development impact bond (DIB) is a variation of SIB used in developing countries to achieve improved social outcomes using a similar financing approach, where the investors are either donors like IFIs, host governments, or a combination of the two.

Because of their at-risk nature, SIBs are not for all investors. They have been used primarily to address social issues and fund

programs such as public safety, prison rehabilitation, homelessness, workforce development, and preventive healthcare programs. They are most appropriate for projects where (a) outcomes can be clearly defined and historical data are available, (b) preventive interventions exist that cost less to administer than remedial services, (c) some interventions with high levels of evidence already exist, and (d) political will for traditional direct funding is difficult to sustain.

The SIB concept is still new, but beginning to generate significant interest from countries like the U.K., U.S., Australia, and Canada. Although national or state/provincial governments have led most SIB programs, there are some that have been led by city governments. In 2012, for example, the City of New York issued $9.6 million in SIBs for a prisoner rehabilitation program. While the city did not put up the up-front capital, Goldman Sachs bought the bond (investor) and Manpower Demonstration Research Corporation (MDRC) was chosen to run the program (intermediary). The Osborne Association was selected as the service provider with independent evaluation to be performed by the Vera Institute of Justice. If the goal of reducing recidivism was met, the city would repay Goldman Sachs, presumably from the savings associated with the reduced recidivism. The use of SIBs to finance "hard" infrastructure projects have been limited thus far, often only as a part of a larger social program. In 2013, for example, the U.S. Department of Housing and Urban Development (HUD) encouraged the use of *Pay for Success* when it provided $5 billion in grants to assist post-Katrina rebuilding efforts. The State of Massachusetts also used *Pay for Success* to address its larger homelessness issues, where a small part was dedicated to providing additional housing.

Although its use is still largely in the testing phase, SIBs can potentially be a powerful tool to finance infrastructure projects, in particular, social infrastructure, such as prisons and public healthcare facilities, or to improve infrastructure services in the operations and maintenance phase. Some industry experts suggest a broader use of SIBs in infrastructure financing, where a risk bearing financial arrangement between public, private, and non-profit organizations can be established to unlock foundation, philanthropic, and NGO investments.[91] Such arrangements could potentially unleash $18 trillion of cash reserves currently held by corporations that are sitting on the sideline. Recently, for example, the Indian government passed legislation requiring large companies to spend at least 2% of their annual profits on corporate social responsibility. In lieu of financial returns, a broader application of SIBs in

[91] See Macomber (2016) for additional discussion on unlocking philanthropic and other non-profit funds.

infrastructure financing can target specific performance outcomes—such as reduction in commuting time, reduction in the rate of urban pollution per unit of GDP, or increase in uptime for electricity in urban areas—that are much more meaningful to cities.

4.5.3 Carbon Tax and Cap-and-Trade

Carbon tax and cap-and-trade are two funding mechanisms that specifically address pollution and global warming. The revenues therefrom are used to fund energy, transport, and other infrastructure projects that address greenhouse gas emissions and other related environmental issues. In some cases, the aim is to create a revenue-neutral situation where revenues are returned back to the taxpayers, or used to reduce other discretionary taxes to improve overall tax efficiency.[92]

Compared to cap-and-trade, carbon tax is more straightforward and is a tax on the emissions caused by the burning of coal, gas, and oil aimed at reducing the production of greenhouse gases. A variation on carbon tax is an energy tax, which is charged directly on energy commodities and effectively increases the energy price uniformly regardless of the emissions produced. Carbon and energy taxes started to take effect as a result of the United Nations Framework Conventions on Climate Change in 2001.[93]

Although many countries have explored implementation of carbon taxes with much political debate, only a handful of countries—e.g., India, Japan, Australia[94] —have been able to adopt the tax scheme as a matter of national policy. In Europe, several countries introduced energy taxes—e.g., Germany, the U.K.—but all failed to introduce uniform carbon taxes. In the U.S. and Canada, the implementation has been at state/provincial and local levels. In the U.S., for example, the City of Boulder was able to pass the first municipal carbon tax in 2006.[95] The tax was manifested in electricity utility bills with deduction for using electricity from renewable energy sources. The revenues were used for citywide programs that reduced greenhouse gas emissions. The nine-county San Francisco Bay Area in California was also able to pass a carbon tax measure in 2008, as was Montgomery County in Maryland in 2010.[96]

A cap-and-trade program[97] is a government-mandated, market-based approach used to control pollution by providing economic incentives for achieving reductions in the emissions of pollutants. A "cap" sets a maximum

[92] See Smith (2008) for additional discussion on carbon and other environmentally related taxes.
[93] See Bashmakov et. al. (2001) for additional discussion of the 2001 UN Framework Conventions on Climate Change.
[94] In Australia, federal carbon tax was introduced in 2012 but it has since been repealed and abolished in 2014.
[95] See, for example, http://www.nytimes.com/2006/11/18/us/18carbon.html?_r=0. Also, see Climate Action Plan Tax, City of Boulder, Colorado
[96] See, for example, San Francisco Chronical May 22, 2008, article on "Air Quality Board to Fine Bay Are Polluters."
[97] See AASHTO, Lazo (2014), and C40 (2013, 2014) for additional discussion of cap-and-trade programs.

allowable level of pollution and penalizes companies that exceed their emission allowance. The allowances are based on a finite number of permits for emissions that government issues. Some companies can choose to reduce their pollution to match their number of permits whereas others may find it more difficult. "Trading" lets companies buy and sell allowances, leading to more cost-effective pollution cuts, and incentive to invest in cleaner technology.

Since 2005, the European Union (EU) has operated the largest cap-and-trade program, but the program has struggled as the auction prices of the permits have fluctuated widely and crashed on more than one occasion. This has led to an oversupply of permits and few incentives for companies to alter their behavior. At a regional level, the Regional Greenhouse Gas Initiative in the northeast region of the U.S. covering nine states has a more limited cap-and-trade program focused on the power sector.

At the city level, the Tokyo Metropolitan Government (TMG) was the first city in the world to launch a municipal cap-and-trade program in 2010.[98] The program was focused on CO2 reductions in large commercial, government, and industrial buildings in Tokyo. With the active engagement of building management and tenants, the city was able to find solutions that reduced energy use and carbon emissions. The city was able to achieve its commitment to ambitious emission reduction targets within a short period of time, with over 90% of the buildings meeting the target well ahead of time. In China, the City of Shenzhen also launched its own carbon trading market in 2013 under the Chinese Certified Emission Reduction (CCER) program.[99] The program involved 635 key companies (representing 26% of the city's GDP) and 197 large public infrastructure facilities committed to reducing carbon emissions from their operations.

Besides meeting the carbon emission reduction goals, a long timeframe is generally required for collection of any revenues from the cap-and-trade system. The State of California has been unique in this regard. The state has been able to set up a working cap-and trade auction program that not only targets emission reductions, but has already collected $2.3 billion in revenue, $250 million of which is specifically earmarked for the state's high-speed rail project.

California has long been an environmental leader and, as early as 2006, adopted legislation that required a massive reduction in greenhouse-gas emissions. It chose a cap-and-trade system because it was more effective, but also because the alternative, a carbon tax, would have required a two-thirds vote in the legislature. Large businesses in the state—those that emit more than 25,000 tons of CO2 a year

[98] See, for example, C40 Cities (2014) for additional discussion of Tokyo cap-and-trade program.
[99] See, for example, C40 Cities (2013) for additional discussion Shenzhen cap-and-trade program.

covering nearly every industry, including refineries, food processors, manufacturers, and utilities—have to get permits from the state for those emissions, a majority of which are given out free. To distribute the rest, the state has been able to develop a working auction system, including setting a minimum price to avoid the collapsing of the auction as experienced in the EU.

Since November 2012, there have been eight quarterly auctions. At each auction, two pools of allowances have been sold, one controlled by the utilities (which get all of their allowances for free) and the other by the state. About 10% of the state-controlled allowances are sold directly to businesses that need them, while the rest are given away. The $2.3 billion of allowances that the state has been able to sell thus far goes into its Greenhouse Gas Reduction Fund, which supports projects that reduce pollution, including the $68 billion high-speed rail system currently underway. A quarter of all future revenue from the fund is also earmarked for the high-speed rail project, with the rest going toward a variety of legislative priorities that include affordable housing, public transit, water conservation, and other infrastructure projects. The utilities are required to spend their proceeds on things like alternative or renewable fuels, or by giving relief to their customers.

Chapter 5 Summary, Conclusions, and Afterthoughts

This handbook is the culmination of the *Financing Urban Infrastructure Initiative* launched by the New Cities Foundation in 2015. The primary aim of the initiative was to address critical infrastructure financing issues and challenges facing cities today as they undergo rapid urbanization. Through this handbook, we aimed to provide a set of practical guidelines that can help cities become smarter in the urban infrastructure finance space and respond more effectively and timely to the basic infrastructure service needs of their citizens and businesses.

At its best, infrastructure serves communities at large and embodies public goods and services. In this regard, this handbook was written for the public sector. Many infrastructure assets such as energy utilities are already in private hands and, though continuously evolving, their financing market is mature and less problematic. The most critical infrastructure financing challenges in cities are those assets in the public domain. The financing approach here largely relies on grants, subsidies, transfers, taxes, and other sources that are unsustainable in the long run.

This handbook was written primarily for mid-size cities in the emerging world where most of the urbanization and growth are taking place and where infrastructure financing challenges are most daunting. Most likely, these mid-size cities and local governments have limited financial savvy and knowledge in what is available in the marketplace. Rather than providing a laundry list of the state-of-the-art financing tools and instruments or detailed case studies of a select few, this handbook focused on the basic concepts underlying the myriad financing vehicles available today so that they are understood in proper context. These basic concepts are intended to help cities and local governments better navigate the complex world of infrastructure financing.

In explaining the basic concepts, we emphasized the important distinction between financing vs. funding. Infrastructure financing in essence is raising the high upfront costs to build the infrastructure when and where needed by leveraging future revenue streams that can repay the upfront costs. Financing is the raising of this upfront capital to expedite the process. Funding is the revenue streams in the future to repay the financing.

On the financing side, focusing on infrastructure assets in the public domain, we provided two broad categories of financing: public sector vs. private sector financing (Chapter 2). Among others, the most prevalent financing vehicles available for cities for public and private sector

financing, respectively, are municipal bonds and public-private partnerships (P3). Although less prevalent outside the U.S., municipal bonds are a robust urban financing tool that should be considered more seriously by cities around the world. Likewise, although at times subject to political controversy, P3 is continuously evolving and can be an effective tool in engaging large private sector capital, especially for major infrastructure projects that are complex and require innovations.

Whether publicly or privately financed, we emphasized the increasing and critical role of institutional investors in infrastructure financing with their patient and long-term capital. We also emphasized the importance of support from national/state governments, international financial institutions and development banks (so called IFIs), especially in providing credit enhancements and financial leveraging tools that help reduce financing costs for cities.

On the funding side, there is no free money and the buck ultimately stops with taxpayers and users. Cities must rely on tax revenues and user charges as the two primary funding sources they can leverage to secure financing (Chapter 3). For tax revenues, value capture and developer exactions are two effective taxing approaches that can be used by cities. For many cities in the developed world, these two approaches are largely within their current taxing authority without requiring major tax reforms. Increasingly, tax revenues must be supplemented with user charges, especially for infrastructure assets in the public domain. User charges are a much more sustainable funding source and are the key to unlocking private capital. Better quality service, more service options catered to specific users, user vouchers, and automated payment collection systems are potential solutions that help incentivize users and their willingness to pay.

There is, however, a limit to how much taxpayers and users can take on to pay for infrastructure. In this handbook, we presented brownfield recycling as a potential solution to addressing the daunting funding gap issue. Brownfield recycling is the leveraging and monetization of existing brownfield assets through long-term leases or asset sales that use the proceeds therefrom to fulfill infrastructure funding needs. This is one of a few options that begins to address the sheer magnitude of the funding gap and as close to unencumbered funding as possible without repayment obligations. Although brownfield recycling can sometimes be mired in political controversy, there is sufficient evidence to prove that wider public acceptance is possible if there is a clear mandate on the use of the proceeds to reinvest in infrastructure, credible institutions such as public pensions are involved on the buyer side, and a clear regulatory regime is established to protect social objectives.

Infrastructure development is a long-term endeavor and addressing funding

and financing issues is only a part of the equation. They must be accompanied by institutional know-how and proper governance structures to carry the efforts to fruition (Appendix A). Cities need the basic institutional building blocks—policies, regulations, enabling institutions, procedures and guidelines, and resources—to ensure that financing terms are honored so that investors can keep coming back. In particular, cities need the most help in the early project preparation stage where their visions are translated into specific projects they can take to the investors. IFIs and NGOs have been playing a critical role in providing the necessary support in this regard. When private sector financing is involved, especially for P3 undertakings that are often complex, cities also need P3 capacity building at multiple levels of governments.

With the changing urban landscape, new urban governance forms are also emerging that can facilitate infrastructure delivery and financing. The "smart city" is one such emerging form which is propelled by technology, but with the larger goals of enhancing the quality of urban services, reducing resource consumption, and engaging more effectively and actively with citizens. Smart city concepts are fast becoming a requisite to critical urbanization policy discussions and no conversation about cities can now takes place without considering their "*smartness*" in one form or another. Much of the dialogues have been focused on technology. This handbook also offers potential financing approaches to key smart city concepts being considered by many cities today (Appendix B).

With infrastructure spending needs almost at 5 percent of gross world product every year from now to 2030, we are facing a global infrastructure financing crisis. This is a big problem that cannot be solved by business-as-usual. We need a collective effort to solve the big problem and each stakeholder plays an important role.

The most critical gap at this juncture is in "development financing," i.e., financing greenfield projects that stimulate new growth and new developments, which have generally been perceived to be risky in the financial community. Some countries, such as Singapore, have made an effective use of their sovereign wealth funds in the past to carry out their critical national development agenda, but such efforts have been limited.[100] IFIs, national governments, and institutional investors need to work together to streamline this development finance. More specifically, IFIs and national governments need to provide short-term early risk capital and institutional investors need to commit their stable low-cost capital for the long-term from the project get-go. For cities and local project sponsors, such streamlining would reduce overall financing costs significantly.

[100] See Dixon et. al. (2014) for the emerging role of sovereign development funds.

Direct and active engagement of public pensions and other key institutional investors cannot be stressed enough, especially for major strategic infrastructure projects that have larger economic and social impacts. This view is consistent with the current global trend where, instead of going through third-party fund managers, institutional investors, in particular public pensions, are intersecting more directly with local infrastructure financing activities. Shared liabilities in these situations have proven to create inherent synergies between the governments and public pensions for the greater benefit of the public, as demonstrated by the N-33 Road Project in the Netherlands. Public pensions are better positioned to mitigate some of the political concerns about private investor involvement because their interests are considered better aligned with those of the public.

From the standpoint of the global investment community, infrastructure investments currently lack proper benchmarking. The infrastructure asset class is all over the map in terms of risk-return profiles. It is a hybrid class where assets that behave like fixed income (e.g., energy utilities) are lumped together with those that behave like private equity (e.g., privatized airports) or like real estate (e.g., new greenfield toll roads) into a single asset class. Too many benchmarks – or a lack thereof – sometimes create ill-founded return expectations from private investors and their fund managers trying to meet those expectations. Through better and proper benchmarking, where appropriate, private investors need to temper their return expectations in the infrastructure investment space.[101]

National and state/provincial governments need to embrace the global urbanization trend fully. They need to help establish coordinated inter-urban growth strategies with specific incentives that are designed to facilitate and encourage decentralization and fiscal self-reliance of the cities. Where appropriate, national and state/provincial governments should also explore using cities and urban settings as venues to test key national infrastructure reform strategies that are more difficult to implement at the national scale.

To the extent feasible, local governments need to become more self-reliant fiscally. Moreover, they need to become smarter and more financially savvy. This handbook offers some of the means that can help cities do so. Instead of relying on national governments and private sector experts, cities need to be at the forefront in developing their own infrastructure financing solutions. They

[101] As part of a new OECD-G20 Initiative, EDHEC Risk Institute in France is developing a new method of benchmarking infrastructure assets, which will including identifying sub-categories, standardizing data collection and performance reporting system, and developing valuation and risk measurement benchmarks for these subcategories for better decision-making. See Blanc-Brude et. al. (2013) for additional discussion of the new benchmarking methodology.

need to be proactive in involving multiple stakeholders early on, coming up with creative and innovative ideas themselves, designing projects that are bankable, and marketing them actively and globally.

Cities interface directly with taxpayers and users. As the local infrastructure project sponsors and service providers, they also have a better understanding of the risks involved in delivering infrastructure projects and services on the ground. When the private sector is directly involved in financing and delivering infrastructure facilities and services, such as in the P3 model, it too has the opportunity to interact closely and directly with the user community, be they individuals or businesses. Along with local governments, the private sector must strive to better understand user needs and develop innovative approaches to improve the service quality that caters to these needs. Together, they must create a new infrastructure value paradigm for users and cultivate the user-paying culture and users' willingness to pay. They need to jointly develop sustainable financing strategies that balance tax revenues with user charges and address both economic efficiency and social equity issues.

Most importantly, taxpayers and users must recognize that, like everything else, they are the ones who will have to pay for the infrastructure in the end. They have to recognize that the choices ultimately come down to these: either they pay taxes or user charges or they will get no service at all. Taxpayers and users need to be better informed about the infrastructure financing and funding pictures of their cities. They must be actively engaged in the civic decision-making process. Their inputs will provide essential ingredients not only in developing well-functioning infrastructure facilities that are sustainable in the long run, but also in envisioning next generation infrastructure systems that are robust, agile, and that fit our modern ethos.

Moving forward, cities would be better served knowing global best practices and emerging new ideas. Innovations in urban infrastructure financing are much needed, especially for cities that must take on the brunt of the infrastructure provision responsibilities. We identified several innovative urban financing models that specifically mitigate the critical funding and financing challenges discussed in this handbook (Chapter 4).

Notably, CEPAC bonds used prevalently by cities in Brazil provide innovative means to obtain additional revenue sources, where future development rights are traded as options in the capital market. Crowdfunding encourages civic engagement through a user-investor approach and provides much needed funding for small civic-oriented projects, such as bike lanes and urban parks. It is also emerging as an additional source of P3 equity capital with lower return requirements, savings of which can be passed onto the users. Local Government Funding Agency (LGFA) is a multi-city pooled

approach proven effective in Scandinavian countries that enables cooperation between cities to build their own financial credibility in the global marketplace and increase their borrowing capacity. Many other socially responsible financing approaches have been emerging in recent years. Select cities around the world are using green bonds, carbon tax, and cap-and-trade to fund infrastructure projects that address climate change, global warming, and other sustainability issues. Social impact bonds are an innovative financing instrument that relies on performance rather than financial returns to address critical social issues that cities face, such as public safety, affordable housing, work force development, and public healthcare. Although still new, they offer a potential venue to unleash the large pool of philanthropic funds for infrastructure purposes. Through an N-33 road project example in the Netherlands, this handbook demonstrated an effective way to directly engage institutional investor to improve infrastructure financing efficiency.

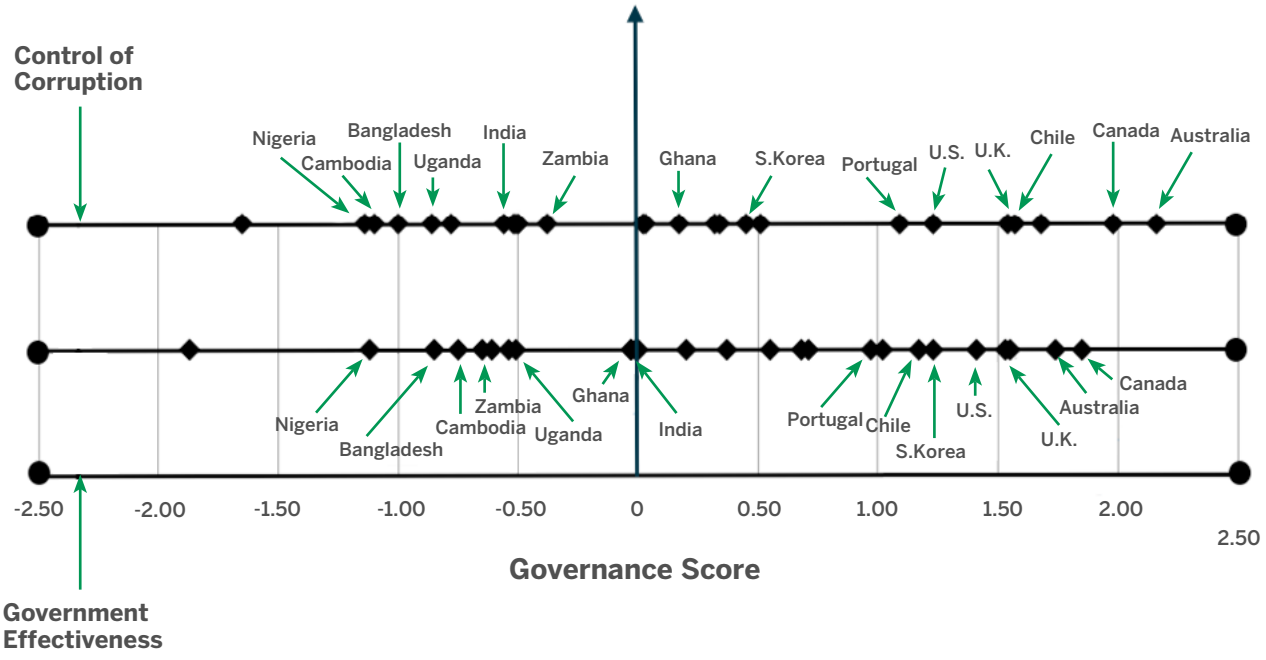
These and other emerging and innovative financing models, along with the solid understanding of the basic concepts underlying them as presented in this handbook, are at cities' disposal to tackle the infrastructure financing challenges they face today and in the future.

Appendix A Institutional and Governance Dimensions to Urban Financing

Institutions and governance matter when it comes to infrastructure financing, especially when private investments are involved. According to the World Bank, there are six key governance indicators: voice and accountability, political stability and absence of violence, government effectiveness, regulatory quality, rule of law, and control of corruption.[102] As a point of reference, two are depicted in Exhibit A.1 for different countries across the world. Though indirectly, these indicators have some bearing on the cost of capital when cities try to secure infrastructure financing from the global marketplace.

Infrastructure development is a long-term endeavor and addressing funding and financing issues is only a part of the equation. They must be accompanied by institutional know-how to carry the efforts to fruition. Cities need the basic institutional building blocks—policies, regulations, enabling institutions, procedures and guidelines, and resources—to ensure that financing terms are honored so that investors keep coming

Exhibit A.1: Governance Indicator for Different Countries



Source: World Bank (2011)

[102] See Kaufmann et. al. (2006) for additional discussion on governance indices.

back. For cities, most help is needed in the early project prioritization and preparation stage where their visions are translated into specific projects they can take to investors. IFIs and NGOs have been playing a critical role in providing the necessary support in this regard. When private sector financing is involved, cities also need support in the overall procurement process. Due to their complexity, P3 implementation often requires institutional capacity building at multiple levels of government. Furthermore, with rapid urbanization, new urban governance forms are also emerging that can facilitate infrastructure delivery and financing. These institutional and governance dimensions are further elaborated below.

A.1 Institutional Capacity Building: IFI and NGO Support

The role of IFIs has been increasing in infrastructure financing, especially for the developing world. In addition to direct financing support, IFIs' support comes as technical assistance by engaging outside consultants and providing their own expert resources. Many IFIs have established additional programs to focus on cities and their need to build capacity in infrastructure financing. These additional resources help fill the critical knowledge gap, especially in early project preparation stages. Project preparation includes institutional, legal, social, environmental, financial, regulatory and engineering work that is needed to take a project from concept to financial closure, with clear identification and allocation of risks.

Cities Development Initiative for Asia (CDIA) is a flagship project developed by ADB to target medium size cities in the Asia-Pacific region and focus entirely on the early preparation stage to enhance *linkage to financing*.[103] CDIA helps bridge the gap between strategic development plans, which typically present a wish list of projects, and the requirements of financiers for well-formulated infrastructure projects. CDIA focuses on four areas of support: (a) infrastructure investment programming and prioritization, (b) pre-feasibility studies, (c) linking cities to finance, and (d) city-level capacity development. CDIA initially started as a joint initiative between ADB and the governments of Austria, Germany, Spain, Sweden and Switzerland, the Nordic Development Fund, and the Shanghai Municipal Government, with additional funding from Germany's KfW. Under ADB's overall coordination and administration, CDIA has since evolved into a major IFI-led international partnership focused on cities.

EBRD has been active in the municipal space since the mid-1990s, financing over 300 projects, with 55 percent of all financing made at sub-sovereign levels and another 20 percent involving the private sector. EBRD's support at the municipal level has focused on the water and urban transport

[103] See, for example, KPMG (2010) for more information on CDIA activities.

sectors in emerging markets. Their support in capacity building has been unique in that, through standardized contracts with proper incentive structures, they help enhance self-funding capabilities and improve the projects' creditworthiness at the outset. EBRD's two-pronged approach is based on a public-service contract (PSC), which is between the service provider and the municipality (owner), complemented and reinforced by a project support agreement (PSA, in the case of water) or municipal support agreement (MSA, in the case of urban transport), which is between EBRD and the municipality. These contracts help to create a stable and predictable operational framework, management autonomy over the revenue streams, and accountability and incentives founded on performance targets. Through standardization based on best practices, EBRD's approach helps to shrink the overall time and effort required in project preparation phases.

IFC InfraVentures, or the IFC Global Infrastructure Project Development Fund, focuses on private sector-led project developments and covers the later phases of project preparation. IFC was established in part to address the lack of adequate funding for project preparation, particularly in less developed countries. IFC InfraVentures is one of the few IFI-funded project development vehicles that allocates significant staff time to help private sectors reach the financing phase. Specifically, their support includes: (a) providing risk capital in the early stages of project development, generally through joint development agreements (JDAs) based on a cost sharing structure, and (b) allocating a team of experienced IFC professionals to act as co-developers to lead project preparation activities such as financial and legal structuring, environmental, social and other impact assessments, and raising of capital through the project's financial closure.

In addition to IFIs, many other international associations and non-governmental organizations (NGOs) have been active in providing valuable support for cities to build capacity in infrastructure financing.

Since its founding in 1990, ICLEI (International Council for Local Environmental Initiatives), an international association of local governments with a network of over 1200 cities in 84 countries, has been providing technical consulting, training, and knowledge-sharing services to cities around the world to build capacity in sustainable development. ICLEI recently launched *Solutions Gateway*, an online tool to support cities in developing low-emission strategies in the water, solid waste, transport, buildings, and energy utility sectors. The tool includes project feasibility assessment, guidance on financing decision-making, and a database on international and national funding resources and their requirements, and case studies documenting best practices. As part of Solutions Gateway, a Finance Tool is currently being

developed to help cities identify possible financing options to implement the low-emission projects they have identified.

FMDV (Global Fund for Cities Development) is created by Metropolis, UCLG, and 34 founding members that are cities and city networks.[104] It is an international organization whose aim is to create conditions that allow local governments to stay in the driver's seat to define, implement, and manage their urban development strategies, thereby achieving effective decentralization of competences and resources in urban development. FMDV has a dual approach of providing technical expertise and facilitating financial engineering in the urban project development process.[105] The dual approach allows local authorities, elected officials, and technical teams to design, develop, and appraise their own development projects, in line with the best interest of local communities and stakeholders. Through its local offices, FMDV helps develop a readily available network of expert and committed international and regional partners, comprising chief financial officers, engineers, and technicians from local authorities, universities, NGOs, private groups, and international institutions. These networks facilitate cities' access to financial resources, which match the specific needs they themselves have identified, be they guarantees, loans, subsidies, grants, access to global financial markets, or other endogenous solutions.

GIB (Global Infrastructure Basel) is an international NGO whose aim is to promote sustainable infrastructure financing practices. GIB's capacity building program helps enable cities develop their skills and knowledge regarding the sustainability of infrastructure projects, including the development of voluntary standards, grading systems, and measurement and backtracking of performance indicators. Together with capacity building workshops, they offer technical support to municipalities and their stakeholders in strategy development and process support for infrastructure projects, including pre-feasibility studies, implementation, and business plans.

A.2 Institutional Requisite in P3 Implementation

Falling short of full privatization, P3 is currently the primary mechanism to involve private sector financing. Because of its complexity, one of the essential ingredients to successful P3 implementation for the public sector is to build necessary P3 capacity and knowledge. Such capacity building would help achieve an optimum and sustainable deal structure that both the private and public sector can commit to over the P3 lifecycle.

[104] Metropolis is a global association of 130 major metropolises with more than 1 million inhabitants. United Cities and Local Governments (UCLG) is an NGO representing interests of local governments and support international cooperation between cities.

[105] See FMDV (2014) for examples of FMDV support for cities around the world.

When P3 options are explored, governments need to begin by considering the basic P3 institutional framework, which includes:

- *P3 visions, policies, and strategies* that are clearly articulated at national, state/provincial, and local levels to avoid premature P3 undertakings that can often become costly.
- *P3 enabling legislations* that carefully consider the use of regulatory versus contractual vehicles to balance enforcement with flexibility in promoting efficient business processes.
- *P3 institutions and capacity buildup* in terms of organizational responsibilities at different levels of government and their interfaces.
- *P3 procedures, guidelines, and standards* during different phases of the P3 implementation lifecycle, including the procurement phase.

Especially for those who are new to the P3 market, P3 capacity building takes a long time and must be established in stages. The following UN-recommended P3 development stages can serve as a useful guideline in this regard:

Stage 1:

- Define policy framework
- Test legal viability
- Identify project pipeline
- Develop concept for project evaluation and procurement
- Begin developing domestic P3 market

Stage 2:

- Establish dedicated P3 unit
- Consolidate legal framework and publish implementation guidelines
- Continue to foster domestic P3 marketplace
- Expand P3 project pipeline
- Extend to new sectors
- Leverage new sources of funds

Stage 3:

- Continue to refine Stage 1 and 2 efforts to reach maturity

These basic institutional requisites should be designed to balance the varying interests of multiple stakeholders involved in a P3 undertaking. Among others, P3 stakeholders include:

- Governments
  - Planning and budgeting (e.g., Ministry of Planning and Finance)
  - Implementing (e.g., Ministry of Public Works)
  - Sector-specific (e.g., Ministries of Energy, Transportation, Health, Education, etc.)
  - Coordinating/integrating (e.g., dedicated P3 units with specific mandates)
  - Project-specific (state/provincial, regional, or local governments)
- IFIs and development banks
- Concessionaires (operator/

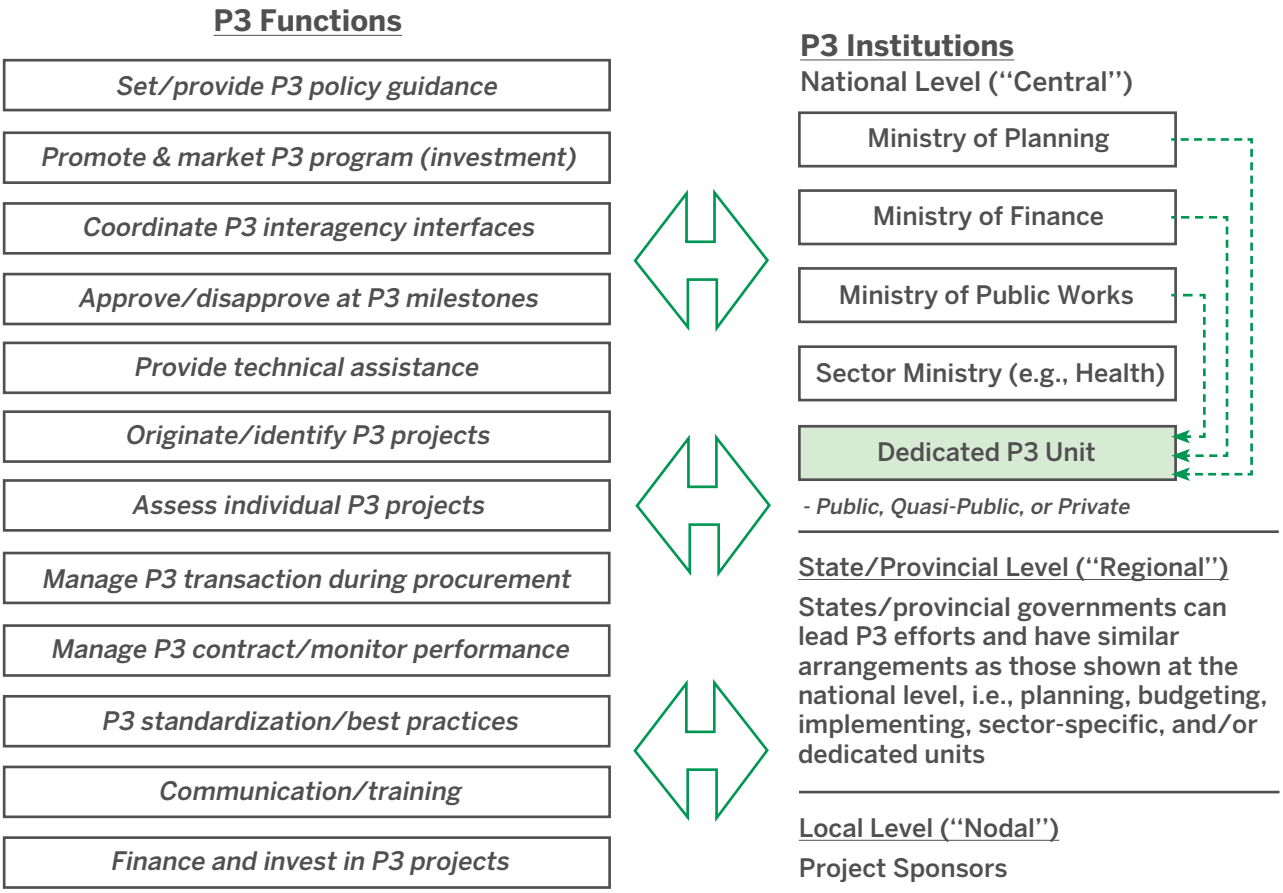
developer, financier, and/or constructor)
- Investment community (debt vs. equity)
- Consultants/advisors (financial, legal, technical)
- Infrastructure vendors (contractors, material supplier, equipment leasing, etc.)
- Local labor forces
- Local businesses
- Users and taxpayers
- NGOs and advocacy groups

When building institutional capacity for the public sector, roles and responsibilities at different levels of government should be considered with respect to the essential P3 implementation functions (Exhibit A.2). Although cities need to rely on their national and state/provincial governments to build much of this capacity, they can also take an active role from a P3 project implementation standpoint.

Being one of the leaders in P3 implementation with a mature P3 market, Canada, for example, has been able to build P3 deep and multi-layered institutional capacity.[106] At the federal level, under the Ministry of Infrastructure, Communications, and Intergovernmental Affairs, Infrastructure Canada has the oversight responsibilities of all major infrastructure implementations at the national level, including P3. PPP Canada, an independent federal Crown corporation under the Ministry of Finance, coordinates closely with Infrastructure Canada to improve the delivery of public infrastructure through P3. PPP Canada provides expertise in assessing and executing P3 opportunities at the federal level and, through P3 Canada Fund, also helps leverage federal dollars by supporting P3 projects at provincial and municipal levels. At the provincial level, reporting through their own designated ministries, each province has their own P3 units with specific functional responsibilities. These P3 units work directly with project sponsors who are local, regional, or provincial level agencies responsible for implementing P3 projects (see Box A.1).

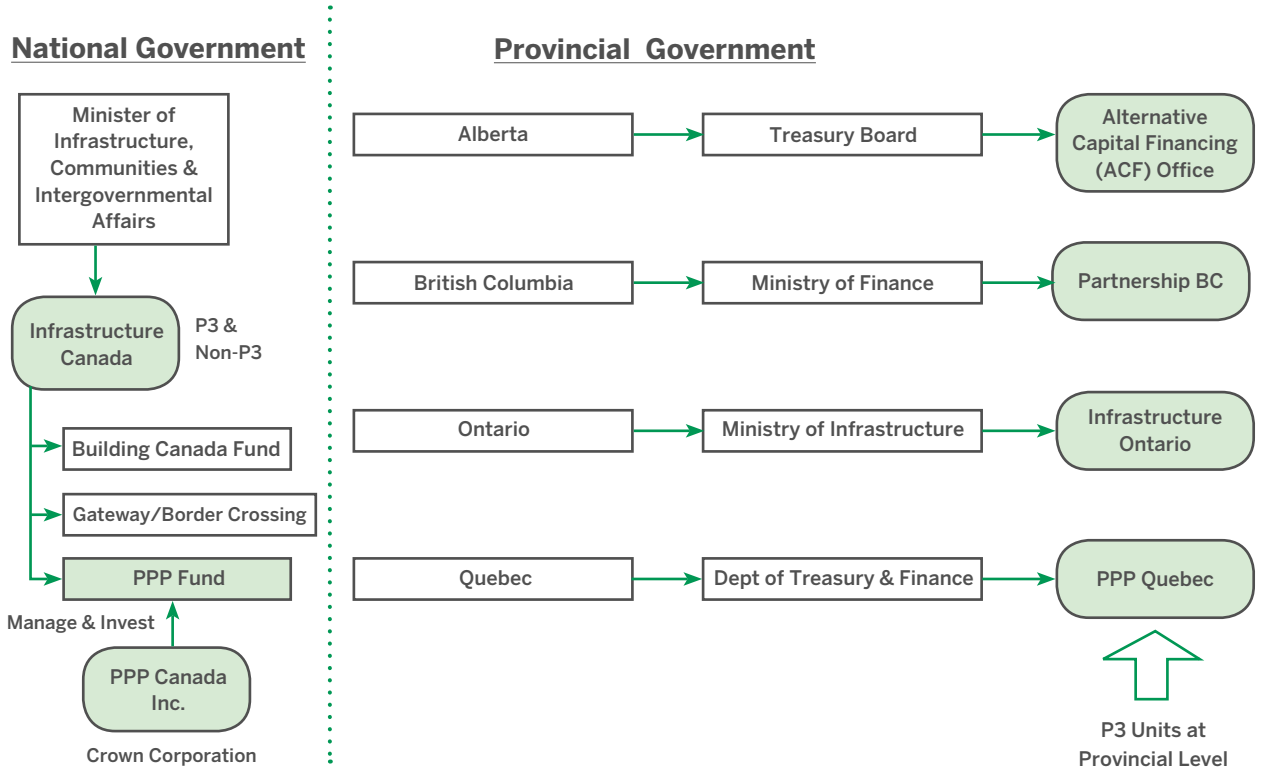
[106] See, for example, Farrugia et. al. (2008), OECD (2010), and World Bank (2007) about P3 capacity building in Canada and other countries.

Exhibit A.2: Aligning P3 Implementation Functions with Multi-Level Government Institutions

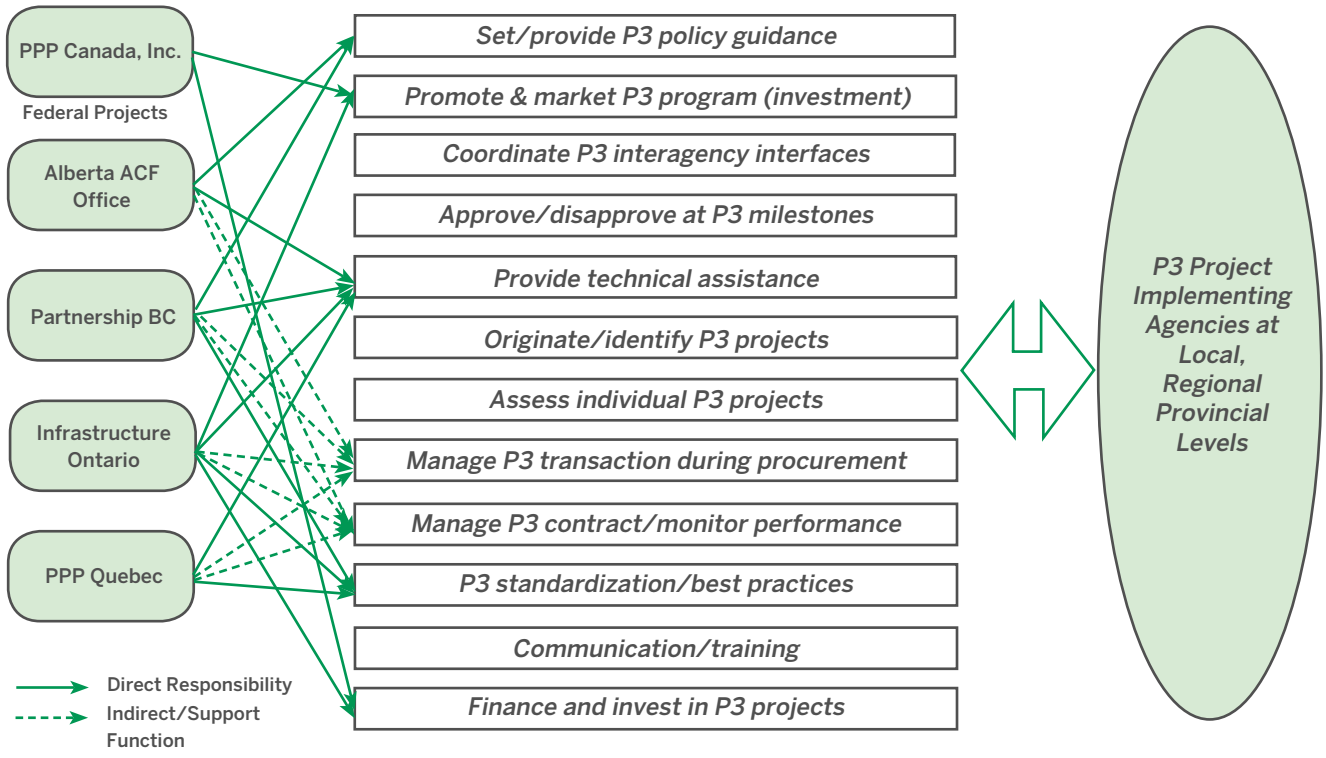


Box A.1: Overview of P3 Institutional Setting in Canada

P3 Institutions at National and Provincial Levels:

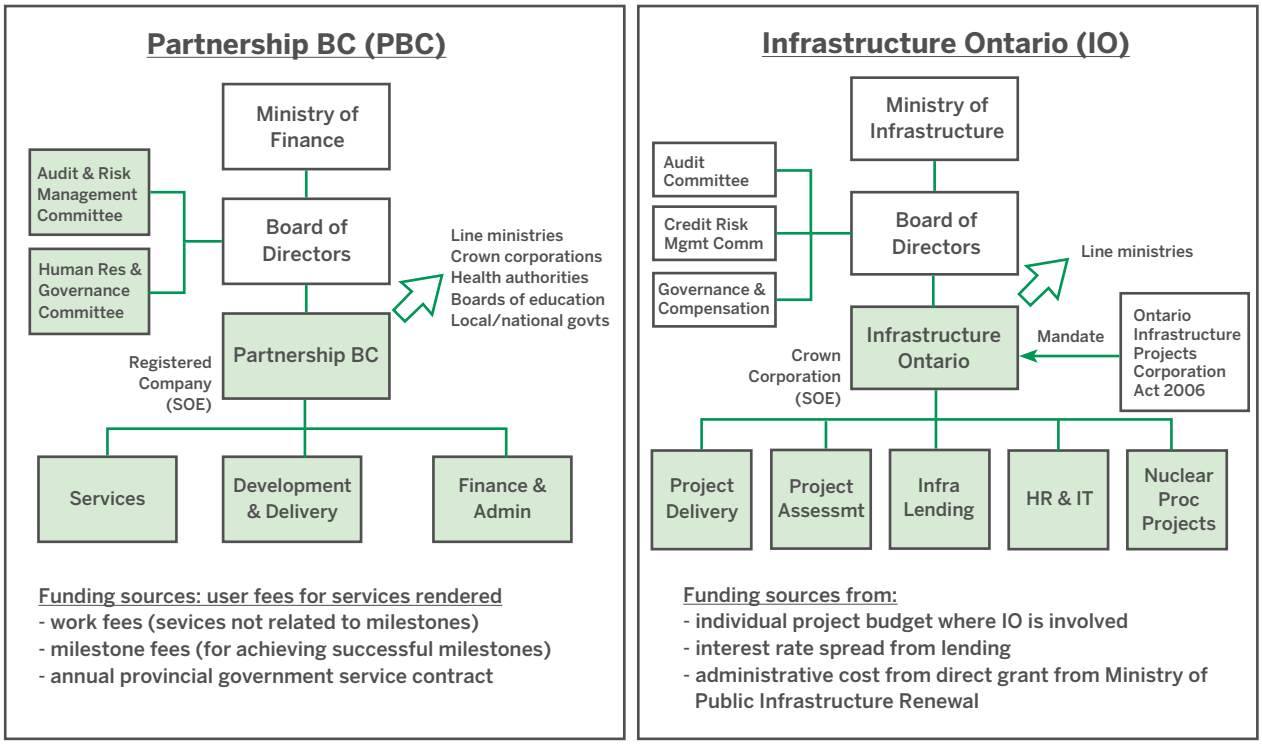


Aligning P3 Institutions with P3 Functions:



Box A.1 continued:

P3 Units and Their Representative Organizational Structure:



Appendix B Financing Smart City Concepts

No conversation about cities can now take place without considering their "*smartness*" in one form or another. The primary goals of these smart concepts are to improve the quality and performance of urban services, reduce resource consumption, and engage more effectively and actively with its citizens. From an infrastructure financing standpoint, these goals have important bearing on increasing the operational efficiency of existing facilities to help reduce new funding needs in the long run. In most cases, the benefits of smart city concepts are well recognized. The challenge, however, is figuring out how to pay for them, especially for cities and local governments facing fiscal constraints. This Appendix is intended to provide a broad-brush discussion on various financing approaches to key smart city concepts, both in terms of financing models that are currently being used as well as potential models that can help address future financing issues.

There are many smart city concepts with varying degrees of cost and financing implications. Some (e.g., BRT dynamic scheduling) bring significant benefits to citizens with little cost implications, whereas others (e.g., LED lighting) require a moderate capital investment with clear and proven savings that can help pay for itself. Some (e.g., operations or emergency control centers) also provide services that are primarily in the public domain where the costs must be borne by the public sector, while others are citywide "enterprise-level' applications that are costly, but with significant potential benefits in the long run.

Many smart city concepts do not require expensive sensors or sophisticated data analytics. In 2013, for example, the Seoul Metropolitan Government (SMG) was able to provide a "smart" demand-based nighttime bus service for low and medium-income residents by analyzing citywide taxi service calls and identifying high nighttime demand areas. The data was provided by taxi drivers from their credit card transactions. In return for the data, taxi drivers received a relief on extra service fees charged on their credit card transactions.[107] By using the data, SMG connected these high demand areas and created new nighttime bus routes (called "owl bus"). Owl bus was voted the best public service project of the year by citizens. The cost to SMG was the nominal credit card service fees that the city assumed on behalf of credit card companies and minimal staff time for coordination and data analysis. For those concepts that do require moderate capital investments such as LED

[107] Based on an interview with Mr. In Dong Cho, Director General of Seoul Innovation Bureau. Also see Cho (2015) for additional smart city services provided by Seoul Innovation Bureau with limited cost implications.

lighting, smart parking or operations centers, Exhibit B.1 summarizes several potential financing approaches. Due to its proven record of savings, LED lighting is often the first smart city concept cities implement. Compared to legacy systems, LED lighting with basic sensors uses less energy and lasts longer with a smaller carbon footprint. Past applications of LED lighting indicate that cities can achieve as much as 50-70% savings in annual energy cost and carbon emissions reduction, and 50-75% savings in annual maintenance costs.[108]

Exhibit B.1: Financing Approaches to Smart City Concepts Requiring Moderate Investments

Smart City Concept	*Upfront Financing*		*Funding/Repayment*		Features/ Representative Financing Examples
	Responsible Party	Financing Instrument	Responsible Party	Repayment Source	
LED Lighting	City Government	GO or Revenue Bonds, Loans, or Pay-as-You-Go	City Government	Cost Savings	LED lights with basic sensors; Los Angeles, Detroit, Asheville NC, etc.
Smart Parking	City Government	GO or Revenue Bonds, Loans, or Pay-as-You-Go	City Government	Increase in Parking Revenues	Generic financing model (see Exhibit B.2)
	Service Provider or City Government	Credit Facility (Upfront Cost)	City Government	Increase in Parking Revenues (*Pay-As-You-Go*)	Citi-Streetline-IBM $25-Million Credit Facility; sensors/ apps (Streetline), data analytics (IBM), financing (Citi)
Operations Center	City Government	Grant/Subsidy, GO Bonds or Loans	City Government	General City Funds (Tax)	Rio de Janeiro, Brazil

The City of Los Angeles was one of the first cities in the U.S. to successfully retrofit their legacy street light system with LED system, achieving almost 65% savings in energy usage and triggering many other cities to follow suit.[109] As shown in Exhibit B.1, cities can use multiple sources to finance the upfront cost of LED system. Los Angeles used loan and rebate funds from the city's Department of Water and Power for the upfront cost, but was able to make the repayment within 7

[108] Based on discussions with Cisco representatives. Also, see Whitehelm Capital (2016)

[109] For more detailed discussion on Los Angeles LED lighting system rollout, see O'Connor (2013), Gerdes (2013), Hargreaves (2015).

years with no adverse impact on its General Fund. Cities can pay the upfront cost from their General Funds on a pay-as-you-go basis or issue GO bonds. Given the proven cost savings, cities can issue revenue bonds for the upfront cost secured with anticipated cost savings.[110] Some cities also chose to set up a separate capital improvement account for any surplus savings beyond the full repayment for use in financing any future initiatives (e.g., Green Capital Improvement Plan for Asheville, N.C.).[111]

In the LED system, the basic funding/revenue model is one of cost savings. In smart parking, the funding/revenue model is based on revenue increases resulting from higher usage, which is further enhanced by dynamic pricing and efficient enforcements.[112, 113] Smart parking mobile apps such as ParkerTM help increase parking occupancy and overall parking revenues for cities, which can be leveraged to pay for the upfront cost of the technology. As shown in Exhibit B.2, the mobile apps provider can get their revenues either directly from customers and/or, as in the Uber model, from the service provider (in this case, either the city or a third-party parking service provider in contract with the city). Similar to the LED system, cities can raise the upfront cost either through GO or revenue bonds. Financing of upfront costs can be facilitated by a pre-established credit line that multiple projects can access. Recently, for example, in partnership with Streetline and IBM, Citi created a $25-million credit facility that can be accessed by multiple cities for smart parking projects that involve Streetline and IBM.[114] Instead of issuing bonds, cities can draw from the credit line for the upfront cost and pay back into the credit line on a pay-as-you-go basis as the parking revenues come in.

For an operations center such as the one provided by IBM in Rio de Janeiro, the basic function of the center was to enhance the command-control capacity of the city to improve public safety, emergency management, civil defense, and other services that are considered in the public domain.[115] Because there are no apparent cost savings or revenue generating

[110] There are non-LED examples where revenue bonds were secured with energy savings, as mentioned earlier for New Mexico schools revenue bonds for energy efficiency upgrades.

[111] For Detroit, see Reindl (2014). For Asheville, see Cleveland et. al. (2013)

[112] In addition to increase in parking fee revenues, efficient enforcements also produce substantial increase in revenues from parking fines.

[113] In addition to the revenue increase, there are cost savings and carbon emission reductions associated with smart parking concepts that cannot be monetized directly into financing. A UCLA study in 2007, for example, indicated that motorists in a 15-block district in Los Angeles drove in excess of 950,000 miles, produced 730 tons of carbon dioxide, and used 47,000 gallons of gas searching for parking. See Shoup (2007) for more a detailed discussion.

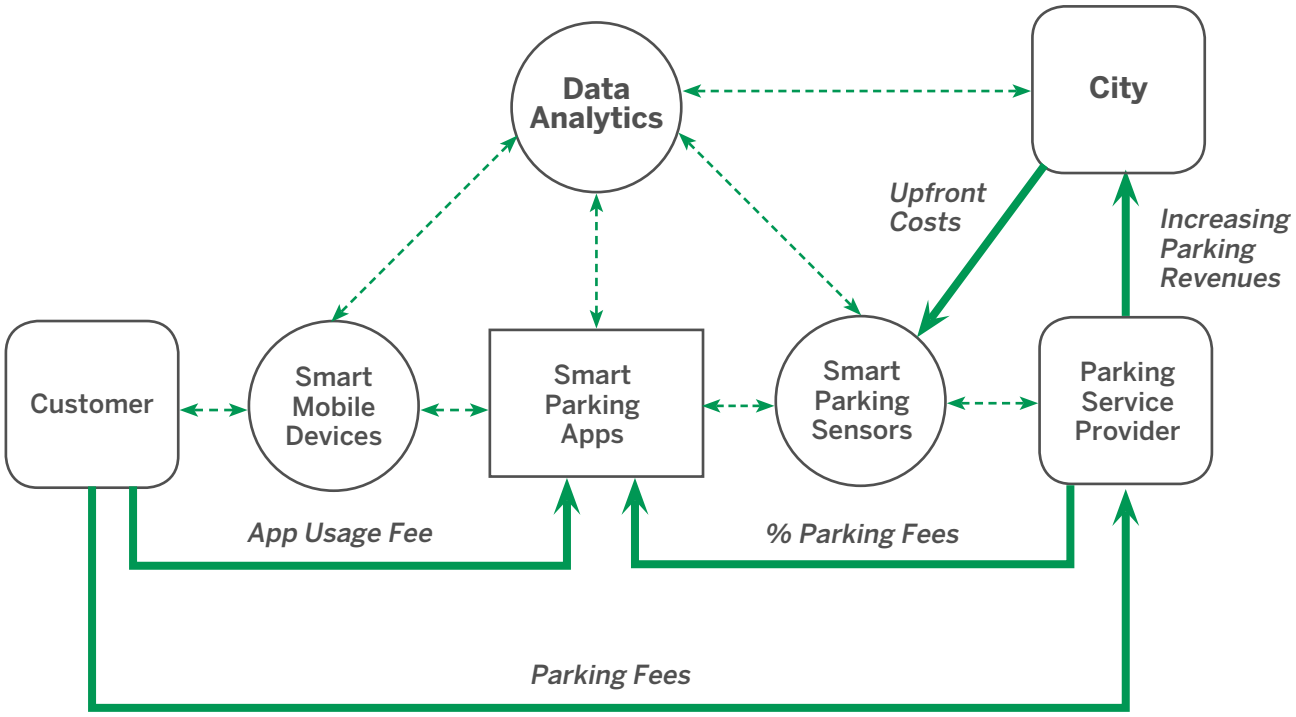
[114] Streetline provides mobile apps/sensors and IBM provides data analytic capability. See http://www.thestreet.com/story/11488069/1/citi-partners-with-streetline-and-ibm-to-provide-25-million-financing-for-cities-to-adopt-smart-parking-technology.html

[115] See Singer (2012) for additional discussion on the Rio operations center.

opportunities that could be capitalized to help with the financing, the government would be responsible for the financing in this case. For city governments, they can rely on grants or subsidies from their higher tier governments and/or on GO bonds or a bank loan that would be repaid ultimately from the city's General Fund.

There are smart city concepts that pertain specifically to smart buildings (see Exhibit B.3). Smart building concepts generally encompass (a) systems such as building management systems (BMS) or building automation systems (BAS) that are focused on energy savings and efficient building operations and (b) more advanced service platforms/applications that cater to the specific needs of building occupants.

Exhibit B.2: Smart Parking Funding/Revenue Model (Notional)



BMS is a smart building system that centrally manages all equipment and facilities in a building (e.g., ventilation, lighting, power systems, fire systems, and security systems) for improved energy use, safety and security, and efficiency in general building management, operations, and maintenance activities. For existing buildings, a prevalent financing model has been for a third-party service provider (such as energy service/savings company or ESCo) to assume the upfront costs of its services for a performance-based contract. ESCos, for example, get paid a fee or assume the utility bill for legacy systems from the building owners for implementing a broad range of energy savings solutions. In all cases, energy savings are guaranteed to exceed the fee or the legacy utility bills so that the building owners in essence take

no risk. Service providers lease various equipment they own (that are designed to reduce energy costs) and get lease payments from building owners to finance the upfront costs. Financing the upfront cost of smart building technologies can be facilitated by a pre-established credit line that multiple projects can access. In partnership with Green Campus Partners (GCP), for example, Citi recently launched a $50-million warehouse funding facility for use in building-related energy efficiency and renewable energy projects.[116]

A smart building financing approach for new buildings can differ from those of existing buildings. In the case of Songdo, for example, Gale International, the city's master developer, provided the latest and most advanced BMS technologies for their buildings and accounted for the upfront costs as part of the final property sales price. In addition, via a partnership with Gale International, POSCO, LG-CNS and Cisco, a technology services joint venture has been providing advanced building service platforms and applications that cater to the needs of building occupants (e.g., video-based applications for remote education or healthcare services). The hardware required for these smart solutions (e.g., video teleconferencing capability) have already been embedded in the new buildings, but Gale International and its partners are continuing to develop new platforms/applications (e.g., u-Healthcare, distance learning programs) that can be used by various service providers (e.g., in-home healthcare consultation, language classes). The basic financing approach for these advanced applications are similar to the smart parking funding/revenue model presented in Exhibit B.*2*, where the costs of providing the technologies are recovered through usage fees from building occupants (customers) and/or service providers.

The real benefits of smart city concepts are considered to lie with the full integration of the disparate concepts through a digital Internet backbone/communications network that enables enterprise-level cloud applications and the use of big data. The digital communications network is the costlier item that is often thought to be the roadblock to a full integration effort. Jointly with Cisco, Whitehelm Capital has recently developed a two-phased financing approach that could potentially help overcome such a roadblock.[117]

The Cisco-Whitehelm (C-W) approach is based on Cisco's *Smart LED Solution* that, in addition to energy savings functions, serves as a multi-sensor node network that is capable of capturing and transmitting real-time data for all other city services (e.g. smart parking, smart traffic, smart waste management, citywide Wi-Fi access). In the first "core" phase, the LED solution is combined with the Internet-of-Everything (IoE) digital backbone that relies on wireless

[116] See: http://www.prnewswire.com/news-releases/green-campus-partners-and-citi-launch-financing-solution-to-fund-energy-efficiency-and-renewable-energy-projects-159455125.html

[117] See Whitehelm Capital (2016) for more detailed discussion.

Exhibit B.3: Financing Approaches to Smart Building Concepts (2004-2009)

Smart City Concept		*Upfront Financing*		*Funding/Repayment*		Features/ Representative Financing Examples
		Responsible Party	Financing Instrument	Responsible Party	Repayment Source	
BMS/ BAS/ Energy Savings	Existing Building	Service Provider (ESCos)	Various	Various	Utility Bill Payments/ Cost Savings	Performance contracts; benefits of cost savings can be shared
		Property Owner	Various	Property Owner	Lease Payments	Equipment lease
		Property Owner	Warehouse Credit Facility	Property Owner	Cost Savings	Citi-GCP Warehouse Facility (Revolving Fund)
	New Building	Developer	Various	Property Owner	One-Time Sales Price	Advanced BMS; Songdo (Gale)
Advanced Building Service Platforms/ Applications		Developer	Various	Service Provider/ Property Owner	Usage-Based Fees	Video-Based Education/ Healthcare Services; Songdo (Gale)

mesh network (WMN) with the goal of achieving energy savings as well as laying out the foundation for a fully networked and integrated system down the road. The second "smart" phase entails the realization of the full potential of the system and includes all additional services that can emerge on the IoE/WMN platform, including a myriad yet-to-be-developed smart applications that help enhance city services.[118]

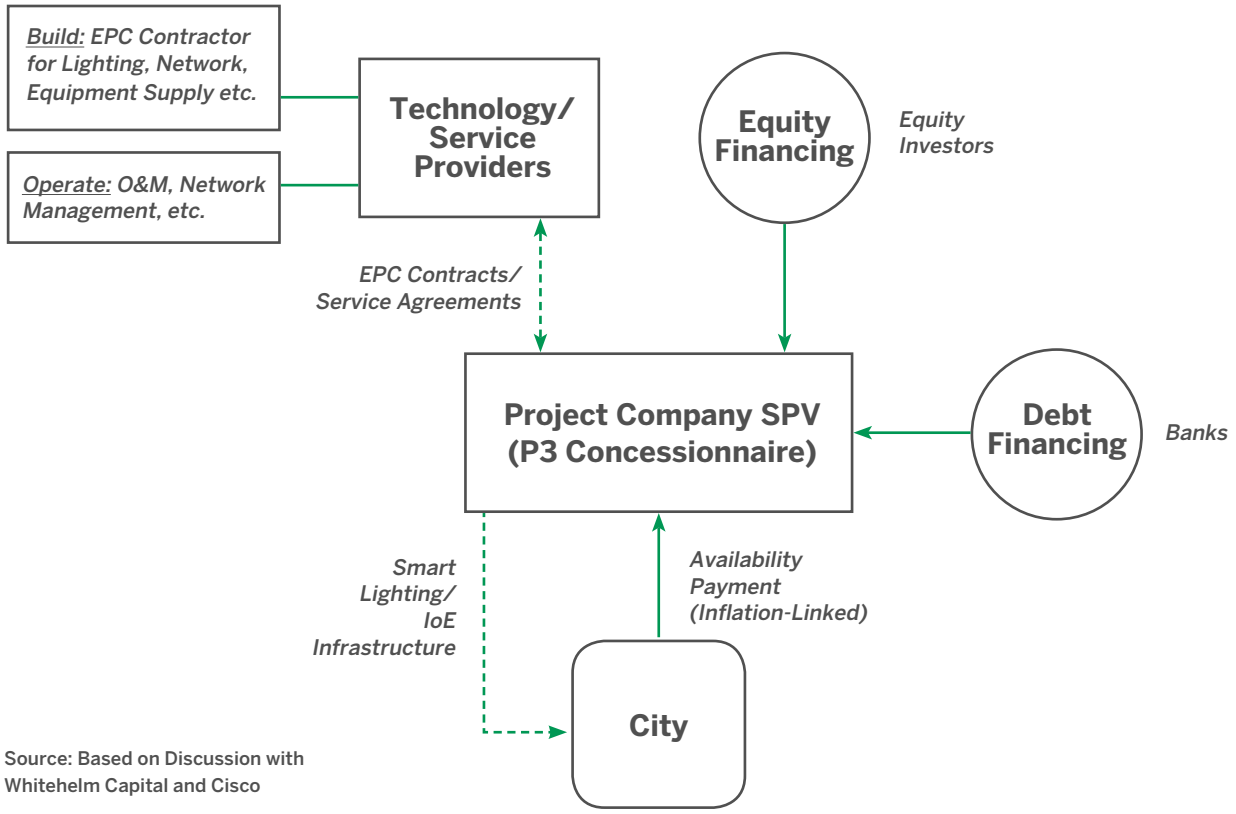
In the C-W approach, financing of the first phase is designed to be largely *cost neutral* by capitalizing on the energy savings of the Smart LED Solution. These energy savings, estimated to provide 10-20% additional savings beyond the 50-70% provided by the basic LED system, are used to help offset the cost of funding the IoE/WMN platform. As covered in Chapter 2, the proposed C-W financing approach for Phase 1 is structured as a P3 concession with availability payments that are inflation-linked. Exhibit B.4 depicts a simplified version of the C-W approach. The financing instrument would be project finance where a project company would be established as an SPV, which will have a direct P3 concession agreement with the city. The process would be streamlined and replicable in the sense that there will be (1) one or more designated equity financiers who can

[118] For example, smart phone apps increased from 550 in 2008 when they were first launched to about 3 million apps that are active in the marketplace as of January 2016. See Whitehelm Capital (2016).

secure sufficient equity capital necessary to leverage and obtain debt financing to pay for both the Smart LED Solution and the IoE/WMN platform and (2) a team of technology and service providers who can deliver EPC (engineering, procurement, and construction) and O&M (operations and maintenance) services through direct contracts or service agreements with the SPV to fulfill any smart technology/service needs that may arise in Phase 2.

For Phase 2, beyond smart lighting, the P3 concession agreement would be extended to cover any new and additional "smart" services that would emerge with the IoE/WMN provision, be they related to parking, traffic, waste management, safety and security, and others that are yet-to-be developed. The C-W financing approach proposes a profit-sharing arrangement for these services anticipated in the future. Exhibit B.5 depicts potential profit-sharing arrangements for Phase 2 for a few notional future applications. Under the proposed approach, any new smart services that may arise would be provided by a team of technology and service providers on behalf of the SPV per the direct service agreements mentioned above. Because the nature of technology/service providers can vary widely (whether they are, for example, service providers and/or mobile apps developers), the nature of the service agreement may vary greatly from one smart city to another or, for that matter, one smart application/service to another. Likewise, the funding/revenue models would also vary for different smart applications/services.

Exhibit B.4: P3 SPV Structure for Smart LED Solution/IoE Infrastructure (Phase 1)

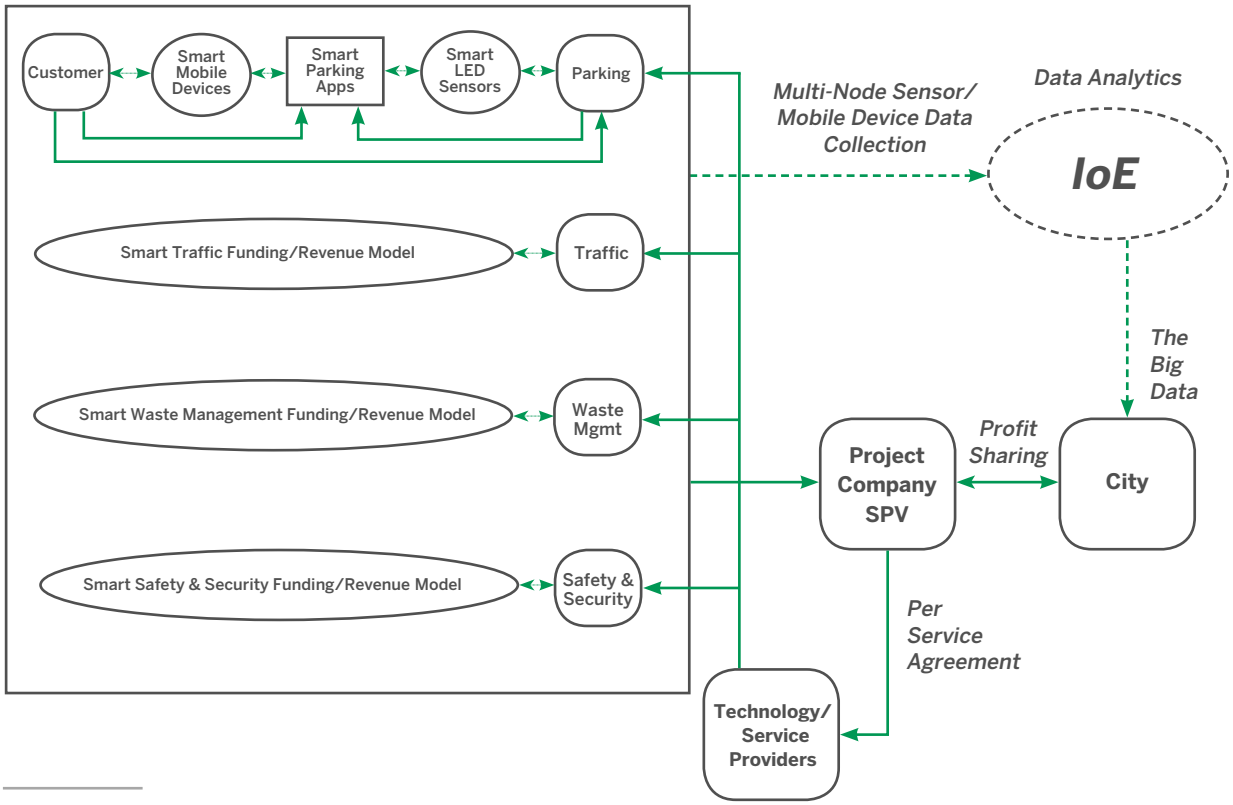


Source: Based on Discussion with Whitehelm Capital and Cisco

In Exhibit B.5, the funding/revenue model presented in Exhibit B.2 is shown for smart parking but similar models need to be developed for other applications. Ultimately, any net revenue that flows out of various service agreements to the SPV would be shared with the city. As the services expand and more data are accumulated, the city would get the full benefit of big data generated from the fully integrated system.

Many cities are evaluating the benefits and potential implementation of the fully networked system and the best strategy to roll out different concepts. Barcelona, for example, was one of the first cities that deployed the IoE/WMN infrastructure early and successfully. According to some estimates, the city has generated as much as $3 billion in value creation because of this investment in smart technology.[119] Other cities are following suit, including the City of Busan in South Korea. Having already gone through the market liberalization path of import substitution economies, Busan has been facing difficult challenges many mature mid-size cities face in producing next generation growth. Along with key major economic initiatives, the smart city program is serving as the basic foundation for triggering this growth. Using some of the financing approaches presented in this Appendix, the city is planning to implement 25 potential applications in the areas of tourism/transportation, safety/security, energy/sustainability, and connected community/citizen engagement (see Box B.1 for more detailed discussion of Busan's smart city implementation).

Exhibit B.5: Potential Cost Sharing Arrangement for Future Smart Services (Phase 2; Notional)



[119] See Whitehelm Capital (2016) for additional discussion on Barcelona case.

Box B.1: A Smart City Case for Busan Metropolitan City, South Korea

With over 3.5 million in population, Busan is a quintessential "mature" mid-size city. Globally, Busan is competing with the Emerging 440 and the rest of the mature mid-size cities for investment capital and human and natural resources. Nationally, Busan has to compete with Seoul and nearby cities like Songdo to obtain the central government's support and to attract major businesses, skilled labor, and foreign investment capital. Locally, Busan's economic sphere of influence is not commensurate with the obsolete jurisdictional boundaries that exist today. Helped along by past central government policies, some of the key residential, commercial, and manufacturing centers that benefit directly from Busan are placed beyond the city boundaries, imposing artificial constraints to the city's growth.

Busan has the same demographic concerns of many mature mid-size cities around the world. The city lost more than 300,000 people to Seoul and other cities in less than 10 years because companies in Busan could not compete with the large "chaebol"[120] companies—located primarily in those cities—preferred by workers. As a result, the birth rate has been declining while the aging population has been growing. The city currently spends more than 35 percent of its budget on welfare, mostly for the elderly.

These challenges and constraints are equally matched by several opportunities and assets working in Busan's favor. Busan is the second largest city in South Korea with a long history, rich and unique culture, and mature businesses. Located at the southeastern tip of the Korean peninsula, the city has long been a major tourist attraction, both domestically and internationally, with its natural coastal terrain and seaside resorts. It also boasts the largest maritime gateway in Korea. The Port of Busan is the fifth busiest container port in the world. The city is also experienced in large-scale developments such as Centum City, an urban enterprise zone converted from a former air base often cited as a successful example of city-led mixed-use developments that generated growth.

[120] *"Chaebol"* is a South Korean form of business conglomerate. They are typically global multinationals owning numerous domestic and international enterprises, controlled by a chairman who has power over all the operations.

An important asset for Busan of today is the newly elected mayor and his administration that maintain a global vision with a can-do mindset. Under the new mayor's leadership, several new initiatives are currently underway to help the city's economy—among others, (a) making Busan an innovative city through the establishment of a new startup ecosystem, (b) building a strong pool of talent and technology base through a new program called TNT2030, (c) establishing a regional R&D powerhouse through the strengthening of local academic institutions, (d) establishing an aggressive global outreach program to create new business ties globally, (e) creating new pillars of growth in six strategic industries, and (f) developing a new airport to enhance global connectivity and generate new investments and jobs.

At the foundation of these initiatives is building a global IoE-based smart city program. A multi-phase rollout of comprehensive smart city programs is currently planned throughout Busan to help facilitate a next generation growth strategy. As a start, a major pilot program is currently underway in the aforementioned Centum City area with 25 distinct smart city concepts under four major themes (see Exhibit B.5).

The pilot program is to be rolled out in phases over a 4-year period from 2015 to 2018 (see Exhibit B.6). The total cost is estimated to be KW860 billion (US$ 72 million), of which KW260 billion (US$22 million) and KW230 billion (US$19 million) are expected to come from the central government and Busan city, respectively (together comprising about 57 percent of the total cost). About KW220 billion (US$18 million) of the remaining (or about 26 percent of the total cost) is expected to be funded through P3 concessions based on build-transfer-lease/build-transfer operate (BTL/BTO) models, and the rest from direct private investment (KW150 billion/US$12.5 million or 17 percent). The basic rationale underlying the overall funding strategy is consistent with the overall financing approach described in this Appendix. The public sector funding from the central government and Busan City is to be used to support the initial capital investment needed for IoE/WMN backbone and integrated operations center. Beyond the public sector funding, a P3 concession model would be central to the delivery of technologies and services and securing the necessary equity and debt capital. P3 concession in turn would be supported by self-sustainable funding/revenue models for specific applications presented in this Appendix, e.g., smart parking and smart building, which in part can be used to repay the initial financing.

Exhibit B.5: Busan Centum City Area Pilot Program—Smart City Major Themes/Concepts

Major Theme	Smart City Concept
Fun and Convenient Tourism/Transportation	1. Location Based Services (LBS) Tour Information 2. Smart Parking 3. Smart Public Transit 4. Smart Event Info Poles 5. Intelligent Traffic Information 6. Citywide Wifi Service for Tourists
Intelligent Safety and Security Infrastructure	7. Missing Children Prevention 8. Smart Safety for Children/Aging 9. Smart Crosswalk 10. Smart LED Lighting 11. Integrated Safety Operations Center 12. Real-Time Evacuation 13. Well-Care for Handicapped 14. Smart LBS
Energy Savings/Smart Green City	15. Smart Home Energy Savings 16. Real-Time Monitor of Water Leakage 17. Smart Energy Management Center 18. Smart Commercial Energy Savings 19. Smart Shared Bikes
Citizen-Driven Leading IoT City	20. Sensor-Based Daily Life 21. Remote Video Education 22. Smart Kindergarten 23. Connected Community 24. Beacon Marketing Platform 25. APT Digital Signage

Exhibit B.6: Busan Centum City Area Pilot Program—Smart City Phased Roll Out

	2015	2016	2017	2018
Phased Smart City Concept Roll Out	Cloud Service Platform			
	Integrated Operations Center			
	Citywide Wifi/IoE Backbone (inc. Smart LED Lighting)			
	Service Applications			
	• Smart Parking • Missing Children Prevention • Smart Safety for Children/Aging • Real-Time Monitor of Water Leakage • Smart Commercial Energy Savings • Remote Video Education • Beacon Marketing Platform	• LBS Tour Information • Smart Event Info Poles • Intelligent Traffic Information • Smart Shared Bikes • Connected Community • APT Digital Signage	• Smart Crosswalk • Real-Time Evacuation • Well-Care for Handicapped • Sensor-Based Daily Life • Smart Kindergarten	• Smart Public Transit • Integrated Safety Operations Center • Smart Home Energy Savings • Smart Energy Management Center
Estimated Cost	KW240 billion (US$20 million)	KW210 billion (US$17.5 million)	KW200 billion (US$17 million)	KW210 billion (US$17.5 million)
Proposed Funding Source	Public Funding: • KW60 billion (Central Govt) Direct Private: • KW20 billion P3 (BTL/BTO): • KW16 billion	Public Funding: • KW70 billion (Central Govt) • KW70 billion (Busan City) Direct Private: • KW30 billion P3 (BTL/BTO): • KW40 billion	Public Funding: • KW70 billion (Central Govt) • KW8 billion (Busan City) Direct Private: • KW5 billion	Public Funding: • KW60 billion (Central Govt) • KW80 billion (Busan City) Direct Private: • KW50 billion P3 (BTL/BTO): • KW20 billion

References

1. AASHTO. "Transportation Funding & Financing." American Association of State Highway and Transportation Officials (AASHTO) Transportation Finance Clearing House. Available at: http://www.transportation-finance.org/funding_financing/.
2. ACG. "Performance of PPPs and Traditional Procurement in Australia, Final Report: Report to Infrastructure Partnerships Australia." The Allen Consulting Group (ACG), November 30, 2007.
3. ADB. "Urban Operational Plan 2012-2020." Asian Development Bank (ADB), 2013
4. Andersson, L. "Finance Cooperation Between Local Authorities in Developing Countries." AB Marten Andersson Productions, 2014a.
5. Andersson, L. "Local Government Finance in Europe—Trends to Create Local Government Funding Agencies." AB Marten Andersson Productions, 2014b.
6. Andersson, L. "What the World Needs Now...is Local Infrastructure Investments: Challenges and Solutions with a Focus on Finance." AB Marten Andersson Productions, 2014c.
7. ASCE, "2013 Report Card for America's Infrastructure." American Society of Civil Engineers (ASCE), 2013. Available at: http://www.infrastructurereportcard.org/.
8. Baird, A.J. and V. Valentine, "Port Privatization in the United Kingdom: Devolution, Port Governance and Port Performance." Research in Transportation Economics, Vol. 17, p. 55-84, 2007.
9. Barber, B. R., "If Mayors Ruled the World: Dysfunctional Nations, Rising Cities." Yale University Press, 2013.
10. Bashmakov, I. et. al. "Policies, Measures, and Instruments." Climate Change 2001: Mitigation, Contribution of Working Group III to the Third Assessment Report of the Intergovernmental Panel on Climate Change, ed. B. Metz; et al. Cambridge University Press, 2001.
11. Bennon, M., A. Monk, and C. Nowacki, "Dutch Pensions Paving the Way for Infrastructure Development." The Journal of Structured Finance, Summer 2015, Vol. 21, No. 2: pp. 45-54.
12. BlackRock, "Build America Bond Special Report.", July 2009.
13. Blanc-Brude, F. "Benchmarking Long-Term Investment in Infrastructure: Objectives, Roadmaps and Recent Progress." EDHEC Risk Institute, June 2014.
14. Blanc-Brude, F., and D. Makovsek. "Construction Risk in Infrastructure Project Finance." Research, EDHEC Risk Institute, February 2013. Available at http://chaire-eppp.org/files_chaire/blanc-brude-makovsek.pdf.
15. Brabham, D. C. "Crowdsourcing as a Model for Problem Solving: An Introduction and Cases." Convergence: The International Journal of Research into New Media Technologies, 2008.

16. Brealey, R., I. Cooper, and M. Habib. "Investment Appraisal in the Public Sector." Oxford Review of Economic Policy, Vol. 13, No. 4, Oxford University Press and the Oxford Review of Economic Policy Limited, 1997.
17. C40 Cities. "Tokyo: City Cap-and-Trade Program." 2013 Climate Leadership Awards, 2013. Available at: http://www.c40.org/2013-close-up/tokyo-closeup.pdf
18. C40 Cities "Shenzhen: Construction of the Carbon Trading Market in Shenzhen." 2014 Climate Leadership Awards, 2014. Available at: http://www.c40.org/profiles/2014-shenzhen-finance
19. C40 Cities. "Johannesburg the First C40 City to Issue Green City Bond." C40 Blog, June 12, 2014. Available at: http://www.c40.org/blog_posts/johannesburg-the-first-c40-city-to-issue-green-city-bond
20. CBO/JCT, "Subsidizing Infrastructure Investment with Tax-Preferred Bonds." A Joint Congressional Budget Office/Joint Committee on Taxation (CB)/JCT) Study, October 2009.
21. Center for American Progress. Social Impact Bond Series. Available at: https://www.americanprogress.org/series/social-impact-bonds/view/.
22. Cleveland, C. and M. Ullman. "LED Streetlights Make Dollars and Sense, Asheville, NC." Asheville LED Street Light Case Study, prepared by USDN Innovation Working Group and City of Asheville Sustainability Program, May 31, 2013.
23. Cho, I. D. "ICT Changes the Ways We Can Deliver Welfare Services." New Cities Foundation blog posted in June 4, 2015. Available at: http://www.newcitiesfoundation.org/ict-changes-the-ways-we-can-deliver-welfare-services/
24. Davies, Rodrigo. "Civic Crowdfunding: Participatory Communities, Entrepreneurs and the Political Economy of Place." 2014.
25. De Freitas, J C. and M. Amado. "Crowdfunding in Urban Planning: Opportunities and Obstacles." At home on the housing market: RC43 conference book of proceedings, ed. R Ronald. Centre for Urban Studies, University of Amsterdam, 2013.
26. Della Croce, R. "Trends in Large Pension Fund Investment in Infrastructure." OECD Working Papers on Finance, Insurance and Private Pensions, No. 29, Organization for Economic Cooperation and Development (OECD), November 2012.
27. Dixon, A. and A. Monk. "Financializing Development: Toward a Sympathetic Critique of Sovereign Development Funds." August 2014.
28. Dobbs, R., J. Remes, and J. R. Woetzel, "Strengthening the foundations of emerging cities." McKinsey on Society, McKinsey & Company, 2012.
29. Economist. "Urban Infrastructure Insights 2015." The Economist Intelligent Unit, sponsored by FCC Citizen Services, 2015.
30. EPEC. "State Guarantees in PPPs: A Guide to Better Evaluation, Design, Iplemetation and Management." European PPP Expertise Center (EPEC), May 2011.

31. EPEC. "Financing PPPs with Project Bonds: Issues for Public Procuring Authorities." European PPP Expertise Center (EPEC), October 2012.
32. Farajian, M., A. Lauzon, and Q. Cui. "An Introduction to a Crowdfunded Public-Private Partnership Model in the U.S." Transportation Research Record: Journal of the Transportation Research Board, No. 2530, Transportation Research Board, Washington D. C., 2015.
33. Farmer, L. "Value Capture: Route 28 Transportation Improvement District." Virginia Department of Transportation Financial Planning Division, January 2015.
34. Farrugia, C., T. Reynolds, R. Orr, "Public-Private Partnership Agencies: A Global Perspective." Collaboratory For Research in Global Projects (CRGP) Working Paper No. 39, Stanford University, August 2008.
35. FER, "Statement on Accounting for the Cost of Government Credit Assistance." Financial Economic Roundtable (FER), Wharton Financial Institutions Center, University of Pennsylvania, October 16, 2012.
36. FMDV. "Resolutions Europe: Local Innovations to Finance Cities and Regions." Regional Publications Context and Case Studies, Fonds Mondial pour le Développement des Villes (FMDV, Global Fund for Cities Development), July 2014.
37. Future Cities Catapult. "Urban Innovation and Investment: The Role of International Financial Institutions and Development Banks." December 2014.
38. Gasparro, K. "Funding Municipal Infrastructure: Integrating Project Finance and Crowdfunding." Stanford University Global Project Center, Research funded by National Science Foundation Graduate Research Fellowship Program (Grant No. DGE-114747), 2015.
39. Gerdes, J. "Los Angeles Completes World's Largest LED Street Light Retrofit." Forbes/Green Tech, July 31, 2013. Available at: http://www.forbes.com/sites/justingerdes/2013/07/31/los-angeles-completes-worlds-largest-led-street-light-retrofit/#29f2e08b4b54
40. Gillen, D., "Airport Governance and Regulation: the Evolution over Three Decades of Aviation System Reform." Sauder School of Business, University of British Columbia, October 2008.
41. Gillen, D. and H.M. Niemeier. "Airport Economics, Policy and Management: The European Union." Comparative Political Economy and Infrastructure Performance : The Case of Airports, Madrid, September 18-19, 2006.
42. Hargreaves, S. "L.A. to control its street lights with a single laptop." CNN Money, April 10, 2015. Available at: http://money.cnn.com/2015/04/10/technology/l-a-lights/
43. HMT, "PFI: Meeting the Investment Challenge," The U.K. Her Majesty's Treasury (HMT), July 2003.
44. HMT. "PFI: Strengthening Long-Term Partnership," The U.K. Her Majesty's Treasury (HMT), March 2006.
45. HMT. "Infrastructure Procurement: Delivering Long-Term Value." Her Majesty's Treasury (HMT), March 2008.

46. HMT, "Reforms of the Private Finance Initiative," The U.K. Her Majesty's Treasury (HMT), December 2011.
47. IIWIR, "Sold to the Highest Bidder." Infrastructure Investor Week In Review (IIWIR), May 1, 2014.
48. IIWIR, "Take Nothing for Granted." Infrastructure Investor Week In Review (IIWIR), July 24, 2014.
49. IIWIR, "Australia Recycled." Infrastructure Investor Week In Review (IIWIR), August 1, 2014.
50. Inderst, G. "Private Infrastructure Finance and Investment in Europe." European Investment Bank (EIB) Working Paper, 2013.
51. Infrastructure Australia. "Australia's Public Infrastructure—Part of the Answer to Removing the Infrastructure Deficit." Infrastructure Australia, Australian Government, December 2012.
52. Infrastructure Australia. "Australia's Public Infrastructure—Update Paper: Balance Sheet Impacts of Sell to Build." Infrastructure Australia, Australian Government, December 2013.
53. JCT, "The Federal Revenue Effects of Tax-Exempt and Direct-Pay Tax Credit Bond Provisions." Prepared by the Staff of the Joint Committee on Taxation (JCT), JCX-60-12, July 16, 2012.
54. Kaufmann, D. Kraay, and M. Mastruzzi. "Governance Matters V: Aggregate and Individual Governance Indicators for 1996-2005." The World Bank, September 2006.
55. Kessides, I.N. "Reforming Infrastructure: Privatization, Regulation, and Competition." A World Bank Policy Research Report, 2004 (co-publication with Oxford University Press).
56. Kidney, S. "Just Out: First emerging market green city bond...City of Johannesburg Green Bond, approx R1.5bn ($139m), 1.5x oversubscribed." Climate Bonds Initiative, June 5, 2014. Available at: https://www.climatebonds.net/2014/06/just-out-first-emerging-market-green-city-bond-city-johannesburg-green-bond-approx-r15bn
57. Kikeri, S. and J. Nellis. "An Assessment of Privatization." The World Bank Research Observer, Vol. 19, No. 1, Spring 2004.
58. Kim, J. "Understanding and Mitigating Political Risks of Public-Private Partnerships in U.S. Infrastructure." Working Paper, Stanford Global Projects Center, May 2014. Available at: http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2431915.
59. Kirk, R.S., and W. J. Mallet. "Funding and Financing Highways and Public Transportation." Congressional Research Service (CRS) Report, September 23, 2013.
60. Knight, E. and R. Sharma. "Retooling In-House Investment Team Inside Institutional Investors." What a CAIA Member Should Know, Alternative Investment Analyst Review, 2013.
61. KPMG International. "Sustainable Insight: Gearing up for green bonds." 2015. Available at: https://www.kpmg.com/Global/en/IssuesAndInsights/ArticlesPublications/sustainable-insight/Documents/gearing-up-for-green-bonds-v2.pdf
62. KPMG, "Linking Cities to Finance: Overcoming Bottlenecks to Financing Strategic Urban Infastructure Investments." commissioned by Cities Development Initiative for Asia (CDIA) and InWent, September 27-28, 2010, Shanghai, China.
63. Lazo, A. "How Cap-and-Trade Is Working in California." The Wall Street Journal, September

28, 2014. Avaliable at: http://www.wsj.com/articles/how-cap-and-trade-is-working-in-california-1411937795.

64. Long Finance. "Financing the Transition: Sustainable Infrastructure in Cities." A Long Finance report prepared by Z/Yen Group and commissioned by WWF, March 2015.
65. Lucas, D., "Valuation of Government Policies and Projects." Annual Review of Financial Economics, Vol. 4, 2012.
66. Lucas, D., "Evaluating the Cost of Government Credit Support: The OECD Context." Economic Policy, July 2014. Printed in Great Britain,
67. Lucas, D., and D. Moore, "Guaranteed versus Direct Lending: The Case of Student Loans (Chapter 7)." Measuring and Managing Federal Financial Risk, University of Chicago Press, February 2010a, ISBN 0-226-49658-9. Available at http://www.nber.org/chapters/c3038.
68. Lucas, D., and M. Phaup, "The Cost of Risk to the Government and Its Implications for Federal Budgeting (Chapter 3)." Measuring and Managing Federal Financial Risk, University of Chicago Press, February 2010b, ISBN 0-226-49658-9. Available at http://www.nber.org/chapters/c3039.
69. Macomber, J.D. "The Future of Cities Depends on Innovative Financing." Havard Business Review, January 11, 2016. Available at: https://hbr.org/2016/01/the-future-of-cities-depends-on-innovative-financing
70. Manchanda, K., and P. Muralidharan, P. "Crowdfunding: A New Paradigm in Start-Up Financing." Global Conference on Business and Finance Proceedings, Volume 9, Number 1, 2014.
71. Mansour, A. and H. Nadji. "U.S. Infrastructure Privatization and Public Policy Issues." RREEF Research, September 2006.
72. Mansour, A. and H. Nadji. "Performing Characteristics of Infrastructure Investment," RREEF Research, August 2007.
73. McKinsey, "A Hidden Roadblock in Public Infrastructure Projects." Corporate Finance Practice, McKinsey & Company, 2015.
74. MGI, "Urban World: Mapping the Economic Power of Cities." McKinsey Global Institute (MGI), McKinsey & Company, March 2011.
75. MGI, "Urban World: Cities and the Rise of the Consuming Class." McKinsey Global Institute (MGI), McKinsey & Company, June 2012.
76. MGI/MIP, "Infrastructure Productivity: How to Save $1 Trillion a Year." McKinsey Global Institute/McKinsey Infrastructure Practice (MGI/MIP), McKinsey & Company, January 2013.
77. Minred, B.S., A.B. Walsh, J. Pass, A. Li, C. Randall, D.A. Stone, and P. Hollowell. "Finance:: Relative Value and Tight Supply." Municipal Market Outlook, Guggenheim Investments, May 2014. Available at https://issuu.com/guggenheimpartners/docs/may_2014_municipal_market_outlook

78. NSTPRSC. "Transportation for Tomorrow." Report of the U.S. National Surface Transportation Policy and Revenue Study Commission (NSTPRSC) (per Section 1909 of SAFETEA-LU), December 2007.
79. NSW State. "Final Report of the Special Commission of Inquiry into the Electricity Transactions." With a recommendation under s. 10(3) of the Special Commissions of Inquiry Act 1983 that the report be made public, State of New South Wales (NSW) through the Special Commission, October 2011.
80. O'Connor, W. "Los Angeles Has Swapped Out 140,000 Street Lights for Highly Efficient LEDS." The Daily Beast/Light Switch, June 20, 2013. Available at: http://www.thedailybeast.com/articles/2013/06/20/los-angeles-has-swapped-out-140-000-street-lights-for-highly-efficient-leds.html
81. OECD. "Infrastructure to 2030, Mapping Policy for Electricity, Water and Transport (Volume 2)." Organization for Economic Cooperation and Development (OECD), 2007a.
82. OECD. "Investment Strategies and Financial Tools for Local Development." Edited by Greg Clark and Debra Mountford, Organization for Economic Cooperation and Development (OECD), Local Economic and Employment Development (LEED), 2007b.
83. OECD. "Dedicated Public-Private Partnership Units: Survey of Institutional and Governance Structure." Organization for Economic Cooperation and Development (OECD), 2010.
84. OECD. "Pension Funds Investment in Infrastructure: A Survey." International Futures Programme—Project on Strategic transport Infrastructure to 2030, Organization for Economic Cooperation and Development (OECD), September 2011.
85. Orr, R.J. and B. Metzger. "General Counsel's Roundtable: Legacy of Failed Projects." The Collaboratory for Research on Global Projects (CRGP) Working Paper Series 1-49, Stanford University, 2005.
86. Oum, T. H., J. Yun, and C. Yu. "Ownership Forms Matter for Airport Efficiency: A Stochastic Frontier Investigation of Worldwide Airports." Journal of Urban Economics 64, p. 422-435, 2008.
87. Pew, "The Fiscal Health of State Pension Plans: Funding Gap Continues to Grow." A Fact sheet from The Pew Charitable Trusts (Pew), March 2014.
88. Pigeon, M., D. McDonald, O. Hoedemand, and S. Kishimoto. "Remunicipalization: Putting Water Back into Public Hands." published by Transnational Institute, Amsterdam, March 2012. (ISBN 978-94-6190-831-5)
89. Poole, R.W. "Annual Privatization Report 2015: Transportation Finance." Edited by Leonard Gilroy, May 2015.
90. Reed, D. "US cities turn could turn to "community mini bonds" to fund infrastructure projects." CityMetric, September 29, 2014. Available at: http://www.citymetric.com/politics/us-cities-turn-could-turn-community-mini-bonds-fund-infrastructure-projects-341
91. Reindl, J.C. "Detroit streetlight repairs ahead of schedule." Detroit Free Press,

December 4, 2014. Available at: http://www.freep.com/story/news/local/michigan/detroit/2014/12/04/new-streetlights-detroit-progress/19866749/

92. Ross, B. :Financial Benefits of Using Crod-financing for a P3." December 20 2015. Available at: https://www.linkedin.com/pulse/financial-benefits-using-crowd-financing-p3-brian-ross
93. RREEF. "A Compelling Investment Opportunity: The Case for Global Listed Infrastructure Revisited." RREEF America LLC, July 2011.
94. Rybeck, R. "Just Economics—Value Capture Methods: Overview." Transportation Research Board (TRB) Annual Meeting, January 2015.
95. Samuel, P. "The Role of Tolls in Financing 21st Century Highways." Policy Study 359, Reason Foundation, May 2007.
96. Sandroni, P. "A New Financial Instrument of Value Capture in Sao Paulo: Certificates of Additional Construction Potential." Municipal Revenues and Land Policies, Proceedings of the 2009 Land Policy Conference, edited by G. Ingram and Y. Hong, Lincoln Institute of Land Policy, 2010.
97. Schmidt, J. "Opinion: A Sane Way to Upgrade Bridges, Ports and Transit." The Wall Street Journal, February 2, 2015.
98. Serva, L. "How Sao Paolo uses "value capture" to raise billions for infrastructure." Cityscope, May 22, 2014. Available at: http://citiscope.org/story/2014/how-sao-paulo-uses-value-capture-raise-billions-infrastructure
99. Shoup, D. "Crusing for Parking." University of California, Los Angeles (UCLA), 2007. Available at: http://shoup.bol.ucla.edu/CruisingForParkingAccess.pdf
100. Singer, N. "Mission Control, Built for Cities." The New York Times/Business Day, March 3, 2012. Available at: http://www.nytimes.com/2012/03/04/business/ibm-takes-smarter-cities-concept-to-rio-de-janeiro.html
101. Smart Cities Council. "Smart Cities Financing Guide." Expert analysis of 28 municipal finance tools for city leaders investing in the future, Developed by the Center for Urban Innovations at Arizona State University, 2014.
102. SMH, "Mike Baird's Electricity Privatization Bills Pass NSW Parliament." The Sydney Morning Herald (SMH), June 3, 2015.
103. Smith, S. "Environmentally Related Taxes and Tradable Permit Systems in Practice." Center for Tax Policy and Administration, OECD Environment Directorate, June 11, 2008
104. Stephens, A. "Crowdfunding Fans Are Crazy About Denver's Mini-Bonds." Next City, September 12, 2014. Available at: https://nextcity.org/daily/entry/denver-mini-bonds-500-crowdfunding-cities.
105. Swiss Re. "Infrastructure Investing: It Matters." published jointly by Swiss Re and Institute of International Finance, 2014.
106. Swope C. and T. Kasse. "How Dakar (almost) got its first municipal bond to market."

Cityscope, February 19, 2015. Available at: http://citiscope.org/story/2015/how-dakar-almost-got-its-first-municipal-bond-market.

107. TxDOT. "Innovative Funding Strategies: How value capture methods have become part of the strategy for innovative funding solutions." Texas Depart of Transportation (TxDOT), 2013 (?).

108. U.S. Treasury, "Treasury Analysis of Build America Bonds Issuance and Savings." The U.S. Depart of the Treasury, May 16, 2011.

109. Von Gunten, D. and S. Mills. "Fianancing Tomorrow's Cities: Meta Analysis." Z/Yen Group and City of London Corporation, July 2014.

110. WEF. "Global Agenda—Accelerating Infrastructure Delivery: New Evidence from International Financial Institutions." World Economic Forum (WEF), April 2014.

111. WFAF. "Deterioration of Monoline Insurance Companies and the Repercussions for Municipal Bonds." Wells Fargo Advantage Funds (WFAF), 2008. Available at: https://www.wellsfargofunds.com/pdf/whitepapers/monoline_insurance_muni_bonds.pdf.

112. Whitehelm Capital. "Smart Cities: The Cisco-Whitehelm Capital Financing Model." January 2016 (draft, unpublished).

113. The World Bank. "Public-Private Partnership Units: Lessons for Their Design and Use in Infrastructure." The World Bank Public-Private Infrastructure Advisory Facility (PPIAF), October 2007.

114. The World Bank. "Overcoming Constraints to the Financing of Infrastructure—Success Stories and Lessons Learned: Country, Sector and Project Examples of Overcoming Constraints to the Financing of Infrastructure." prepared by the Staff of the World Bank Group for the G20 Investment and Infrastructure Working Group, February 2014.

115. Wyman, O. "Funding the Future: Insurers' Role as Institutional Investors." Insurance Europe, June 2013.

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