

AN ECONOMIC FRAMEWORK FOR COMPARING PUBLIC-PRIVATE PARTNERSHIPS AND
CONVENTIONAL PROCUREMENT

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Abstract

In spite of its potential to benefit taxpayers, procurement of infrastructure through a public-private partnership (PPP) can be complex and difficult to structure. Indeed, partly reflecting these challenges, experience with PPPs in the United States is limited, which may be self-reinforcing by deterring public sponsors not familiar with PPPs from ever considering one to procure infrastructure assets.

This discussion paper aims to demystify infrastructure PPPs by explicitly describing the conditions under which a PPP can be a better choice for procurement over conventional methods from the perspective of how economists typically look at these issues. No single factor definitively informs whether a PPP is likely to yield higher benefits to society and the taxpayer than conventional procurement. Instead, a balance of elements – the project’s characteristics, the economic environment in which the project is being developed, and the ability of the project sponsor to take certain actions – jointly determines whether a PPP’s delivery and operation of the project is mutually beneficial to both the public and private sectors.

This paper also describes important steps for a government sponsor to take before a project being procured through a PPP is started. An essential prerequisite to achieving the potential net benefits of a PPP is for the government sponsor’s to fully understand the project’s characteristics and economic environment before initiating the procurement. In addition, successful PPP implementation requires executing a set of complementary best practices before the project gets underway. Not taking these steps may lead to higher costs, failure to meet performance targets later in the project’s life cycle, and a misallocation of scarce public resources.

I. Introduction

Infrastructure investment can play a vital role supporting economic growth and prosperity in America.¹ The challenges of paying for and managing infrastructure investment, on top of grappling with tighter budgets at every level of government, mean that the development of sound innovative financing methods is more important than ever. The Administration has embraced the opportunity to encourage such development through the Build America Investment Initiative (BAII), which is designed to expand private investment and public-private collaboration in major infrastructure sectors. Among other activities, the Initiative strives to raise awareness regarding the appropriate use of well-designed public-private partnerships (PPPs) for providing and managing infrastructure assets and associated services that have traditionally been provided by the public sector.² A major Initiative milestone occurred when the President signed the Fixing America's Surface Transportation Act (FAST) last summer; FAST established a National Surface Transportation and Innovative Finance Bureau at the Department of Transportation to collaborate with the public and private sectors in the development of best practices for innovative financing and PPPs.

Under a PPP, the government contracts with a private firm to take on a set of roles for an infrastructure asset involving its design, financing, construction, operation, and maintenance (or any subset of these roles) on behalf of the public sector. The gains potentially realized by society from procuring an infrastructure asset through a PPP rather than through a “conventional procurement” are induced by the transfer of responsibility for multiple project phases to a single private-sector entity. These potential gains include cost savings, higher service quality, and accelerated project delivery.

In spite of this promise, PPP procurement may be underused because it can be complex and difficult to structure. One complication is that the procurement must allow for joint benefits to the public and private sectors while also supporting the level of infrastructure investment that most benefits society and the economy. Moreover, given the robust municipal bond market in the United States, experience with PPPs in the United States is thus far limited. As a result, many public sponsors are not yet comfortable with assessing the relative benefits of PPP alternatives versus conventional procurement. Indeed, limited experience with PPPs – and attendant lack of knowledge about PPPs – may deter public sponsors from ever considering one to procure infrastructure assets.

The purpose of this discussion paper is to help fill this gap in knowledge by explicitly describing the conditions under which a PPP can be a better choice for procurement over conventional

¹ This paper was authored by Jane Dokko, Owen Kearney, and Neal Stolleman.

² See, for example, U.S. Department of the Treasury. Office of Economic Policy. 2015. *Expanding the Market for Infrastructure Public-Private Partnerships: Alternative Risk and Profit Sharing Approaches to Align Sponsor and Investor Interests*.

<https://www.treasury.gov/connect/blog/Documents/Treasury%20Infrastructure%20White%20Paper%20042215.pdf> (accessed April 5, 2016); and U.S. Department of Transportation. Federal Highway Administration. 2016. *Successful Practices for P3s: A review of what works when delivering transportation via public-private partnerships*. https://www.transportation.gov/sites/dot.gov/files/docs/P3_Successful_Practices_Final_BAH.PDF (accessed April 5, 2016).

methods using an organizing framework based on of how economists typically evaluate these issues. The target audience for this discussion is those in state and local government who may be interested in PPP procurement but who are less familiar with this form of procurement of public infrastructure. However, even more-experienced officials may find that reviewing this document will sharpen their decision-making. The discussion assumes that the project underlying the procurement decision has a positive economic rate of return that makes acquiring the infrastructure asset worthwhile but there is uncertainty as to whether a PPP or conventional procurement yields higher net benefits to society.

In short, a balance of elements – the project’s characteristics, the economic environment in which the project is being developed, and the ability of the project sponsor to take certain actions – jointly determines whether a PPP can deliver and operate a project that yields higher social welfare³ than would have been the case under conventional procurement. In other words, no one single factor informs whether a project yields a higher net social benefit as a PPP than under conventional provision, while providing a competitive rate of return for the private partner.

This paper also describes important steps for a public sponsor to take before a project being procured through a PPP is started. An essential prerequisite to achieving the potential net benefits of a PPP is for the public sponsor to fully understand a project’s characteristics and economic environment before initiating either type of procurement. In addition, successful PPP implementation requires executing a set of complementary “best practices” before the project gets underway.

Section II provides background information on conventional procurement and PPPs while Sections III describes the attributes of a project and the economic environment that would make an infrastructure project amenable to provision via PPP. Section IV discusses the best practices that maximize the net benefits of a PPP, highlighting that the public sponsor should determine its capability to execute and enforce these procedures when choosing between conventional procurement and a PPP.⁴

³ The term “social welfare” is a concept used in economics to mean the difference between the value consumers place on the infrastructure service and the resource costs of providing the service (which reflect the opportunity cost of not using these resources in their best alternative use elsewhere in the economy). There are two subparts to the concept: (1) the difference between the value consumers place on the service and what they have to pay to receive it, called “consumer surplus”, and (2) the difference between the revenue received by the infrastructure service provider and its incremental costs, called “producer surplus”. The value consumers place on the service reflects both its basic characteristics and quality level initially written into the contract, plus enhancements to quality that occur due to implementation of technical innovations after the project gets underway. When we refer to the “benefits of quality,” we mean the impact of new innovations on the value consumers place on the service, and their consumer surplus, but will not explicitly mention these terms.

⁴ Many topics are outside the scope of this note but are nonetheless important. Such topics include the process by which enabling legislation for PPPs is designed and implemented, functions and responsibilities of centralized PPP units, details of setting up a PPP project management office, the risk management and risk analysis process, and conducting a value-for-money analysis. For resources on these and other related topics, see U.S. Department of Transportation. Federal Highway Administration. 2016. *Successful Practices for P3s: A review of what works when delivering transportation via public-private partnerships*. https://www.transportation.gov/sites/dot.gov/files/docs/P3_Successful_Practices_Final_BAH.PDF (accessed April 6, 2016); and Virginia Department of Transportation. Office of Transportation Public-Private Partnerships. 2011. *PPTA Value for Money Guidance*. http://www.virginiadot.org/office_of_transportation_public-

II. PPPs and Conventional Procurement: Evaluating Infrastructure Procurement Alternatives

In the United States, publicly owned infrastructure assets are typically designed, constructed, operated, and maintained through a conventional procurement, in which the government owns the asset but the sponsoring agency separately contracts for each service, often from different private firms.⁵ With competitive bidding, this approach allows the public sector to have qualified private firms fulfill the requirements of various project phases; however, contracted parties have very limited incentives to minimize lifetime project costs and instead will minimize only those costs that they incur during the respective single phases in which they are involved. Under conventional procurement, the public sponsor retains all revenue streams (net of project costs) and has direct control over most aspects of the project (subject to its budgetary constraints); the sponsor also assumes most of the project risks.

By contrast, under a PPP, the government contracts with a single private entity (generally structured as a special purpose vehicle, or SPV)⁶ to complete, over a period of time that typically spans decades, multiple stages of a project: design, construction, operations and maintenance (O&M), and decommissioning. Depending on how the PPP is structured, the private partner may also be responsible for financing the project, in which case a mix of debt and equity investors will participate in the project over its life-cycle. In exchange for assuming these responsibilities and risks, the SPV will receive a stream of revenue during the life of the contract, where the revenue stream typically takes the form of either user fees that the SPV collects directly from consumers of the infrastructure service, or availability payments, which are fixed periodic payments that the government pays to the private partner as long as performance, safety and quality standards are met, regardless of usage.⁷ These arrangements are not monolithic – PPPs can vary in the extent to which they transfer responsibilities from the public to the private sector. Realizing the lower overall costs and higher quality from an infrastructure asset procured as a PPP will depend on both the specific attributes of the project and the ability of the public sponsor to take certain actions.

[private_partnerships/resources/VDOT%20VfM%20guidance%20document_final_20110404.pdf](#) (accessed April 6, 2016); Virginia Department of Transportation. Office of Transportation Public-Private Partnerships. 2011. *PPTA Risk Analysis Guidance*. http://www.p3virginia.org/wp-content/uploads/2015/03/PPTA-Risk-Guidance-Documents_9.30.2011_Old-Version.pdf (accessed April 6, 2016); PPP Canada. 2012-2013. *Annual Report – Delivering Value for Taxpayers*. <http://www.p3canada.ca/~media/english/annual-reports/files/2012-2013%20annual%20report.pdf>; and World Economic Forum. 2013. *Strategic Infrastructure Steps to Prepare and Accelerate Public-Private Partnerships*. http://www3.weforum.org/docs/AF13/WEF_AF13_Strategic_Infrastructure_Initiative.pdf (accessed April 6, 2016).

⁵ In some cases, the responsibility for operating and maintaining the infrastructure asset may reside with a different government agency than the one that contracts for its design and construction.

⁶ We will also sometimes refer to this entity as a consortium or concessionaire. The private partner establishes an organization called a special purpose vehicle (SPV) for the single PPP transaction, the operations of which are limited to construction, financing, and operation of the infrastructure asset under the PPP contract. In this paper we will use the term concessionaire and PPP interchangeably.

⁷ See page 2 of Engel, Eduardo, Ronald D. Fischer, and Alexander Galetovic. *The Economics of Public-Private Partnerships*. New York: Cambridge University Press, 2014.

Regardless of the method of procurement chosen – conventional or PPP – an infrastructure asset still must ultimately be funded by a combination of tax revenue and user fees. PPP procurement is not a funding mechanism for public infrastructure, but a financing tool: as stated above, the private entity requires a revenue stream in order to provide and operate the infrastructure asset under a PPP, either from direct payments to the PPP by the sponsoring government, or from user fees collected by the concessionaire⁸ that the sponsoring government would otherwise have collected.⁹ Conventional procurement relies on the same sources of funding. In the United States, the majority of publicly owned infrastructure assets are currently financed by (1) federal grants and direct loans, federal loan guarantees, state and local expenditures, and general obligation bonds, and are therefore ultimately funded by tax revenues; and (2) revenue bonds backed by user fees, such as tolls, fees and charges, generated by enterprise systems such as toll roads, water and sewer systems, airports and public power utilities.

When a PPP either lowers the costs incurred over the life of the project (while maintaining quality standards) or raises quality (without offsetting increases in cost), a PPP may be a more suitable form of procurement than conventional methods. The chief mechanism for inducing cost savings in a PPP is “bundling,” or the transfer of responsibility for several distinct project stages by the public sector to a single private sector entity.^{10,11} Bundling may encourage cost-savings in at least three important ways. First, it provides incentives to the private partner to minimize costs across project phases by, for example, making investment choices in the design or construction phase that may lower costs in the O&M phase. The incentive to minimize life-cycle costs arises because the PPP contract both holds the private partner responsible for paying the unknown future costs of completing various project phases and endows the private partner with full decision-making authority and control of the asset in completing those phases. These incentives are absent under conventional procurement, where a single party does not have responsibility for more than one stage of the project and taxpayers bear most, but not all of the

⁸ The term concessionaire refers to the case where a public authority assigns to a private company the right to provide a monopoly service by charging users, usually through making investments at its own risk. This means the private party is offering a service directly to the public and taking end user risk. In this paper, we will sometimes use the term concessionaire and PPP interchangeably because a contract may allow for the private firm to receive a mix of payments from both end users and the government. See Public Services International Research Unit (PSIRU). Terminology of Public-Private Partnerships (PPPs). March 2003. <http://ppp.worldbank.org/public-private-partnership/overview/what-are-public-private-partnerships>.

⁹ User fees set by the concessionaire would have to cover the private firm’s rate of return on capital, which are likely to be higher than the public sector’s financing costs, as discussed below. However, a well-structured PPP will have lower life-cycle costs than a conventionally procured project, mitigating the need for higher fees.

¹⁰ The term “bundling” can also have another meaning in the context of PPPs: “...contracting with one partner to provide several small-scale PPP projects in order to reduce the length of the procurement process as well as transaction costs.” Here, we use “bundling” to mean the transfer of multiple types of project stages to the private sector. See page 17 of Deloitte Research. “*Closing America’s Infrastructure Gap: The Role of Public-Private Partnerships*,” 2007. http://worldbank.mrooms.net/file.php/251/docs/optional_readings/Closing_America_s_Infrastructure_Gap.pdf (accessed April 5, 2016).

¹¹ Specifically, bundling can result in improved quality of the initial asset and improved service quality during its useful life. In principle, the government sponsor can set up a project through “public bundling”, analogous to a PPP. However, this approach tends to weaken incentives to lower the project’s life-cycle costs. See Engel, Eduardo, Ronald D. Fischer, and Alexander Galetovic. “*Public-Private Partnerships: When and How*.” Working paper, Yale University (2008).

project's risks, including those the government may not be well-positioned to influence.¹² Second, bundling may lower the public sponsor's costs of monitoring the private entity's actions. Whereas conventional procurement requires contractual relationships with each one of multiple private entities, a PPP requires fewer contracts that, if the fixed costs of structuring and enforcing these contracts are large, may lead to lower public sector monitoring costs. Finally, bundling can also reduce costs through accelerated project delivery; if the private partner is responsible for the construction, operation, *and* financing of the project, and receives a share of project revenues, then it will have increased incentives to complete construction and begin operation as early as possible in order to start providing a given return to both debt and equity investors.

Generally, the incentive for generating cost savings is strengthened as the number of related phases that can be appropriately transferred to the private partner increases, and as the relationships between project phases become more complex. For example, the "design-build" (DB) contract transfers both the design and construction phases, which encourages the private partner to design the project so as to minimize building costs and the likelihood of design flaws. The "design-build-operate-maintain" (DBOM) model additionally encourages the private partner to select building methods and materials that minimize O&M costs, while the "design-build-finance-operate-maintain" (DBFOM) structure also provides incentive for the private partner to reach the operations phase as early as possible to begin paying back investors.

Whether a government sponsor selects provision via conventional procurement or PPP, the project will incur costs and generate benefits.¹³ Conceptually, costs include, but are not limited to: material, labor, and equipment costs for installing initial capacity, O&M expenses, investments to improve cost efficiency and/or quality, and financing costs.¹⁴ The benefits of a well-structured PPP, though more difficult to measure, are at least as large as what users in the aggregate would be willing to pay to use the infrastructure asset. The preferred provisioning mechanism is the one that is expected to yield a higher stream of (discounted) benefits net of the (discounted) stream of costs for the project. As we will discuss further, the relative magnitudes of these costs and benefits will depend on the project's characteristics and economic environment and the actions of the public sponsor.

¹² For discussions of why the government might have difficulty achieving cost savings across project phases on its own, See Hall, John. "Private Opportunity, Public Benefit?" *Fiscal Studies* 19, no. 2 (1998): 121-140; and Engel, Eduardo, Ronald D. Fischer, and Alexander Galetovic. "*Public-Private Partnerships: When and How.*" Working paper, Yale University (2008). <http://www.econ.uchile.cl/uploads/publicacion/c9b9ea69d84d4c93714c2d3b2d5982a5ca0a67d7.pdf> (accessed April 5, 2016).

¹³ It is also possible for an infrastructure asset to be provided and operated solely by the private sector, i.e. complete privatization, but we do not explore this case.

¹⁴ An important aspect of PPP procurement is that financing and transaction costs are higher compared to conventional procurement because projects cannot borrow as inexpensively as city or state governments and because technical expertise is required to write and negotiate the contracts.

III. Determining PPP Suitability: Attributes of the Project and Economic Environment

This section identifies key project attributes and conditions in the economic environment that help inform whether a PPP is likely to yield a higher present value of net benefits than conventional procurement. The organizing framework and characteristics are presented in Table 1 below. For the most part, these attributes and conditions are known prior to the project being put out for bid, and the extent to which they are met can be assessed in an initial PPP screening process. For instance, as mentioned earlier, projects may vary in the number of phases or risks that can be bundled, with the most comprehensive being DBFOM. Projects may also differ in the availability of private sector-expertise and the extent to which a potential private partner's knowledge covers all, or just a portion, of the project's life-cycle.

To provide guidance in assessing the relative importance of these conditions, we characterize each one as being of "High" or "Medium" importance. The complete absence of any of the attributes characterized as having High importance means that procurement should favor conventional provisioning. Similarly, if all conditions are met, procuring the infrastructure asset through a PPP will likely yield a higher net benefit than conventional methods. As a general matter, conditional on the High importance factors being present, the presence of the factors identified as having Medium importance increases the likelihood of a PPP achieving a higher net benefit to society over conventional procurement. But, all told, whether a PPP is chosen will likely rely on a balance of conditions being satisfied and, because there will be uncertainty and the relative benefits of PPPs will be imprecisely measured, judgment will be necessary when determining PPP suitability for an infrastructure project.

The discussion in this section is most applicable to the cases of a proposed PPP set up as a DBFOM or DBOM.¹⁵ Importantly, the analysis covers publically provided infrastructure, such as roadway, transit, water supply and wastewater treatment systems, and excludes infrastructure assets that are generally privately owned and financed, such as telecommunications and electrical power.

¹⁵ In the United States, between April 2012 and April 2015, DBFOM contracts were the most common type of PPP structure.

Attribute	Importance	Caveats
1 Potential exists for bundling	High	
2 Private-sector expertise in project delivery exists across most project phases	High	
3 Asset and/or service quality are contractible	Medium	If asset and/or service quality are not contractible, then cost-cutting must not diminish quality
4 Project features high capacity and long-lived assets	Medium	
5 Capital and O&M costs can be accurately forecasted to some degree	Medium	If forecasting these costs is not possible, then it must be feasible to allocate cost risk to the private sector
6 Unanticipated investments lower costs by more than they lower quality	Medium	If this attribute is not met, then incentives must be developed to foster socially beneficial investments
7 There is scope for private sector innovation across the project life-cycle	Medium	
8 Potential private partners are willing to assume limited demand risk	Medium	

Table 1. Attributes of project and economic environment that increase PPP suitability

Attribute 1: The potential exists for bundling the responsibility for multiple project phases with a single private entity

As explained in the previous section, the main opportunity for cost savings through a PPP is bundling, whereby the public sponsor transfers multiple project risks – e.g. design, construction, O&M, finance – to the concessionaire, which then has a strong incentive to capture savings across the project’s phases; for example, by performing high-quality construction, the concessionaire lowers later O&M costs by an amount that more than offsets the increase in construction costs. The discussion in the previous section presupposed that such savings are possible. If phases and risks cannot be bundled, however, then a PPP is much less likely to result in lower overall savings than conventional procurement.

Attribute 2: Private-sector expertise in project delivery exists, especially for managing complex projects

The availability of private sector-expertise across all project phases is a highly important determinant of whether PPP procurement will achieve the maximum possible net benefit. In particular, the private sector may have an advantage over the public sector when a project is complex, such as when a mix of project management skills, technical expertise, sector-specific knowledge, life-cycle asset management, and project finance capabilities is necessary for successful execution. The absence of a potential private partner possessing the expertise to perform these functions across the project’s life cycle or the inability of a private partner to effectively manage the risks allocated to it reduces the likelihood that PPP procurement yields a

higher net benefit compared to conventional procurement. This condition is more likely satisfied if projects of similar size and scope have previously been successfully executed.¹⁶ Moreover, if multiple potential private sector partners possess the necessary expertise, then bidding for the project is likely to be more competitive, allowing the public sector to capture more of the potential cost savings (though the overall net benefit from the project procured as a PPP need not be altered).

Attribute 3: Asset and/or service quality are contractible and enforceable

A properly structured PPP contract strongly encourages cost savings across the project's life-cycle. But it is important for the private partner's actions that lower costs to not come at the expense of lower service quality. If the public authority cannot clearly define and enforce service quality standards in the contract, i.e., if a quantifiable service level agreement cannot be incorporated into the contract, then other considerations are necessary to determine whether a PPP is an appropriate procurement option.

For example, for infrastructure projects for which quality is not contractible and user fees are generally not collected (this includes many types of social infrastructure, such as schools and prisons), a PPP can still be the preferred choice if the chief impact of the concessionaire's decisions is to lower life-cycle costs with relatively little or no effect on service quality.¹⁷ If, on the other hand, user fees can be collected – though quality is still not contractible and the infrastructure project has increasing returns to scale – then the private partner in a PPP may face incentives to unilaterally cut costs regardless of the effect on quality, which would make regulated privatization – akin to a public utility – more suitable for the project.

In designing a PPP contract with service quality standards, the public authority should also determine the degree to which measurable output or quality metrics are available. If “off-the-shelf” metrics already exist – based on experience with the same type of assets in other projects – these can be more readily incorporated into the contract. If new technical output or quality specifications must be developed because leading-edge technology is being used, it will add time and risk to the project, and also make enforcing the contract more challenging. As an intermediate case, converting existing specifications for similar assets into clearly defined stipulations should present less of a challenge. The closer quality metrics are to being “off-the-shelf,” the easier it will be to write a performance-based contract.

Attribute 4: The project features high capital costs and long-lived assets

As briefly mentioned earlier, the existing financing environment is not favorable to PPPs. First, private debt issued by a PPP consortium is generally subject to higher financing costs under

¹⁶ In situations where first-in-class expertise is not available at a reasonable price, a government sponsor may be inclined to consider using a less-expensive but less-qualified partner for the project. This path should be taken with extreme caution given the risks, such as the greater likelihood of delays and missed performance targets relative to conventional procurement, due to the limited expertise of the private partner.

¹⁷ For example, design of a prison with better lines-of-sight for staff can reduce the required number of security guards without diminishing the level of security provided. See, Iossa, Elisabetta and David Martimort. “The Simple Microeconomics of Public-Private Partnerships.” *Journal of Public Economic Theory* 17, no. 1 (2015): 4-48.

current tax law than municipal bonds used to finance conventional infrastructure provisioning because 1) private debt generally has a higher default risk than bonds issued by governmental agencies, and 2) municipal bonds are exempt from federal income taxes, and generally exempt from state and local income taxes in the state where issued. Second, PPPs also tend to result in higher transaction costs than conventional procurement because of the need to compensate additional external financial, legal, and technical advisors who plan and develop project specifications and documents and who participate in the procurement process.¹⁸ These added costs must be weighed against the cost savings generated by the bundling in the PPP procurement.¹⁹

Since PPP transactions costs tend to be fixed and are mostly independent of the size of overall project costs,²⁰ assets procured using a PPP need to be sufficiently large to generate the cost savings necessary to offset those transaction costs. In addition, smaller projects will find it difficult to attract large, institutional investors, such as pension funds, which do not view investments in smaller projects as being worthwhile. In addition to financing opportunities, these investors also provide expertise in monitoring managerial effort to high capital-value projects. They may perform other due diligence functions as well, such as reviewing documentation, evaluating the project's financial viability, and assessing the jurisdiction's legal and regulatory environment. But executing these due diligence functions has a cost, which investors will not agree to incur unless there is a likelihood of earning a reasonable return on their efforts, which is more likely to be met the larger the project is.²¹

When an asset's useful life matches its contract length, longer-lived assets, all else equal, allow for PPP contracts that are more likely to be mutually beneficial to the public and private sectors. A longer-term contract allows the public authority to benefit from efficiencies and innovations while the private partner can rely on a lasting source of revenue, such as availability payments, that is both reasonably secure and sufficient to recover its investment while earning a competitive return.²² Allowing for risk-sharing arrangements in a long-term contract could further help tilt the procurement decision in favor of a PPP for projects that collect user fees (see Attribute 8 below).

¹⁸Unlike conventional procurement, a PPP consortium can consist of multiple private entities, each with its own need for external advisors. PPP Canada. 2014. *Identifying PPP Potential – A Guide for Federal Departments & Agencies* <http://www.p3canada.ca/~media/english/resources-library/files/p3%20a%20guide%20for%20federal%20departments%20%20agencies.pdf> (accessed April 6, 2016).

¹⁹ PPP Canada. 2014. *Identifying PPP Potential – A Guide for Federal Departments & Agencies* <http://www.p3canada.ca/~media/english/resources-library/files/p3%20a%20guide%20for%20federal%20departments%20%20agencies.pdf> (accessed April 6, 2016).

²⁰ See page 20 of Iossa, Elisabetta and David Martimort. “*The Simple Micro-Economics of Public-Private Partnerships.*” CEIS Tor Vergata Research Paper Series Vol. 6, Issue 12, No. 139 (2013): “...transaction costs are also to a large extent independent of the size of a project, which suffices to make PPP unsuitable for low capital value projects.”

²¹ See Iossa, Elisabetta and David Martimort. “The Simple Microeconomics of Public-Private Partnerships.” *Journal of Public Economic Theory* 17, no. 1 (2015): 4-48.

²² PPP Canada. 2015. *Application Guide and Application Form, Round 7.* <http://www.p3canada.ca/~media/english/resources-library/files/application%20guide%20round%207-english%20final.pdf> (accessed April 6, 2015).

Attribute 5: Capital costs and O&M costs can be forecasted with some degree of accuracy

Being able to forecast both construction and O&M costs (including the labor component) over the duration of the long-term contract with some precision is desirable. The PPP contract commits the private partner to covering costs and meeting schedules over the long term and commits the public authority to assuming responsibility for the total costs of the project should the SPV fail. The public authority should ascertain whether long term O&M needs are relatively stable and predictable, based on established technologies and historical demand patterns, such as they exist. If these are not well understood because leading-edge technology will be used and/or there is significant demand uncertainty, then the project sponsor will be more vulnerable to the risk that subsequent opportunistic contract renegotiations will result in additional reimbursements from the government to the private partner.²³ Moreover, forecasts of O&M costs should limit the scope for cost reductions to occur through wage and benefit reductions, and should generally incorporate the need for strong labor standards.

For infrastructure projects that collect user fees, flexible PPP contracts that contain profit-sharing provisions can mitigate the private sector's construction cost risk and O&M cost risk by shifting a mutually acceptable portion of the risk to the public sponsor, reducing the likelihood of bankruptcy or costly contract renegotiation. A higher probability of renegotiation also induces moral hazard on the part of the concessionaire; the more likely the private partner is to be reimbursed for its costs, the weaker are the cost-saving incentives fundamental to a PPP.

Attribute 6: There is the possibility of investments that are unknown at the time of contracting but will later lower costs more than quality along with being implementable and observable

Even if quality standards can be clearly defined by the project sponsor at contract signing, investment opportunities affecting service quality and life-cycle costs will often arise subsequently that could not have been written into the contract prior to execution for any number of reasons. In this way, PPPs are “incomplete” contracts, that is, they cannot specify actions and

²³Under conventional procurement, the public authority implicitly self-insures against unexpected cost shocks. When making a comparison with PPP procurement in a value-for-money analysis, the imputed value of the insurance premium should be added to conventional project costs. A PPP is generally able to purchase insurance to cover a number of project risks, such as covering equipment and materials up to delivery to the site, a Construction all-risk (CAR) policy that covers operations and assets on site during the construction phase, or liability insurance for claims by third parties. World Bank Group. Public-Private Partnership in Infrastructure Resource Center. 2015. *Insurance Checklist Explanatory Note*. http://ppp.worldbank.org/public-private-partnership/sites/ppp.worldbank.org/files/documents/insurance_checklist_explanatory_note_en.pdf (accessed April 6, 2015); Insurance companies are increasingly able to offer insurance against risks in PPP projects insofar as they are defined and standardized in regular insurance packages. “Regular” risks are relatively typical risks that the market is willing to accept or insure against. Any risks that go beyond what the insurance industry is willing to accept can be thought of as “extraordinary”. It may become difficult or very expensive to obtain insurance that covers risk outside of regular packages. International Institute for Sustainable Development (IISD). 2015. *Risk Allocation in Public-Private Partnerships: Maximizing value for money*. <https://www.iisd.org/sites/default/files/publications/risk-allocation-ppp-maximizing-value-for-money-discussion-paper.pdf> (accessed April 6, 2016). Without insurance, the private partner would have to absorb all or some of an unexpectedly large increase in cost, increasing its risk exposure. For this reason, it is possible the private sector may make overly conservative cost estimates in an effort to win the bid, with the expectation that it will be able to recoup higher than expected cost increases through renegotiating the contract with the sponsor.

payments for all possible contingencies.²⁴ Although these contracts can be incomplete for different reasons, for our purposes, we focus on investments that are uncertain at the time of contract execution but are observable after they are implemented. For example, an investment made by the private partner would have been uncertain to the public sponsor at the time the contract came into force if the technology had not yet been developed then. This means that the public sponsor cannot enforce the contract until after the investment has been completed, when the effects of the technical innovation on service quality and life-cycle costs can be observed. In other words, a technological innovation occurring after the contract signing may give rise to investment opportunities that could not have been anticipated at the time of signing, but which would have been written into the contract had they been foreseeable.²⁵ For instance, the development of a highly energy-efficient heating system that would lower fuel consumption and pollution may occur after the contract to build a hospital is awarded.

The socially optimal level of non-contractible investment balances benefits and costs at the margin, but in practice there may be either too little or too much because investment incentives need not be aligned for the government sponsor, the firm that builds the asset, and the firm that operates the asset. Private parties tend to more heavily weigh the effects of these investments on costs, while the sponsor more heavily weights their effects on social benefits.²⁶ For example, conventional procurement may result in an overinvestment in quality, meaning that incremental investments in higher quality cannot justify their costs, which ultimately reduces the project's net benefit. Alternatively, a PPP may implement a cost-cutting innovation for which the resulting savings are outweighed by the reduction in quality; that is, cost cutting can have a negative spillover effect on quality. Conversely, if the private partner is exclusively concerned with cost-cutting, it may invest less than is socially optimal by not considering the positive spillover effects that another type of cost-cutting investment might have on service quality. The best procurement choice will depend, in part, on whether the non-contractible investment opportunities that can be expected to arise during the contract term will have a larger effect on quality or costs.²⁷

More specifically, a PPP is more appropriate when there is an expectation that non-contractible investments that affect cost more than quality will be possible during the contract term. If this is not expected to be the case, a system of enforceable rewards and penalties can be used to steer the level of future non-contractible investment toward the socially optimal level. For example, linking the concessionaire's compensation to achieving measurable output or service quality

²⁴ Klein, Peter G. "Incomplete Contracts." Palgrave Macmillan (2015).

<http://www.palgraveconnect.com/esm/doi/10.1057/9781137294678.0287> (accessed April 5, 2016).

²⁵ Although it is not the only approach for conceptualizing investments under incomplete contracts in the context of PPPs, we adopt the framework of Bennett, John and Elisabetta Iossa. "Building and managing facilities for public services." *Journal of Public Economics* 90, no. 10-11 (2006): 2143-2160. See page 2145: "...we model investments by the firms as the undertaking of research into innovative approaches to carrying out their respective tasks. Such investments are noncontractible ex ante but verifiable ex post: whilst it is not possible to contract ex ante on the delivery of an innovation, once a potential innovation has been discovered, its implementation is verifiable."

²⁶ See page 126 of Dewatripont, Mathias and Patrick Legros. "Public-private partnerships: contract design and risk transfer." *EIB Papers* 10, no. 1 (2005): 120-145.

http://www.eib.org/attachments/efs/eibpapers/eibpapers_2005_v10_n01_en.pdf#page=96 (accessed April 13, 2016).

²⁷ It is also important to recognize that this decision will also depend on the types of non-contractible investments the public sponsor thinks will be available to and feasible for the private partner.

outcomes can compensate for investment shortfalls by providing a monetary incentive to undertake *additional* quality-enhancing non-contractible investment that also reduces life-cycle cost (or that increases life-cycle cost by less than the value of the additional quality). Similarly, penalties that reduce compensation for failing to achieve or maintain service performance targets can discourage socially wasteful overinvestment in cost-cutting technology that otherwise would lead to excessive reductions in quality. For more details about PPPs in the context of incomplete contracts, see the appendix at the end of this document.

Attribute 7: There is scope and incentive for private sector innovation not present with conventional procurement

The scope and incentive for private sector innovation will depend heavily on the extent to which performance-based contracts are used to specify features of the infrastructure asset or the service it provides. Performance-based contracts maximize the private sector's incentive to use innovative approaches to achieve the specified outcome at the least cost, and depend on the ready availability of quantifiable output/quality measures.²⁸ As discussed above, if output and quality measures are not contractible, then conventional procurement may be preferable, particularly if the level of service quality is sensitive to the actions taken by the private partner to lower costs. Moreover, if the public sector believes as a matter of policy that it must rely on prescriptive input specifications rather than allow the private partner to independently make those decisions, then the potentially greater benefits of PPP procurement are unlikely to be realized, and conventional provisioning would be preferable. The public sector's preference for defining the inputs will depend, in part, on the type of project under consideration; for example, the sponsor may want or need to exert tight control over a project with stringent security requirements, making a PPP unattractive or unfeasible.

Attribute 8: Potential private partners are willing to assume limited demand risk in projects with user fees as a funding source

It is conceivable that a project could have a higher expected net benefit as a PPP, but that no potential private partner is willing to assume all demand risk when the revenue stream is based entirely on user fees, and no public sponsor is willing to assume all the demand risk when the revenue stream is based entirely on availability payments. A PPP might still be possible, however, if the private partner is willing to assume a portion of the demand risk through one of several risk-sharing arrangements that may be negotiated in the contract.²⁹ If the private sector is willing to share risk both on the project's upside and downside, then the risk-return tradeoff may become more acceptable to the private partner (and at least as acceptable to the public sponsor).

²⁸ PPP agreements are output-based in the sense that the public-sector party specifies basic capacity and quality standards but the private sector assumes responsibility over how to meet the specified output. See Iossa, Elisabetta and David Martimort. "The Simple Microeconomics of Public-Private Partnerships." *Journal of Public Economic Theory* 17, no. 1 (2015): 4-48.

²⁹ See U.S. Department of the Treasury. Office of Economic Policy. 2015. *Expanding the Market for Infrastructure Public-Private Partnerships: Alternative Risk and Profit Sharing Approaches to Align Sponsor and Investor Interests*. <https://www.treasury.gov/connect/blog/Documents/Treasury%20Infrastructure%20White%20Paper%20042215.pdf> (accessed April 5, 2016).

In essence, PPP deals might be more attractive to investors if investors can exchange some upside demand risk for protection from downside demand risk. This type of contract flexibility increases the odds of the project's success by reducing the likelihood of the SPV's bankruptcy or costly contract renegotiation. It also has the benefit of aligning incentives of the project sponsor and investor, given that they both share in the project's upside and/or downside potential.

IV. Best Practices for Successful PPP Implementation

The decision to procure a project as a PPP should be based on the expectation that it will yield a higher net benefit to the public sector than would have been the case under conventional procurement. Yet, a PPP is a more complex structure than a traditionally procured public infrastructure project, and for this reason, the public sponsor must undertake additional actions to support project execution prior to letting the contract out for bid in order to ensure that the higher net benefit is realized. These actions should be consistent with the economic principles enumerated above – allocating project risks to the party best able to manage them, optimizing life-cycle costs through bundling of project responsibilities, strengthening incentives for investors to participate in PPP projects, and introducing incentives that bring about socially optimal investment levels – in order to maximize the project's expected net benefit.³⁰ Not taking these steps may lead to higher costs and failure to meet performance targets later in the life cycle.³¹

These procedures can be grouped into four broad best practice areas. The first area includes practices that create a favorable enabling environment that aims to reduce transactions costs by establishing a predictable legal and regulatory climate and enhancing public sector capacity, which will increase investors' incentives to participate in the PPP market. The second area involves practices that ensure a rigorous project preparation process that institutionalizes critical planning and monitoring functions, such as defining the strategic objectives of the project, and verifying that progress is being made consistent with the project plan. Implementing this practice area creates an incentive to select output and quality metrics that can measure progress and that are necessary for performance-based contracts; it also creates an incentive to minimize costs by avoiding costly scheduling delays due to poorly coordinated work streams. Moreover, the ongoing identification and tracking of emerging risks, which is part of the monitoring function, encourages development of effective risk-mitigation strategies.³² The third area involves conducting a bankable feasibility study that provides robust and high-quality analysis of the technical, commercial, legal, and environmental feasibility of the project in order to

³⁰ This section lists actions that are appropriate after a project has passed both a cost-benefit analysis (i.e. it is expected to generate a positive net social benefit) and a value-for-money analysis (i.e. it is expected to cost less if organized as a PPP than would be the case if it was conventionally procured).

³¹ World Economic Forum. 2013. *Strategic Infrastructure Steps to Prepare and Accelerate Public-Private Partnerships*. http://www3.weforum.org/docs/AF13/WEF_AF13_Strategic_Infrastructure_Initiative.pdf (accessed April 6, 2016).

³² Organizationally, this requires setting up the project team and leadership, designing the project governance structure and project management, as well as securing required preparation funding.

demonstrate its financial viability.³³ The final area includes practices that would structure a balanced risk allocation in concert with regulatory protections in order to allow for a long-term partnership between the public and private sectors that balances efficiency incentives and public-interest safeguards.

In considering whether to go forward with a project as a PPP, the public authority should first determine its capacity to execute these best practices. If these capabilities are lacking, the public sponsor will require support from external consultants and advisors to conduct preliminary designs, develop technical and operating criteria, undertake traffic and environmental impact studies, and create preliminary financing structures, for example. In the following sections, we present each of the four practice areas in greater detail.³⁴

Fostering a favorable environment for PPPs, including strengthening public sector expertise

This section describes the prerequisites that the public sponsor should put in place prior to any PPP procurement. Any jurisdiction seriously weighing infrastructure procurement via PPP should likely lay the groundwork in the form of PPP-enabling legislation, incorporating strong labor standards, institutions, and means for capacity building. Private investors are most likely to assume the risks stipulated in a PPP contract in a predictable and enforceable legal and institutional environment.³⁵ Furthermore, the public sector cannot capably execute complex,

³³ The environmental component of the feasibility study should include strategies for minimizing the risk of environmental damages due to the project.

³⁴ This discussion distills information from several sources: World Economic Forum. 2013. *Strategic Infrastructure Steps to Prepare and Accelerate Public-Private Partnerships*. http://www3.weforum.org/docs/AF13/WEF_AF13_Strategic_Infrastructure_Initiative.pdf (accessed April 6, 2016); International Bank for Reconstruction and Development. The World Bank. Asian Development Bank. Inter-American Development Bank. 2014. *Public-Private Partnerships Reference Guide Version 2.0*. http://www-wds.worldbank.org/external/default/WDSContentServer/WDSP/IB/2014/09/08/000442464_20140908133431/Rendored/PDF/903840PPP0Refe0Box385311B000PUBLIC0.pdf (accessed April 6, 2015); OECD. 2012. *Recommendation of the Council on Principles for Public Governance of Public-Private Partnerships*. <https://www.oecd.org/governance/budgeting/PPP-Recommendation.pdf> (accessed April 6, 2016); Urban Land Institute. 2005. *Ten Principles for Successful Public-Private Partnerships*. http://uli.org/wp-content/uploads/2005/01/TP_Partnerships.pdf (accessed April 6, 2015); and Asian Development Bank. 2012. *Public-Private Partnership Operational Plan 2012-2020*. <http://www.adb.org/sites/default/files/institutional-document/33671/ppp-operational-plan-2012-2020.pdf> (accessed April 6, 2016). For additional information on the operational details of these practices, see U.S. Department of Transportation. Federal Highway Administration. 2016. *Successful Practices for P3s: A review of what works when delivering transportation via public-private partnerships*. https://www.transportation.gov/sites/dot.gov/files/docs/P3_Successful_Practices_Final_BAH.PDF (accessed April 6, 2016).

³⁵ A local jurisdiction's statutory ability to implement a PPP may be circumscribed by the scope of the state's PPP-enabling legislation. Enabling legislation sets the framework under which a PPP project can be developed. Private participation in project development, financing, and operation must be legally possible. While not absolutely essential, well-crafted enabling legislation increases the prospects for PPP development because it will delineate the range of acceptable projects and the process for consideration and award. Legislation also signals to investors that the state is committed to this form of procurement, and lowers PPP transactions costs by standardizing the procurement process. Where legislative support is not available, or is limited, the design of a robust legal and regulatory framework will require cooperative effort across state and local jurisdictions, including formulation of an overarching PPP policy that sets down clear objectives and principles and defines a "roadmap" for implementation.

multiphase transactions with the private sector without highly skilled staff possessing financial, legal, and negotiating expertise. Strong institutional capacity can be facilitated by disseminating standardized tools and knowledge products, policy formulation, and technical assistance. Depending on the degree of expertise within the jurisdiction, these types of functions could be carried out by PPP units established within state transportation departments or treasury/finance departments. For transportation projects in particular, state and local governments can avail themselves of federal-level expertise and analytical tools through the Build America Transportation Investment Center (BATIC). Depending on the public authority's size and technical capacity, many of the benefits of standardization and increased investor interest can be facilitated by formulating a steady project pipeline and an integrated infrastructure plan for the jurisdiction (or a multi-jurisdictional, regional plan, where projects span political boundaries).³⁶ Finally, guidelines for an effective stakeholder engagement program are critical to a successful PPP implementation.

Managing a rigorous project preparation process

Fundamentally, the actions in this best practice area contribute to the avoidance of costly scheduling delays while also lessening the impact of unanticipated risks, two factors that diminish the expected net benefit of the PPP project. The preparation process involves multiple stakeholders: government agencies and bureaus ranging from federal to local levels, regulators, engineering firms, banks, investors, and users. It is important to assemble a capable, cross-functional team with a well-defined and transparent governance structure that includes key stakeholders with well-defined roles and responsibilities. The team should cover a broad range of expertise, including sector-specific knowledge, project management, technical expertise, and project finance and deal-making experience.³⁷ A project management office should be established to define a multi-stage project plan; coordinate and monitor interdependent work streams; and identify and track emerging risks. It is also important to obtain upfront funding for feasibility studies, so governments should establish project-preparation facilities, i.e. dedicated funds for feasibility studies. More generally, the public authority should standardize the project-preparation process to the extent possible, by using common feasibility study guides, specification manuals, and draft concession agreements.

Credibly Assessing Project Feasibility

One benefit of having a credible feasibility study that demonstrates the project's viability is that it reduces the risk of the project to the SPV, which improves its pricing of the overall

Despite this daunting challenge, to the extent possible, local jurisdictions should leverage whatever flexibility they have to establish a predictable institutional framework.

³⁶ Regional efforts that leverage common infrastructure requirements and economic priorities may be able to achieve efficiencies in planning and creating political critical mass beyond what is possible on an individual basis, including harmonizing institutions and PPP governance. Advantage should be taken of any available legal flexibility.

³⁷ For more information on the activities of this team, see U.S. Department of Transportation. Federal Highway Administration. 2016. *Successful Practices for P3s: A review of what works when delivering transportation via public-private partnerships*.

https://www.transportation.gov/sites/dot.gov/files/docs/P3_Successful_Practices_Final_BAH.PDF (accessed April 5, 2016).

procurement package to the sponsor. On the other hand, should the SPV fail financially, the public sponsor would then have to undertake the costly process of finding a new private partner. The more likely this contingency is, the more likely it is that conventional procurement is the better choice from the perspective of maximizing the project's net benefit. To be credible, a feasibility study must be undertaken to demonstrate that the project is a viable financial investment for the private partner, delivers net economic benefits to society, and possesses sound technical foundations. The study should include a sensitivity analysis for key risks, including possible setbacks due to stakeholder opposition or failure to obtain necessary permits or acquire needed land.³⁸ Conducting a feasibility study is especially important if the private partner's revenue is comprised entirely of user fees, where overly optimistic demand forecasts have led a number of PPPs to fail financially, particularly in cases of newly constructed toll roads. Therefore, in order to avoid "optimism bias" in the forecasts, it is critical to ensure the independence of the party making the forecasts, confirm that high quality data and methods are being used, and allow for forecasts to be challenged.

Moreover, the public sponsor can take steps to increase the feasibility of a project. To provide an incentive for contractors to develop innovative solutions, output specifications should be written into the contract (to the extent possible), and service requirements should be broadly defined to allow for competing technical solutions to be evaluated. And while user charges and availability payments are the major funding mechanisms, financial viability of projects located in high-density areas may be enhanced by considering ancillary revenues from retail operations or from converting a portion of the increase in adjacent property value generated by the infrastructure investment into public revenue (via land value capture). Moreover, we note that when credit rating agencies assess PPP projects, including their effects on public sector finances, availability payments and other relevant costs and contingent liabilities are treated as long-term obligations on the public budget. Finally, the private partner should vigorously engage with stakeholders and have ample opportunity for due diligence that all parties feel that they had sufficient opportunity to raise possible concerns.

Structuring the PPP contract with a balanced risk allocation and regulatory protections

Under the assumption that an infrastructure project yields a net social benefit, a PPP will be mutually beneficial if it achieves a lower overall cost versus conventional procurement for the public sector and it generates a competitive rate of return for the private partner. Therefore the public sponsor should only transfer those risks that will induce the private partner to take actions that will increase the net value of the project (e.g., higher quality of service or lower per unit costs), which requires contractually allocating controllable risks to the party best able to manage them.³⁹ Price changes should be regulated in the contract to limit any tendency for the private firm to overcharge, while the public authority can provide quality incentives through bonuses and penalties to motivate a socially optimal level of investment. The public sponsor can also take steps that change the risk-reward profile or mitigate risk to make PPPs more attractive. The

³⁸ The feasibility study could be conducted by an established PPP unit or the sponsoring agency, with assistance from external financial advisors and technical consultants.

³⁹ If risks are allocated incorrectly, for example if the government cannot cost-effectively manage the risks it assumes, then the risk-reward balance will be skewed in favor of the private partner.

public authority might address investor dissatisfaction with a contract based strictly on either user fees or availability payments by transferring some, but not all, demand risk to increase the project's attractiveness to both parties. For example, the public authority can use guaranteed minimum revenues while alleviating concerns about perceived excessive earnings through maximum revenue caps. The regulatory/contract system can also include adaptive mechanisms that self-correct against economic cycles or commodity price volatility, e.g. power-sector regulations include pass-through clauses to dampen fuel cost volatility.⁴⁰ Further, public sector intervention options should have triggers, for example, building a non-tolled road near a PPP toll road concession only if the latter has become severely congested; or specifying the conditions when refinancing should occur, such as a pre-specified debt-service coverage ratio.⁴¹ Intervention should balance the public authority's need for flexibility when economic circumstances change with the private sector's need for predictability.

Much additional information concerning the operational details associated with best practices can be found in a BAII report entitled *Successful Practices for P3s*.⁴² The report provides very detailed and practical suggestions for public agencies in the early stages of establishing a PPP program; for example, it discusses the diverse characteristics of PPP-enabling legislation that exists in different states and provides an in-depth review of the organizational requirements for setting up a centralized PPP unit. Such practical considerations are outside the scope of this report. For instance, we generally assumed that the required PPP-enabling legislation was in place, and focused on the fundamental economic characteristics that make PPP procurement under a DBFOM – the most prevalent organizational form in the United States – preferable to conventional provisioning of infrastructure. But, we encourage potential project sponsors to read the BAII report to learn more about the operational details of implementing successful PPPs.

Conclusion

Infrastructure investment is vital for America's continued economic growth and prosperity, especially given the significant infrastructure gap currently being faced by the nation. Constrained budgets at all levels of government have led to increased focus on sound innovative infrastructure financing methods. Public private partnerships represent a promising approach that can leverage the strengths of the private and public sectors to expand and improve our

⁴⁰ See U.S. Department of the Treasury. Office of Economic Policy. 2015. *Expanding the Market for Infrastructure Public-Private Partnerships: Alternative Risk and Profit Sharing Approaches to Align Sponsor and Investor Interests*. <https://www.treasury.gov/connect/blog/Documents/Treasury%20Infrastructure%20White%20Paper%20042215.pdf> (accessed April 5, 2016).

⁴¹ The debt service coverage ratio measures the ratio of cash flow available to pay the debt service, divided by that debt service. If the ratio becomes too low, then the government may view refinancing at lower market interest rates as a prudent measure to lower recurring debt costs.

⁴² U.S. Department of Transportation. Federal Highway Administration. 2016. *Successful Practices for P3s: A review of what works when delivering transportation via public-private partnerships*. https://www.transportation.gov/sites/dot.gov/files/docs/P3_Successful_Practices_Final_BAH.PDF (accessed April 5, 2016).

nation's infrastructure. Yet, PPPs are not a good fit for all projects. In each case, the public authority must establish that a PPP would provide net benefits to society that go beyond what is attainable through conventional procurement alone, including a careful screening of projects for their suitability factors. Thereafter, successful PPP implementation requires executing a set of additional best practices before the project gets underway. Not taking these steps may lead to higher costs, failure to meet performance targets later in the life cycle and a misallocation of scarce public resources.

V. Technical Appendix: PPPs and Incomplete Contracts

*Observable (and therefore verifiable) investments affecting service quality and life-cycle costs can be included in the PPP contract, but “non-contractible” investments that affect quality and life-cycle costs cannot be written into the contract prior to execution.*⁴³

In order for the terms of a PPP contract to be enforceable, a court must be able to verify them as written into the contract (e.g. baseline service quality standards or the level of investment in infrastructure capacity). During the contract term, however, the private partner may face investment opportunities that could not have been foreseen when the contract was signed (due to technical innovation) but will affect service quality or life-cycle costs in observable ways;⁴⁴ these type of investments are called non-contractible.

What determines the socially optimal amount of non-contractible investment, and why might it not be attained?

From society’s perspective, the optimal amount of non-contractible investment balances marginal investment cost with the marginal benefit of quality-enhancement and/or life-cycle cost savings.⁴⁵ In practice, however, conventional provisioning and PPPs provide different investment incentives. For instance, under conventional provisioning the public sponsor is interested in the capital budget and innovations that improve quality and does not consider life-cycle O&M costs when making investment decisions (either O&M is separately contracted to a different private firm or, if carried out by the government, may fall under the operating budget with a separate dedicated funding source).⁴⁶ Under a PPP, the private sector is focused on optimizing life-cycle costs given the nature of the PPP contract and is less attentive to potential quality improvements from possible investment decisions (unless quality incentives are included in the contract beyond the provision of a minimum quality standard) because it likely cannot capture any of the increase in users’ welfare through price increases under the existing contract absent any renegotiation. Given these differences in investment incentives, the choice of a PPP vs. conventional procurement will have different implications for the optimal level of investment. The choice of procurement method will depend in part on expectations over the

⁴³ See footnote 25 for what is meant by the term “non-contractible” as we use it in this paper.

⁴⁴ The effects of non-contractible investment on quality and life-cycle costs will not be observed until after the fact, at which point there may be *ex-post* renegotiations between the public authority and private partner to decide how to share the net benefits of the investment.

⁴⁵ This explanation is based on a simplifying assumption that investment costs and benefits are continuous, i.e. they change in infinitesimally small increments, so that we can find an exact level of investment at which marginal benefit equals marginal cost, which characterizes the optimal level of investment in elementary economics. The same principle holds for “lumpy” investments that are made in discrete intervals, in which case investments are made as long as the marginal benefit exceeds the marginal cost of the next discrete unit of investment.

⁴⁶ This is an assumption, and one that is generally not consistent with the usual approach, where the government’s objective function is the sum of consumer and producer surplus. See page 56 of Engel, Eduardo, Ronald D. Fischer, and Alexander Galetovic. “Public-Private Partnerships: When and How.” Working paper, Yale University (2008) <http://www.econ.uchile.cl/uploads/publicacion/c9b9ea69d84d4c93714c2d3b2d5982a5ca0a67d7.pdf> (accessed April 5, 2016): “...we assume that the government is benevolent but for one defect, ignoring life-cycle costs when bargaining with the builder and considers only consumer surplus. This assumption is necessary because the case for bundling would be rather weak if governments would routinely internalize life-cycle costs.”

different types of non-contractible investment opportunities that might arise and their relative impacts on service quality and life-cycle cost.

A particular procurement method can induce too little or too much of the non-contractible investment when both quality and costs are affected.

It is possible that the level of investment will be too low. Under conventional provision, only the effect of investment on service quality is considered (see above). If the quality effect is positive, then certainly investment will be undertaken – up to the point where the marginal benefit of higher service quality equals marginal investment cost – with the benefits shared between the private builder and public authority.⁴⁷ However, the total investment level will be too low compared to the socially optimal level because neither the builder nor the public sponsor considers the incremental benefit from making additional quality-enhancing investments that also lower life-cycle costs. In other words, investment is too low compared to the socially optimal amount because the *joint* marginal benefit of higher quality and saved costs is greater than the marginal investment cost.

Next consider a PPP, in which the private partner fully internalizes life-cycle costs, but does not consider the consumer benefits derived from improved service quality. If the effect on life-cycle costs is positive (i.e. costs decline), then certainly some cost-reducing investment will be made, up to the point where the marginal cost savings equals the firm's marginal investment cost, with all benefits accruing entirely to the private partner.⁴⁸ Again, the investment level will be too low because the private partner does not consider the incremental benefit to consumers that would arise from making additional cost-cutting investments that also improve service quality. In other words, investment is too low compared to the socially optimal amount (the joint marginal benefit of higher quality and lower cost is greater than the marginal investment cost).

It is also possible that investment could be too high. For instance, conventional procurement is preferable if the main effect of a technical innovation would be to increase benefits to consumers while also *increasing* operational costs, because only the government would be willing to make the costly investment needed to enhance quality. In this situation, however, it would be incumbent on the public authority to ascertain whether the increase in quality was worth the added cost, to avoid the risk of making a socially wasteful overinvestment in quality. Conversely, only a PPP would be interested in making investments that reduced life-cycle costs

⁴⁷ Improved quality increases the value of the infrastructure service to consumers, and as a result, they are willing to pay more for it; the private builder and public authority may then share the monetized value stemming from higher quality. This could be accomplished through a sharing rule (say 50/50) incorporated into the contract, which is triggered only after the investment is made and its value realized (in other words, the *value* of the investment cannot be put into the contract because it is not known beforehand, but a sharing rule can be applied after the investment is made and its value quantified). In this scenario, the private builder has an incentive to underinvest because it knows in advance that it will receive only a portion of the incremental value; this is in addition to the underinvestment that occurs by not taking life-cycle cost savings into account. Having a preset rule in place may be preferable to waiting until after the investment is made before negotiating a sharing arrangement with the public sponsor; the added uncertainty could exacerbate the incentive to underinvest.

⁴⁸ Absent other controlling contract provisions, the private partner in a PPP can unilaterally implement cost-cutting innovations and retain all of the benefits.

that also *lowered* service quality (the public authority would not take any actions that reduced quality). It would be important for the PPP to internalize the spillover effects of its investment decision, to avoid making a socially wasteful overinvestment in cost cutting that inordinately reduces quality. Yet if quality is contractible, this likely would not be an issue, and if quality was not contractible, then the public sponsor should probably opt for conventional procurement if cost-cutting leads to quality reductions (see discussion in section III).

Of course, if life-cycle costs are not very sensitive to quality-enhancing investment, so that the value of any quality enhancement would likely exceed the cost of the investment, then conventional procurement is likely preferable because the private partner in a PPP would not have the incentive to undertake this investment. In other words, a PPP would not be willing to make quality-enhancing investments that did not also reduce life-cycle costs (by more than the cost of the investment).

Incentives can be used to encourage socially beneficial non-contractible investments and discourage non-contractible investments that are socially wasteful.

A system of rewards and penalties can be used to steer the level of investment toward the socially optimal level. Performance-based contracts in which the PPP's compensation is tied to achieving measurable output or quality outcomes can compensate for investment shortfalls by providing a monetary incentive to undertake *additional* quality-enhancing non-contractible investment that also reduce life-cycle cost. Similarly, penalties that reduce compensation for failing to achieve or maintain service performance targets can discourage socially wasteful cost cutting that otherwise would lead to excessive reductions in quality.