



June 2015

MAKING PUBLIC INVESTMENT MORE EFFICIENT

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MAKING PUBLIC INVESTMENT MORE EFFICIENT

June 11, 2015

EXECUTIVE SUMMARY

Public investment supports the delivery of key public services, connects citizens and firms to economic opportunities, and can serve as an important catalyst for economic growth. After three decades of decline, public investment has begun to recover as a share of GDP in emerging markets (EMs) and low income developing countries (LIDCs), but remains at historic lows in advanced economies (AEs). The increase in public investment in EMs and LIDCs has led to some convergence between richer and poorer countries in the quality of and access to social infrastructure (e.g., schools and hospitals), and, to a lesser extent, economic infrastructure (e.g., roads and electricity).

However, the economic and social impact of public investment critically depends on its efficiency. Comparing the value of public capital (input) and measures of infrastructure coverage and quality (output) across countries reveals average inefficiencies in public investment processes of around 30 percent. The economic dividends from closing this efficiency gap are substantial: the most efficient public investors get twice the growth “bang” for their public investment “buck” than the least efficient.

Improvements in public investment management (PIM) could significantly enhance the efficiency and productivity of public investment. Based on a sample of 25 countries, the IMF’s new Public Investment Management Assessment (PIMA) finds significant scope to strengthen the 15 key institutions which shape the planning, allocation, and implementation of public investments. Countries with stronger PIM institutions have more predictable, credible, efficient, and productive investments. Strengthening these institutions could close up to two-thirds of the public investment efficiency gap.

Priorities for strengthening PIM institutions vary across country groups. AEs should ensure that their fiscal and budgetary frameworks provide stable and sustainable bases for investment planning across levels of government. EMs should adopt more rigorous and transparent arrangements for the appraisal, selection, and approval of investment projects. LIDCs should focus on strengthening the institutions related to the funding, management, and monitoring of project implementation. All countries would benefit from stricter oversight of public-private partnerships (PPPs) and better integration between national strategic planning with capital budgeting.

The Fund has a key role to play in helping countries to become more efficient public investors. In this context, the Fund plans to develop the PIMA into a comprehensive assessment of PIM practices, and launch a new PPP Fiscal Risk Assessment Model (P-FRAM) to complement its various other fiscal assessment tools.

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CONTENTS

I. INTRODUCTION	5
II. PUBLIC INVESTMENT AND INFRASTRUCTURE QUALITY	6
A. Trends in Public Investment and Capital Stock	6
B. Trends in Infrastructure Coverage and Quality	12
C. Estimating Public Investment Efficiency	14
D. Public Investment Efficiency and Growth	17
III. ASSESSING PUBLIC INVESTMENT MANAGEMENT	19
A. The Public Investment Management Assessment (PIMA) Framework	19
B. PIMA Methodology	22
C. Results of the PIMA Evaluation	23
IV. EXPLAINING PUBLIC INVESTMENT PERFORMANCE	27
A. Measuring Public Investment Performance	27
B. PIM Institutions and Overall Public Investment Performance	28
C. PIM Institutions and Other Performance Indicators	30
V. STRENGTHENING PUBLIC INVESTMENT MANAGEMENT	36
A. Priorities for PIM Reform	36
B. Role of the Fund in Supporting PIM Reform	38
VI. ISSUES FOR DISCUSSION	39

FIGURES

1. Trends in Public Investment and Capital Stock _____	8
2. Private vs. Public Investment in Core Infrastructure in the UK and India _____	10
3. PPP Capital Stock _____	10
4. Indicators of Infrastructure Quality and Access _____	13
5. Public Investment and Infrastructure Coverage and Quality _____	14
6. Constructing the Public Investment Efficiency Frontier _____	15
7. Public Capital and Infrastructure Performance _____	16
8. Public Investment, Efficiency, and Output _____	18
9. The PIMA Framework _____	22
10. PI Institutional Overall Score by Country Group _____	23
11. Overall Scores by Income and Region _____	24
12. Correlations Among Public Investment Institutions _____	25
13. Public Investment Efficiency and Productivity to Institutional Strength _____	29
14. Institutions and Other PI Performance Indicators _____	33

TABLE

1. Composition of Public Sector Investment _____	12
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REFERENCES _____	40
-------------------------	----

ANNEXES

I. Estimating Public, Private, and PPP Capital Stocks _____	45
II. Measuring Efficiency Using Frontier Methods _____	50
III. Assessing the Impact of Investment on Growth _____	54
IV. The Public Investment Management Assessment _____	56
V. PPP Fiscal Risk Assessment Model (P-FRAM) _____	66

GLOSSARY

AE	Advanced Economies
COFOG	Classification of the Functions of Government
DEA	Data Envelopment Analysis
EM	Emerging Markets
FTE	Fiscal Transparency Evaluation
GG	General Government
ICOR	Incremental Capital to Output Ratio
ICRG	International Country Risk Guide
IIWG	Infrastructure and Investment Working Group
LIDC	Low Income Developing Countries
MTBF	Medium-Term Budget Framework
PEFA	Public Expenditure and Financial Accountability
P-FRAM	Public Fiscal Risk Assessment Model
PI	Public Investment
PIE-X	Public Investment Efficiency Indicator
PIM	Public Investment Management
PIMA	Public Investment Management Assessment
PPP	Public-Private Partnership
PWT	Penn World Tables
SOE	State-Owned Enterprises
TA	Technical Assistance
WEF	World Economic Forum

I. INTRODUCTION

1. Public investment can be an important catalyst for economic growth. Both theoretical and empirical studies have underscored the positive relationship between high-quality public infrastructure and economy-wide productivity (e.g., Buffie and others, 2012; Ghazanchyan and Stotsky 2013). Against the background of a steady decline in public investment as a share of GDP in advanced economies, evidence of infrastructure bottlenecks in emerging and developing economies, and the sluggish global economic recovery, many have called for ramping up public investment to raise long-run economic growth (IMFC 2014e; G20 2014). The Fund's October 2014 *World Economic Outlook* (IMF 2014c) underscored the contribution of public investment to growth and called for a surge in infrastructure investment to help further global recovery.

2. What determines public investment efficiency and productivity, i.e., the impact on public infrastructure quality and economic growth? Despite widespread anecdotal evidence of projects plagued by time delays, cost overruns, and inadequate maintenance, there are few robust empirical studies of the determinants of public investment efficiency. An exception is Warner (2014), who examined five episodes of public investment surges and found limited impact on long-run growth, due, in part, to weak or circumvented project appraisal, selection, and management procedures. Similarly, in a study of 52 LIDCs, Gupta and others (2014), found the strength of public investment management to be a significant factor in the relationship between public investment and growth. Also, based on a survey of their experts, McKinsey (2013) identified US\$1 trillion in potential efficiency gains from improvements in PIM around the globe.

3. This paper finds that better PIM enhances public infrastructure quality and economic growth, and pinpoints key institutional reforms needs to boost public investment efficiency and productivity. In doing so, the paper links recent macroeconomic studies regarding the connection between public investment and growth (e.g., IMF 2014c) and microeconomic analysis of the relationship between PIM practices and project-level performance (e.g., Flyvbjerg 2009; and Rajaram and others, 2014). This paper's findings and recommendations are based on a new comprehensive data set on trends in public investment, infrastructure quality, productivity, and growth, and two analytical innovations: (i) a new cross-country Public Investment Efficiency Index (PIE-X); and (iii) a new Public Investment Management Assessment (PIMA) which is applied to countries across a range of income levels.

4. The paper is structured as follows. Section II examines trends in and relationships between public investment, infrastructure quality, and economic growth, and estimates public investment efficiency across 134 countries. Section III presents the new PIMA and uses it to evaluate the strength of PIM institutions in a sample of 25 countries. Section IV explores the relationship between the PIMA estimates regarding institutional strength and various measures of public investment efficiency, productivity, and performance. Section V identifies priorities for enhancing public investment management and performance across countries, and explores the Fund's role in supporting these reforms in collaboration with other multilateral institutions.

II. PUBLIC INVESTMENT AND INFRASTRUCTURE QUALITY

5. This section reviews cross-country trends in and relationships between public investment, infrastructure quality, and economic growth. In doing so, it:

- Explores trends in public investment and the changing roles of the public and private sectors in the provision of infrastructure, and finds that the value of the public capital stock has only recently begun to recover from decades of decline relative to output;
- Analyzes the impact of public investment on the size and quality of public infrastructure, using a new index measuring the efficiency of public investment, and finds that around 30 percent of the potential gains from public investment are lost due to inefficiencies in public investment processes; and
- Examines the relationship between public investment efficiency and long-run growth, and finds that the most efficient public investors get twice the economic return from their investment than the least efficient.

Box 1 provides definitions of the key terms used in this section and the rest of the paper.

A. Trends in Public Investment and Capital Stock

6. Following three decades of steady decline, public investment as a share of GDP has begun to recover in some parts of the world. In advanced economies (AEs), average public investment has steadily decreased from a high of just under 5 percent of GDP in the late 1960s to a historic low of just over 3 percent of GDP in 2012. In contrast, in emerging markets (EMs) and low-income developing countries (LIDCs), public investment rates peaked at over 8 percent of GDP in the late 1970s/early 1980s, declined to around 4-5 percent of GDP in the mid-2000s, but have since recovered to 6-7 percent of GDP. Hence, public investment rates in AEs remain at historic lows, but have partially recovered in EMs and LIDCs over the last decade.

7. While the real value of the accumulated public capital stock has risen steadily on a per capita basis across countries, it has generally lagged behind economic output. Since 1960, the real value of the public capital stock has nearly tripled on a per capita basis across all countries. However, the public capital stock has failed to keep pace with rising output in AEs throughout this period. After a significant recovery of public capital stocks in the 1980s and 1990s, EMs and LIDCs saw reductions in their public capital/output ratios over the past decades, which have only just begun to reverse in the past few years (Figure 1).

Box 1. Definition of Public Investment Efficiency, Productivity, and Performance**Public Investment Performance**

Public Investment. Public investment is measured as general government gross fixed capital formation (GFCF) and comprises the total net value of general government acquisitions of fixed assets during the accounting period, plus variations in the valuation of nonproduced assets (e.g., subsoil assets). The general government comprises central and subnational governments, but excludes other public entities, such as state-owned enterprises (SOEs) and public-private partnership (PPP) arrangements.

Public Capital Stock. The public capital stock is the accumulated value of public investment over time, adjusted for depreciation (which varies by income group and over time), and is the principal input into the production of public infrastructure.^{1/}

Public Infrastructure. Public infrastructure is the network of physical assets created by public investment. These fixed assets include both *economic* infrastructure (e.g., highways, airports, roads, railways, water and sewer systems, public electric and gas utilities, pipelines, and telecommunications) and *social* infrastructure (e.g., public schools, hospitals, and prisons). The volume of infrastructure is measured using indicators of both access to and quality of the key infrastructure assets, including roads, electricity, water, education, and health care institutions.

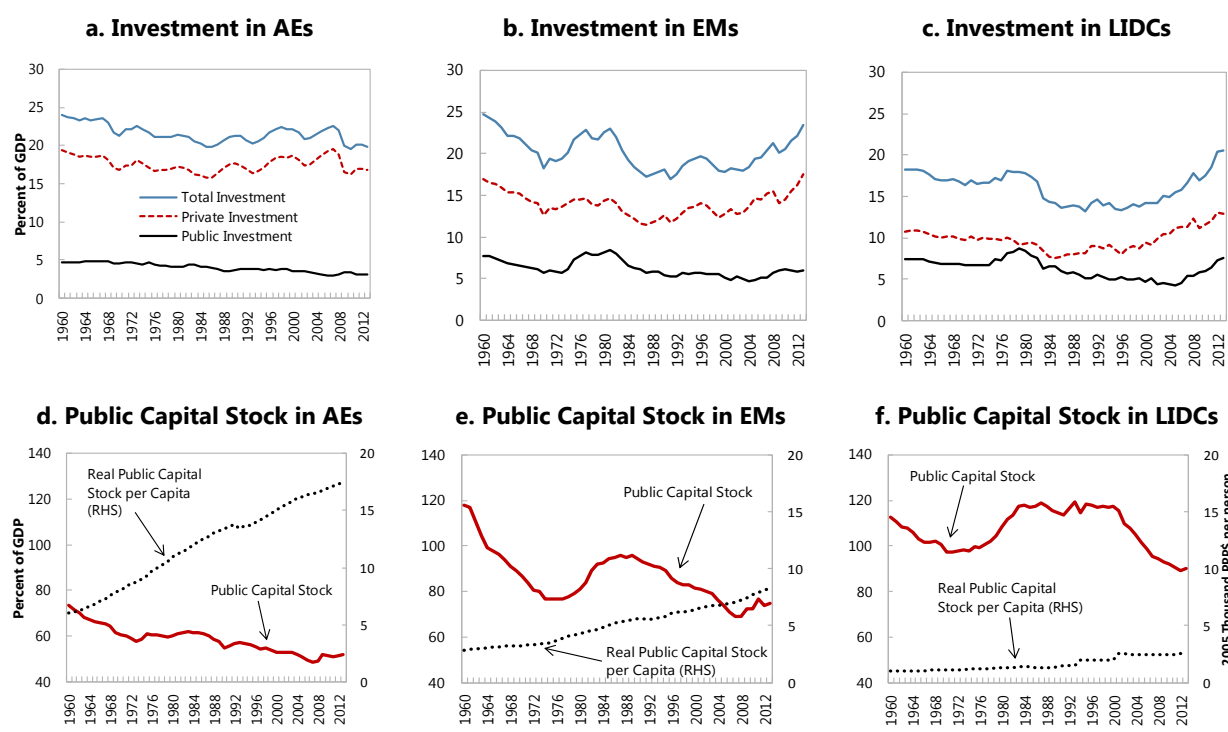
Public Investment Efficiency. The efficiency of public investment is the relationship between the value of the public capital stock and the measured coverage and quality of infrastructure assets. As described in Section II and Annex II, the level of efficiency in a given country is calculated as the distance from an efficiency frontier, which is defined by the countries with the highest coverage and quality of infrastructure (output) for a given level of public capital stock (input).

Public Investment Productivity. Public investment productivity is the relationship between investment and economic growth measured by the ratio of average real rate of capital stock growth to the average real rate of economic growth.

Public Investment Performance. Public investment performance refers to both the efficiency and productivity of public investment.

1/ The paper estimates the public capital stock using the perpetual inventory method—drawing from the methodology employed by Kamps (2006) and Gupta and others (2014). See Annex I for the detailed methodology.

Figure 1. Trends in Public Investment and Capital Stock
(percent of GDP and per-capita real terms, 2005 PPP\$-adjusted)



Sources: Center for International Comparisons (2013); OECD (2014); WEO; and IMF staff estimates.

8. While the public sector continues to dominate the provision of economic infrastructure in EMs and LIDCs, the private sector plays an increasingly important role in AEs. As discussed in Box 2, over the past half century, innovations in technology and financing arrangements, along with a reassessment of the role of the state, have enabled the commercialization of a growing array of infrastructure networks. In many AEs, the private sector has largely displaced governments in providing economic infrastructures, such as communications, energy, transport, and water supply networks. The privatization of infrastructure provision is most pronounced in AEs like the United Kingdom, where private companies account for almost two-thirds of investment in these sectors. By contrast, in EMs and LIDCs, these networks remain largely in public hands. In India, for example, the private sector accounts for less than a third of infrastructure investment (Figure 2). In addition, the public sector is still the main provider of social infrastructure. In education, the public sector accounts for more than half of total investment in both AEs and EMs; while for health, it ranges from about a third of investment in selected EMs, to about two-thirds in AEs, with a significant dispersion across countries.

Box 2. Public and Private Roles in the Provision of Infrastructure

The traditional rationale for the public provision of infrastructure is based on the concepts of public goods and market failures. Markets will fail to provide the socially beneficial level of a public good because it is nonrival (it can be consumed by many at the same time without being exhausted, e.g., a road) and nonexcludable (it is not possible to prevent those who do not pay from using it, e.g., national defense).^{1/} Potential underprovision of infrastructure also arises where services exhibit network effects (e.g., subway systems), positive externalities (e.g., clean water), or natural monopoly characteristics (e.g., electricity transmission). These characteristics give a private provider the ability and incentive to raise prices and/or restrict output below socially desirable levels and provide a rationale for public provision. Governments may also intervene to address social or equity considerations, such as providing universal access (e.g., basic education) or ensuring that vulnerable groups have access to services (e.g., transportation).

Technological innovations have better enabled the commercialization of a number of infrastructure networks, which were previously mostly the preserve of the public sector. Market segments formerly characterized by monopoly provision have changed due to growth in the size of the market and competition introduced by new technologies (e.g., electricity generation, mobile phones). In addition, more sophisticated instruments have been developed to regulate tax, or subsidize activities which generate externalities directly (e.g., pollution taxes, noise ordinances, electronic tolling on roads, and airport landing fees), enabling service provision and infrastructure investment decisions to be left largely to the private sector within an overarching policy or regulatory framework (e.g., telecommunication, electricity, airports, ports).

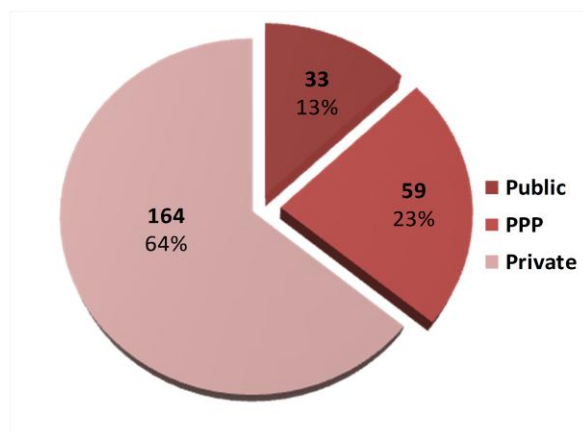
In recent decades, concerns about the public sector's efficiency in providing infrastructure have also encouraged greater private sector provision. Government intervention can generate inefficiencies due to the absence of market signals and commercial discipline. Thus, the case for government intervention due to market failure has to be balanced against risks of "government failure." Therefore, even if market failure occurs, private sector provision may be justified if governments cannot operate efficiently—that is, when governments incur excessive costs relative to expected benefits.

Nonetheless, the public sector still dominates the provision of social infrastructure because of equity considerations (e.g., universal access, social mobility). Similarly, despite technological advances, governments also remain the main providers of large and complex infrastructure projects, such as national railways and urban transport networks, mainly due to market conditions (e.g., pure monopolies) and private sector difficulties in financing big infrastructure projects (e.g., large fixed costs).

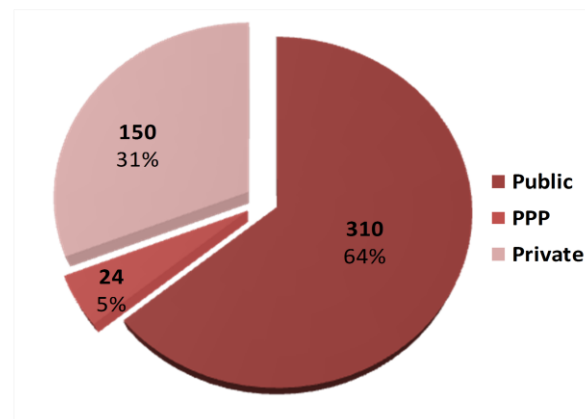
1/ Most publicly supplied services are mixed or "impure" public goods such as roads—consumption is rivalrous during congested periods, while exclusion may be difficult.

Figure 2. Private vs. Public Investment in Core Infrastructure in the UK and India
(percent of total investment)

UK Investment in Core Infrastructure
(US\$ 257 billion, 2011-15)



India Investment in Core Infrastructure
(US\$ 485 billion, 2007-11)

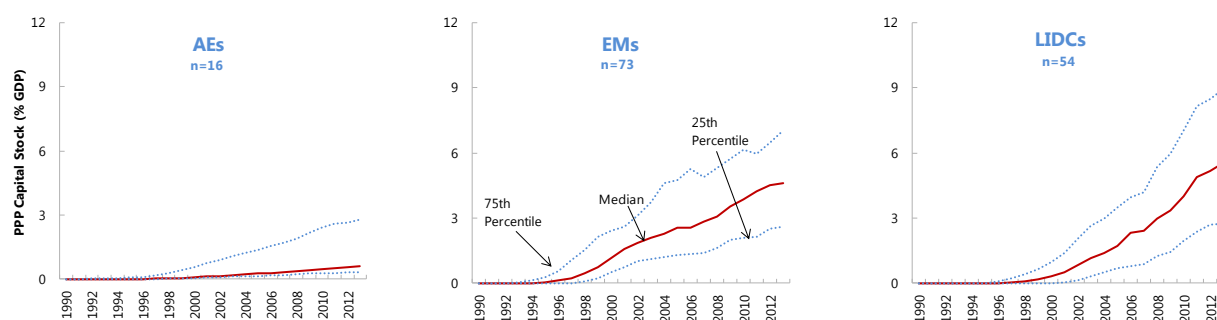


Source: McKinsey Global Institute (2013).

9. In the last decade, a growing proportion of infrastructure services has been delivered through PPPs, though with significant differences across countries (Figure 3).

In AEs, the PPP capital stock averaged around 1 percent of GDP in 2013 (or less than 5 percent of the public capital stock). In EMs and LIDCs, PPP capital stock has increased more rapidly to around 5 percent of GDP on average, and up to 9 percent of GDP in some countries. The sharp increase is of particular concern in LIDCs, where PPP frameworks remain weak, potentially exposing public finances to significant risks, and having significant implications for the efficiency of public investment spending (Box 3).

Figure 3. PPP Capital Stock
(percent of GDP)



Sources: EIB, WB, and IMF staff estimates.

The full line corresponds to the median level of PPPs capital stock as percent of GDP; while the dotted lines show the ratios for countries in the 25th and 75th percentiles.

Box 3. Role of Public-Private Partnerships in Public Infrastructure Provision

When used effectively, PPPs can deliver substantial savings relative to purely public provision of goods and services. Under a typical PPP, a firm provides upfront financing, and designs, builds, operates, and maintains an asset in exchange for a combination of user fees and/or periodic payments by the government over the life of the contract. PPPs can offer significant advantages over traditional public procurement in terms of mobilizing private financial resources and know-how, promoting the efficient use of public funds, and improving service quality. Although private financing is typically more expensive than government borrowing, a well-designed PPP contract can generate efficiencies that more than offset the higher cost of private capital by bundling the design, construction, and operation of an asset to incentivize the efficient, timely construction of high-quality assets, and the maintenance of and cost recovery from those assets over time.

However, not all investment projects can be effectively delivered using a PPP. The benefits of PPPs mainly arise from the government's ability to allocate risks efficiently between public and private parties to ensure the right incentives and reduce overall project costs. To do so, the outputs and the quality of services must be predictable and measurable for the duration of the project. PPPs in the IT or health sectors can be difficult, as the technological change is simply too rapid in relation to the typical length of a PPP contract. PPPs also require strong legal, policy, appraisal, approval, and monitoring arrangements to negotiate contracts and ensure that private partners meet their obligations.

Evidence of whether PPPs can provide infrastructure more efficiently than traditional public procurement is mixed. As discussed in Schwartz and others (2008) and Engel and others (2014), the benefits of PPPs vary significantly across projects and countries. For example, in Australia, the rolling stock rail infrastructure project was procured as a PPP, with cost savings of around 30 percent relative to the public-sector comparator. Similarly, five PPP water projects in Singapore resulted in a lower-than-expected bid price, partly due to design innovations and the use of improved technology. However, in many countries, projects have been procured as PPPs not for efficiency reasons, but to circumvent budgetary constraints and delay the recording of the fiscal costs of providing infrastructure services. This has led some governments to proceed with low-quality and fiscally costly projects that would otherwise have been excluded from their public investment plans. In some cases, PPPs have also resulted in large fiscal costs due to poor contract designs, optimistic assumptions about revenues from user fees, and minimum income guarantees provided by the governments. For example, during the 2008 global financial crisis, Portugal was forced to renegotiate its road PPPs when the calling of revenue guarantees by private partners threatened its fiscal position. The complexities and interdependencies between large infrastructure projects can also make them poorly suited to PPPs. In Scotland, the Skye Bridge PPP project faced significantly reduced demand due to lack of coordination with other crossings, which resulted in the government buying back the whole project from the private partner.

The Fund can play a role in helping countries manage PPPs. FAD is developing a PPP Fiscal Risk Assessment Model (P-FRAM), an analytical tool for systematically assessing the potential costs and risks arising from PPP projects (see Annex V).

10. Within the public sector, subnational governments and public corporations are major contributors to public investment. This is particularly true in AEs and large EMs, where regional and local governments undertake more than half of public investment.¹ Investment is more centralized in LIDCs where the central government still accounts for the bulk of general government capital expenditure. Public corporations (government-owned or controlled companies), also account for a large share of total public sector investment in some AEs and in many EMs and LIDCs (Table 1).²

Table 1. Composition of Public Sector Investment, 2013
(percent of GDP)

Institutions	Australia	Denmark	France	Peru	Mexico	Senegal	UK
Central government	0.5	0.9	1.3	2.3	3.4	1.6	1.7
Local government	2.6	1.4	2.8	3.9	0.8	n.a.	0.9
Public corporations and other entities	1.6	1.7	1.7	0.4	2.0	9.4	0.3
Public sector (consolidated)	4.7	4.0	5.8	6.6	6.2	11.0	2.9

Source: IMF staff estimates.

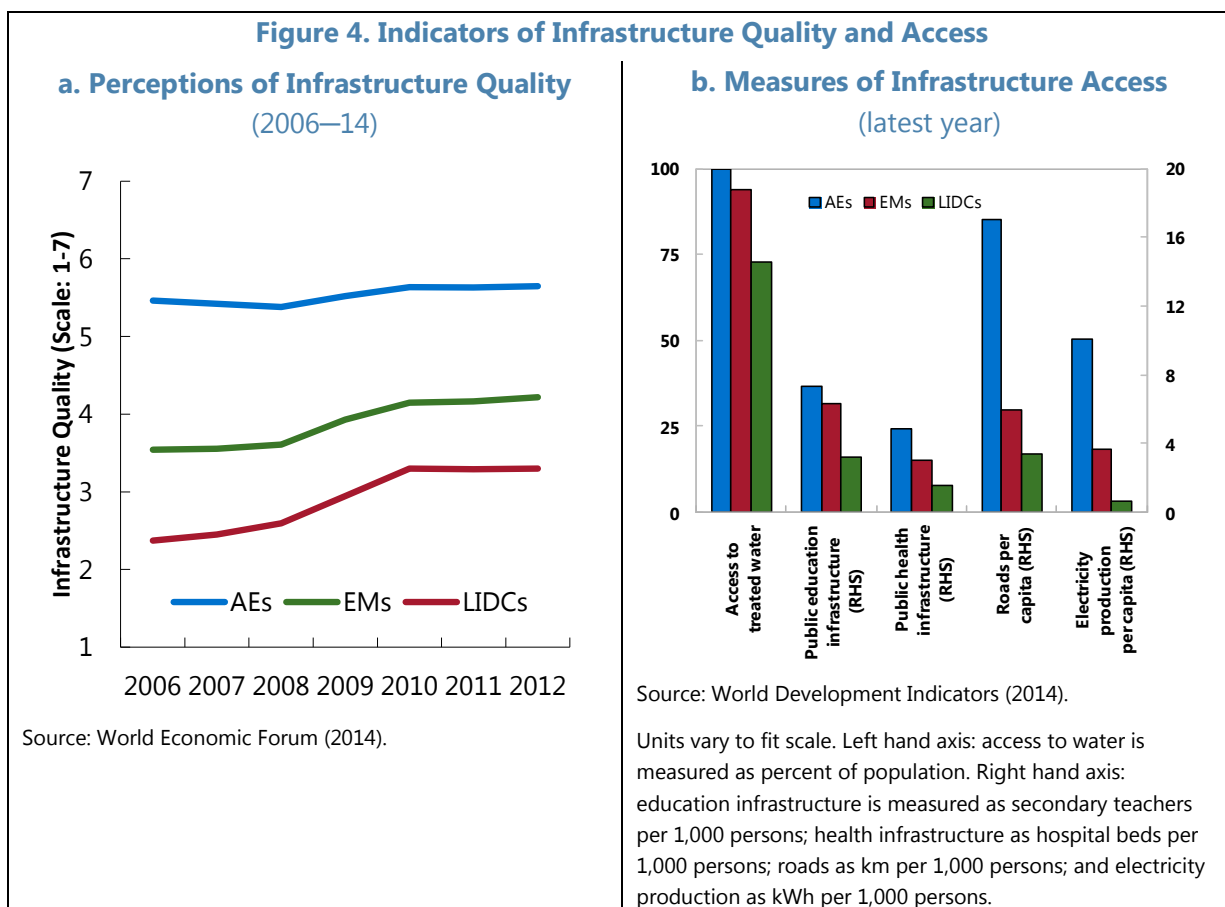
For Mexico, local government data are estimated from OECD National Accounts Database 2012, and may not be fully consistent with central government data.

B. Trends in Infrastructure Coverage and Quality

11. Large discrepancies in infrastructure coverage and quality persist across countries, although higher rates of public investment in EMs and LIDCs have brought about some convergence in access to social infrastructure. Survey-based measures of infrastructure quality suggest that the recent ramping up of public investment in LIDCs has helped reduce the perceived disparity in infrastructure across countries (Figure 4a). Physical measures of infrastructure also suggest significant convergence across countries in the coverage of social infrastructure (e.g., schools, hospitals, and water). However, large and persistent disparities between higher- and lower-income countries remain within the coverage of economic infrastructure (e.g., roads and electricity networks) (Figure 4).

¹Data on the share of subnational governments in total spending can be used as a proxy for their shares in investment spending. For the 28 EMs that report both central and general government spending in the IMF's *Government Finance Statistics*, central governments accounted for 82 percent of total spending. In the eight LIDCs reporting these data, almost all spending was undertaken by central governments.

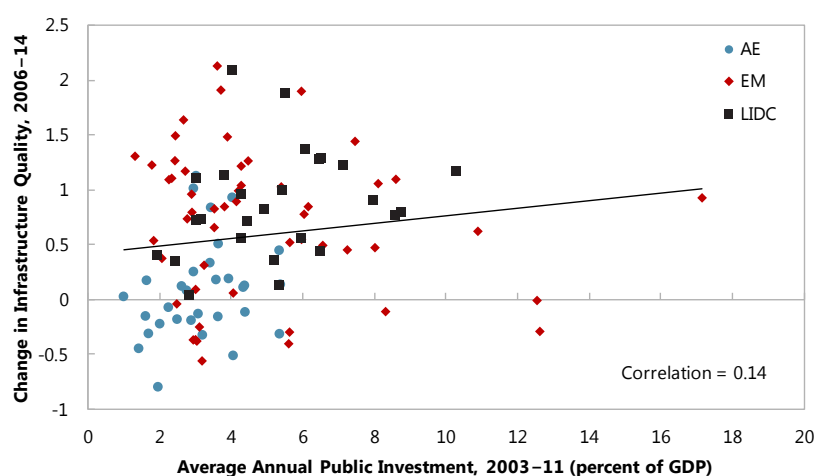
² Table 1 is purely illustrative, as data on the breakdown between central and local governments are limited.

Figure 4. Indicators of Infrastructure Quality and Access

12. Improvements in infrastructure coverage and quality are only loosely correlated with public investment, pointing to significant levels of inefficiency across countries.

Figure 5 shows the relationship between a lagged measure of public investment and the change in perceptions of infrastructure coverage and quality, as measured by the World Economic Forum. The relatively weak correlation between average annual public investments over the previous three years and the perceived improvement in infrastructure coverage and quality, suggests that there is considerable scope to enhance the efficiency of public investment in most countries.³

³ See IMF (2014d) for a similar discussion.

Figure 5. Public Investment and Infrastructure Coverage and Quality

Sources: Center for International Comparisons (2013); OECD (2014); WEO; World Economic Forum (2014); and IMF staff estimates.

C. Estimating Public Investment Efficiency

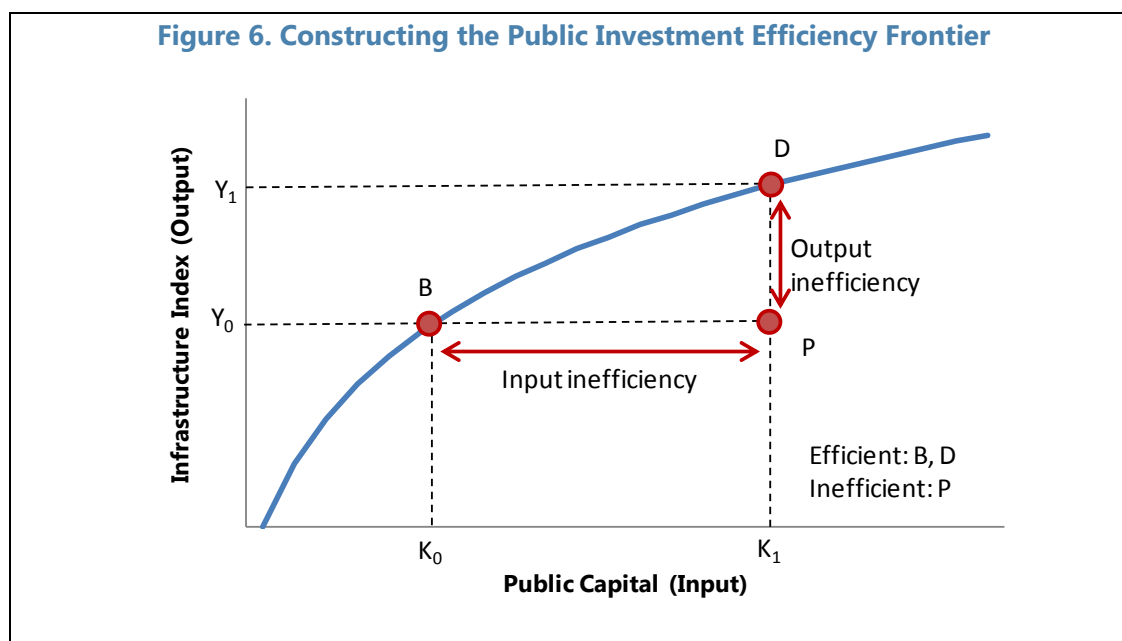
13. This section provides a new comprehensive measure of how much infrastructure “bang” a country gets for its public investment “buck.” For over 100 countries, the new Public Investment Efficiency indicator (PIE-X estimates the relationship between the public capital stock and indicators of access to and the quality of infrastructure assets.⁴ Countries with the highest levels of infrastructure coverage and quality (output) for given levels of public capital stock and income per capita (inputs) form the basis of an efficiency frontier and are given a PIE-X score of 1 (Figure 6). Countries are given a PIE-X score of between 0 and 1, based on their vertical distance to the frontier relative to peer best performers. The less efficient the country, the greater the distance from the frontier, and the lower its PIE-X score. Three measures of infrastructure quality and access are considered in constructing the frontier⁵:

- A *physical indicator*, which combines data on the volume of economic infrastructure (length of road network, electricity production, and access to water) and social infrastructure (number of secondary teachers and hospital beds). While this indicator provides a sense of the coverage of infrastructure networks and physical output of public investments, it does not fully measure the quality of the infrastructure.
- A *survey-based indicator* based on the World Economic Forum’s survey of business leader’s impressions of the quality of key infrastructure services. While this indicator provides a measure of the quality of infrastructure assets, it is affected by individual perception biases and fails to capture the coverage dimension adequately.

⁴ The number of countries with available PIE-X scores ranges from 114 to 134 depending on the model used.

⁵ A more detailed discussion of the measurement of infrastructure performance as well as the construction of PIE-X can be found in Annex II.

- A *hybrid indicator*, which combines the physical and survey-based indicators into a synthetic index of the coverage and quality of infrastructure networks.

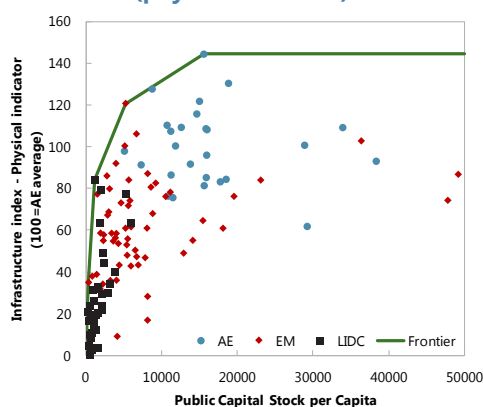


14. PIE-X estimates confirm that there is substantial scope for improving public investment efficiency in most countries. This is illustrated in Figures 7a, c, and e, which show the estimated efficiency frontier, linking the real value of public capital and the three indicators of infrastructure coverage and quality. While there are efficient countries in all income groups, the efficiency of public investment generally increases with income per capita. However, the slope of the frontier decreases as the level of the public capital stock rises, illustrating the decreasing marginal returns to additional investment. This leveling off of the efficiency frontier is especially pronounced for the physical indicator, given the limited scope to expand access to infrastructure services once universal coverage has been achieved. Given the similar results yielded by the different infrastructure indicators and the advantages of using an indicator that incorporates both infrastructure coverage and quality dimensions, the hybrid indicator is used for the subsequent analysis in this section.

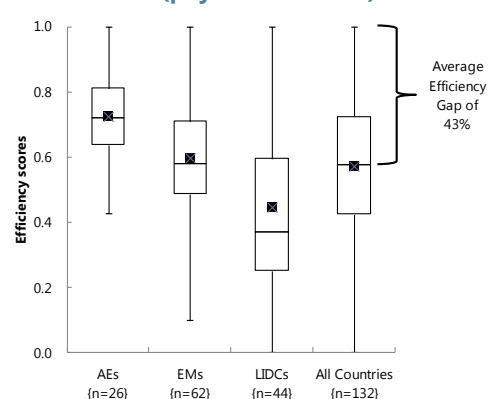
15. Based on the hybrid indicator, the average efficiency gap is 27 percent with some countries having much higher gaps (Figure 7f). This efficiency gap is measured as the distance between the average country and the frontier for a given level of public capital stock and income per capita. The size of the gap shrinks as income rises, with LIDCs facing a gap of 40 percent, EMs facing a gap of 27 percent, and AEs facing a gap of 13 percent on average.

Figure 7. Public Capital and Infrastructure Performance

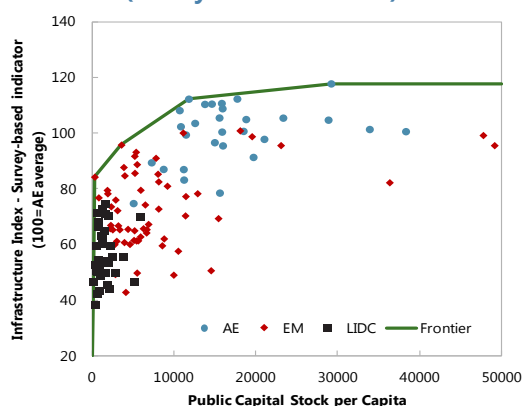
a. Public Investment Efficiency Frontier (physical indicator)



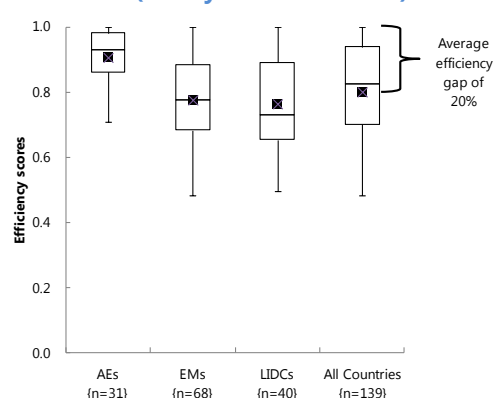
b. Public Investment Efficiency Index (PIE-X) (physical indicator)



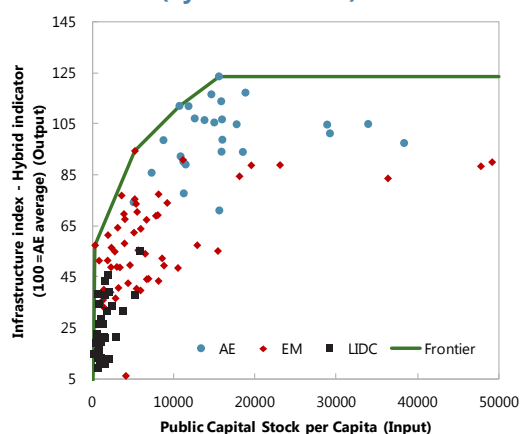
c. Public Investment Efficiency Frontier (survey-based indicator)



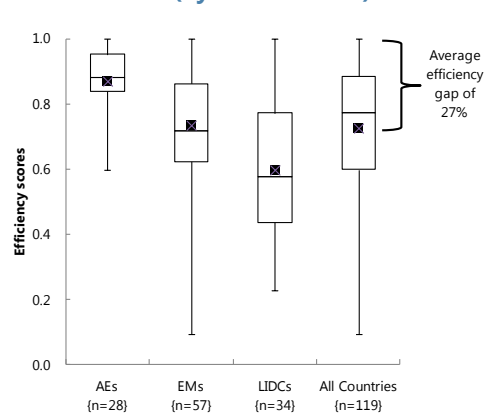
d. Public Investment Efficiency Index (PIE-X) (survey-based indicator)



e. Public Investment Efficiency Frontier (hybrid indicator)



f. Public Investment Efficiency Index (PIE-X) (hybrid indicator)



Sources: Center for International Comparisons (2013); World Economic Forum (2014); OECD (2014); WEO; World Development Indicators (2014); and IMF staff estimates.

The box shows the median as well as the 25th and 75th percentiles while the whiskers show the maximum and minimum values. The black square shows the average. Scores range between 0 and 1.

D. Public Investment Efficiency and Growth

16. The efficiency of public investment has important implications for growth. The impact of public investment on growth is well documented (see Aghion and Howitt, 2009; and Ghazanchyan and Stotsky, 2013). A number of authors have recently argued that countries with more efficient public investment also see stronger relationships between investment and economic growth. Gupta and others (2014) present evidence that public capital—when adjusted for efficiency—is a significant contributor to growth. The IMF (2014c) argues that the growth dividend from investment can be significant, but is limited when the investment process is inefficient. At the same time, Berg and others (2015) point out that countries with low efficiency often also have relatively scarce capital and thus can still enjoy high returns to investment relative to those with more efficient investment but also more capital (see Box 4).

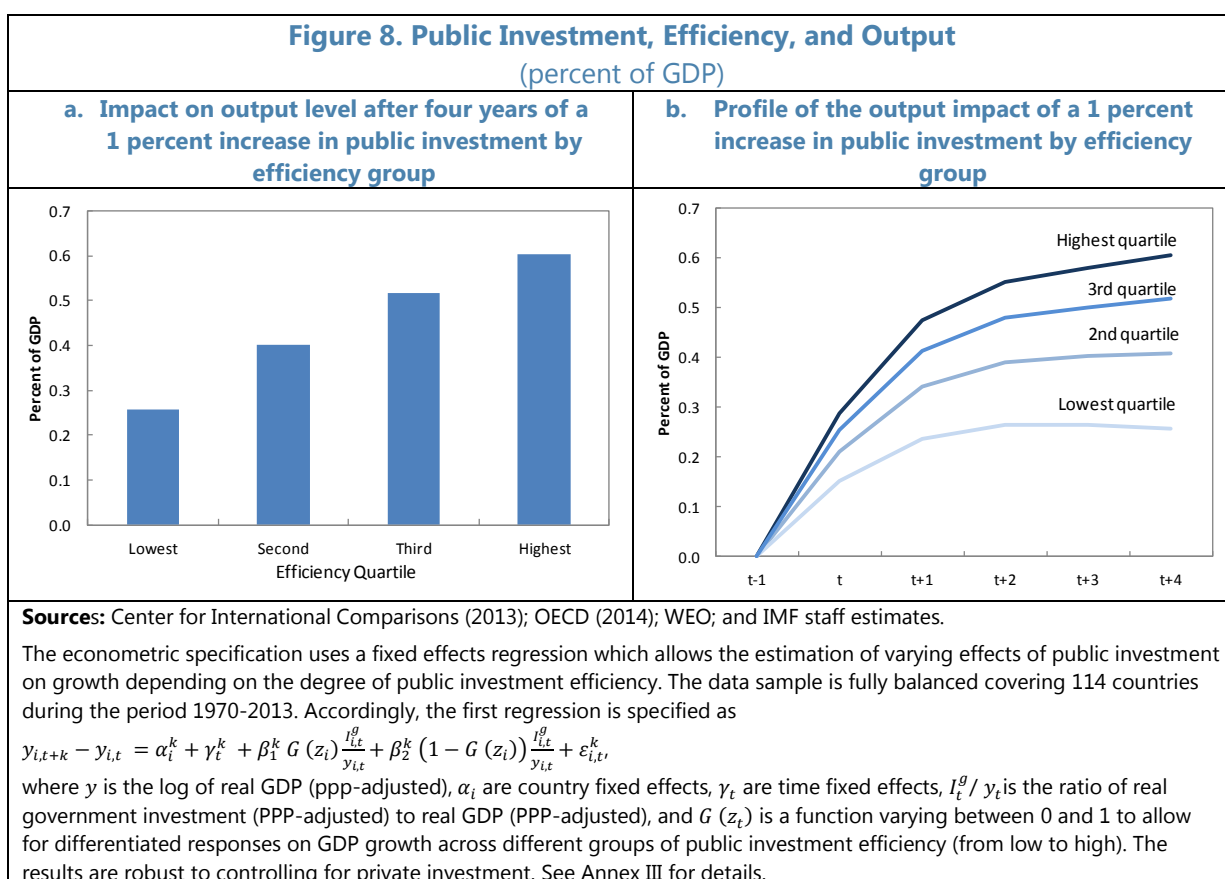
Box 4. Public Investment Efficiency and Growth

Much of the theoretical and empirical literature supports the idea that public investment raises output through both demand and supply effects (see Aschauer, 1989; Straub, 2007; and Chakraborty and Dabla-Norris, 2009). Estimates of the size of this impact vary due to uncertainties around fiscal multipliers on the demand side and inefficiencies on the supply side (Easterly and Rebelo, 1993; and Warner, 2014). The IMF (2014c) found that public investment shocks raise the level of output by around 0.4 percent in the same year, and 1.5 percent after four years in advanced economies. In developing countries, the impact on output was smaller, at around 0.25 in the same year, and 0.5 after four years.

The impact of improvements in the efficiency of public investment on growth has received less attention. Intuition would suggest that countries with more efficient PIM arrangements would also see a bigger growth “bang” from their investment “buck.” This is supported by theoretical (Chakraborty and Dabla-Norris, 2009) and empirical (Gupta and others, 2014) analyses. IMF (2014c) finds that investment shocks have an even bigger growth impact in AEs with more efficient public investment, increasing the level of output by 2.6 percent after four years. However, Berg and others (forthcoming) qualify this latter finding. They note that countries with low levels of efficiency are likely to have particularly scarce public capital and, therefore, a higher marginal productivity of public capital than high-efficiency countries. As a result, the higher marginal productivity may offset any losses from lower levels of efficiency, such that the growth impact of higher investment spending is likely to be roughly invariant to the level of efficiency. These theoretical results however, rely crucially on the assumption that efficiency is constant over time.

The empirical results presented here would support the view that investment efficiency matters for growth. Cross-country regressions suggest that the growth dividend of investment is larger for high-efficiency than for low-efficiency countries (Figure 8 below). Regardless of the relationship between public investment efficiency and growth *across* countries, improving efficiency *within any given* country has an unambiguously positive impact on growth. As discussed in the main text, the most efficient public investors see twice the growth impact compared with the least efficient, in line with the results in IMF (2014c). This is also consistent with model simulations in Berg and others (forthcoming) that show that efficiency may have substantial growth benefits for low-efficiency countries. Indeed, “investing in investing”—or strengthening public investment management—could yield an even high growth “bang” for their investment “buck.”

17. The economic dividend from closing the public investment efficiency gap could be substantial—moving from the lowest quartile to the highest quartile in public investment efficiency could double the impact of that investment on growth.⁶ Figure 8a shows that a one-off 1 percent of GDP increase in public investment increases output by just 0.3 percent for countries in the bottom efficiency quartile, but 0.6 percent for countries in the top efficiency quartile. Were a country in the lowest efficiency quartile able to increase its efficiency to the level of the highest quartile, it would double the economic “bang” it gets for its public investment “buck.” As shown in Figure 8b, the effect is strongest in the first year of the investment increase and then tapers off, this decrease occurring most rapidly for the lowest efficiency countries. This illustrative calculation is consistent with more comprehensive empirical studies of the relationship between investment and growth (Calderón and Servén, 2004; IMF, 2014c; and Gupta and others, 2014).



⁶ Higher efficiency could increase growth through a number of channels. Higher quality public capital can lower transaction costs for the private sector and raise the marginal productivity of private human and physical capital. Improving investment efficiency would also create fiscal space by providing better infrastructure at lower cost and releasing resources for more investment or growth-enhancing recurrent expenditure and/or reductions in marginal taxes.

III. ASSESSING PUBLIC INVESTMENT MANAGEMENT

18. Differences in the efficiency of public investment across countries partly reflect differences in the relative strength of PIM institutions. The impact of public investment on infrastructure quality and economic performance is, of course, mediated by a range of factors. These include, for example, the level of economic development, structural characteristics of the economy,⁷ the quality of governance, geography, and climate. However, a growing body of literature underscores the role that the legal, institutional, and procedural arrangements for public investment management play in determining the level, composition, and impact of public investment (see Box 5). The analysis presented in Sections III and IV suggests that improvements in public investment management practices could reduce the efficiency gap identified above by two-thirds on average across countries. Clearly, the necessary institutional changes cannot be introduced overnight; they entail significant legal and institutional changes, often require the development of new skills and capacities, and will take time to deliver the envisaged benefits. Countries need to invest in public investment management.

A. The Public Investment Management Assessment (PIMA) Framework

19. Fund staff has developed a new Public Investment Management Assessment (PIMA) to assess the quality of public investment management practices. The PIMA evaluates 15 key institutions for planning, allocation, and implementing public investment. These PIM institutions are a subset of the broader framework of budget institutions that govern the public financial management process.⁸ The PIMA includes elements similar to other PIM diagnostic tools,⁹ but provides a more comprehensive assessment of the public investment decision-making process at three key stages:

- i. **Planning** sustainable levels of investment across the public sector;
- ii. **Allocating** investment to the right sectors and projects; and
- iii. **Implementing** projects on time and on budget.

Based on a review of the PIM literature (summarized in Box 5), the remainder of this section discusses the 15 institutions that make up the PIMA framework, describes the methodology used to generate the overall PIMA scores, and presents the results of PIMA evaluations for a sample of 25 AEs, EMs, and LIDCs.

⁷ See (Albino-War, 2014) for a discussion of public investment in natural resource-rich MENA and CCA oil-exporting countries.

⁸ See IMF (2014b).

⁹ Such as the Public Investment Management Index (Dabla-Norris and others, 2012) and the World Bank's "unified framework" (Rajaram and others, 2014).

Box 5. Public Investment Management: Literature Review

Empirical studies underscore the importance of fiscal institutions for public investment performance.

Weak institutions are associated with higher levels of investment, but also greater volatility in investment expenditure and lower quality of infrastructure (Tanzi and Davoodi, 1997; Keefer and Knack, 2007; and Grigoli and Mills, 2013). By contrast, higher public investment efficiency is generally associated with stronger institutions and low dependency on natural resource revenues (Albino-War and others, 2014). The Public Investment Management Index (PIMI) developed by Dabla-Norris and others (2012) showed wide variations in the efficiency and effectiveness of PIM across middle- and low-income countries. Yet, because the index relied largely on secondary-data sources, it could not evaluate all key institutions specific to public investment and depended on proxies for others. Nonetheless, using a PIMI-adjusted capital stock, Gupta and others (2014) found that the quality of PIM is an important determinant of the productivity of public capital.

The literature on PIM practices highlights the importance of transparency and well-governed institutions at key stages of the investment cycle:

- **Planning:** Balassone and Franco (2000), Creel and others (2007), and Schaechter and others (2012), discuss the role of *fiscal rules* in ensuring sustainable levels of public investment. OECD (2014) underscores the importance of effective, integrated *strategic planning* at the *national and subnational level*. Schwartz and others (2008) discusses the institutional arrangements needed to maximize the gains and minimize the risks associated with *PPPs*. OECD (2005) provides detailed guidance on the financial oversight and governance of *state-owned enterprises*, many of which operate in the infrastructure sector.
- **Allocation:** Dabla-Norris and others (2012), and Fainboim and others (2013) stress the importance of *medium-term budget frameworks*, *the unification of current and capital budgets*, and *consolidation of extrabudgetary funds* to the effective allocation of investment to the most productive sectors. Rajaram and others (2014) highlight the contribution of transparent and rigorous *project appraisal and approval* procedures to ensure that projects are selected based on credible estimates of their costs and benefits.
- **Implementation:** Dabla-Norris and others (2012), Flyvberg (2009), and Rajaram and others (2014) all underscore the role of firm *expenditure controls*, efficient *liquidity management*, regular *project execution reporting* and strong *project management* arrangements in ensuring that investment projects are delivered on time and on budget. The IMF's Government Finance Statistics Manual 2014 (GFSM 2014) discusses the benefits of regular *reporting on the condition and value of the resulting infrastructure assets* for fiscal monitoring and investment planning purposes.

20. Stage 1: Planning. Efficient investment planning requires institutions that ensure public investment is fiscally sustainable and effectively coordinated across sectors, levels of government, and between public and private sectors. The PIMA therefore assesses whether countries have:

- **Fiscal principles or rules** which ensure that overall levels of public investment are adequate, predictable, and sustainable;
- **National and sectoral plans** which ensure public investment decisions are based on clear and realistic priorities, cost estimates, and objectives for each sector;

- **Central-local coordination** arrangements that integrate public investment plans across levels of government, provide certainty about funding from the central government, and ensure sustainable levels of subnational borrowing;
- **Management of public-private partnerships**, which ensure effective evaluation, selection, and monitoring of PPP projects and liabilities; and
- **Regulation of infrastructure companies**,¹⁰ which promotes open and competitive markets for the provision of infrastructure services, objective pricing of infrastructure outputs, and effective oversight of infrastructure company investment plans.

21. Stage 2: Allocation. Allocation of capital spending to the most productive sectors and projects requires a comprehensive, unified, and medium-term perspective to capital budgeting, as well as objective criteria and competitive procedures for appraising and selecting particular investment projects. The PIMA therefore assesses whether countries have:

- **Multi-year budgeting** that provides transparency and predictability regarding levels of investment by ministry, program, and project over the medium term;
- **Budget comprehensiveness** that ensures that all public investment, regardless of the funding channel, is authorized by the legislature and disclosed in the budget documentation;
- **Budget unity** that ensures that decisions about individual projects take account of both their immediate capital and future operating and maintenance costs;
- **Project appraisal** that ensures that project proposals are subject to published appraisal using standard methodology and taking account of potential risks; and
- **Project selection** that ensures that projects are systematically vetted, selected based on transparent criteria, and included in a pipeline of approved projects.

22. Stage 3: Implementation. The timely and cost-effective implementation of public investment projects requires institutions that ensure projects are fully funded, transparently monitored, and effectively managed. The PIMA therefore assesses whether countries have:

- **Protection of investment** that ensures project appropriations are sufficient to cover total project costs and cannot be diverted at the discretion of the executive;
- **Availability of funding** that allows for the planning and commitment of investment projects based on reliable forecasts and timely cash flows from the treasury;
- **Transparency of budget execution** that ensures that major investment projects are tendered in a competitive and transparent process, monitored during project implementation, and independently audited;

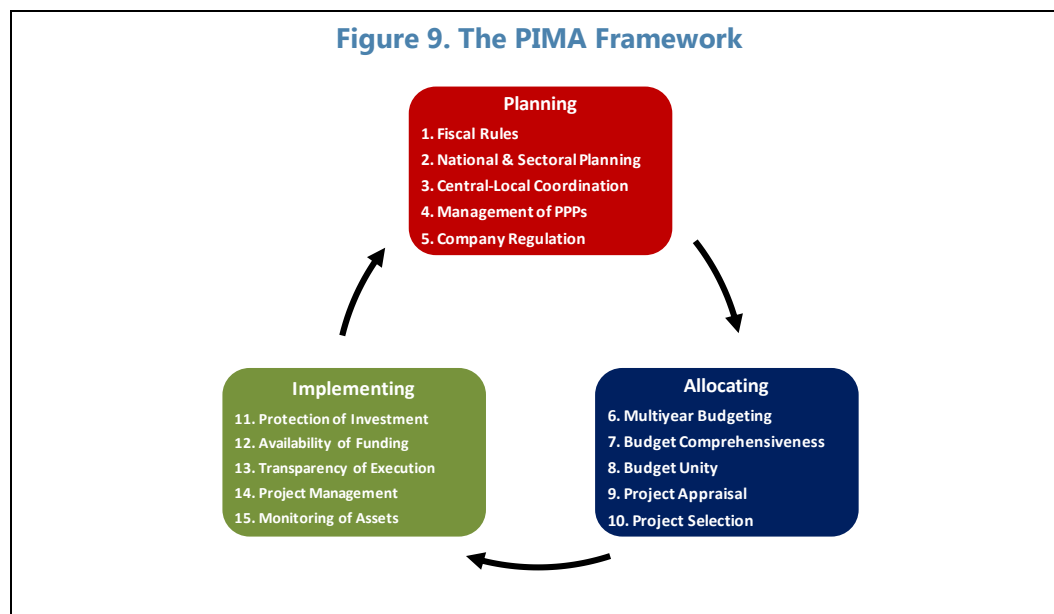
¹⁰ Examples are regulated private sector companies in the telecom, energy, transport and water sectors.

- **Project management** that identifies an accountable project manager working in accordance with approved implementation plans, and provides standardized procedures and guidelines for project adjustments; and
- **Monitoring of public assets** that ensures assets are properly recorded and reported and that their depreciation is recognized in financial statements.

B. PIMA Methodology

23. The 15 institutions described above provide the framework for PIMA (Figure 9).

For each of the 15 PIM institutions, three key design features are identified, each of which can be fully met, partly met, or not met. Based on how many of these key features are in place, countries are given a PIMA score of between 0 (no key features in place) and 10 (all 45 key features fully in place). The precise evaluation methodology is described in Annex IV. The PIMA improves upon other evaluations of public investment management in a number of respects. The PIMA is more comprehensive, bringing in elements related to macro-fiscal frameworks, integration of investment planning in medium-term budgeting, coordination of public investment across levels of government, and private sector participation in the provision of public infrastructure. The framework is also more relevant to countries at the higher end of the income scale, reflecting more advanced practices in the areas of fiscal principles, management of PPPs, project appraisal and selection, and monitoring of public assets. Using the new tool, the next section looks at the relative strengths and weaknesses of PIM practices across a sample of 25 AEs, EMs, and LIDCs.¹¹

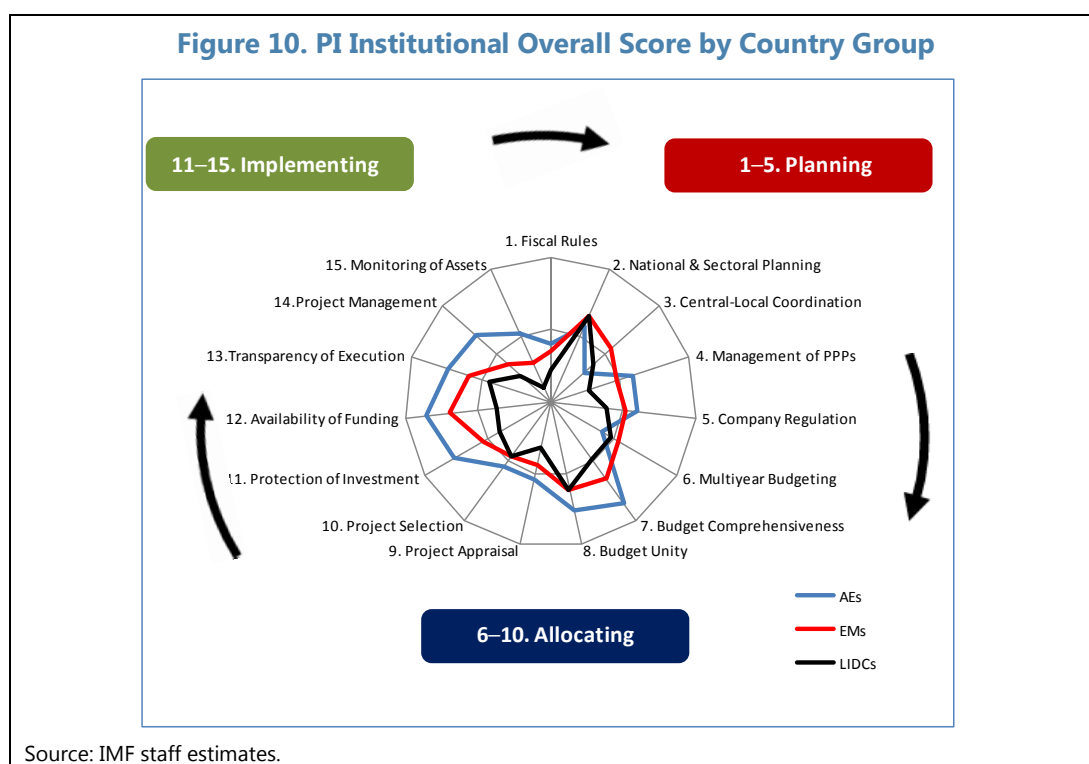


¹¹ The countries in the sample were selected to represent a broad range of countries in terms of income, geography, size, public investment levels, and public investment quality. They include seven AEs (Finland, Germany, Japan, Korea, Spain, the United Kingdom, and the United States); nine EMs (Algeria, Brazil, Chile, India, Jordan, the Philippines, Qatar, Romania, and South Africa); and nine LIDCs (Bolivia, Cambodia, Ethiopia, Ghana, Nepal, Niger, Senegal, Sri Lanka, and Uganda).

C. Results of the PIMA Evaluation

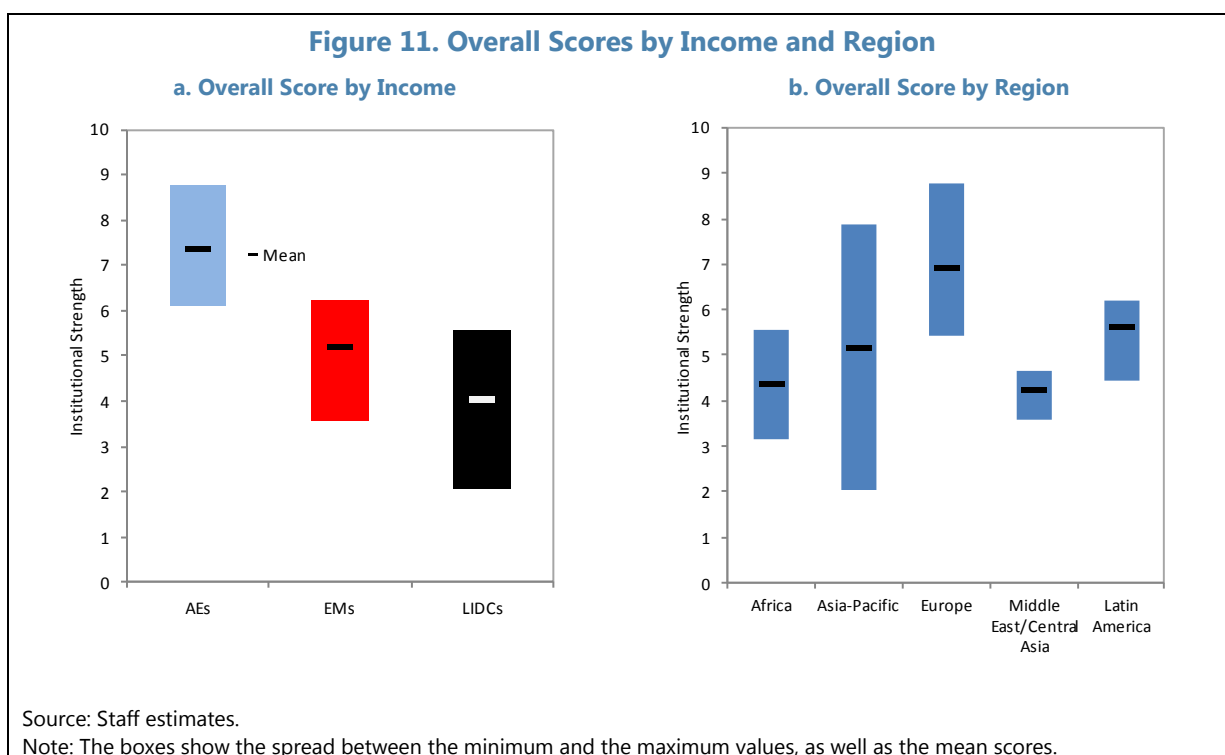
Overall PIM Strengths and Weaknesses

24. AEs have stronger PIM institutions overall, but not uniformly so. The overall strength of PIM is strongly correlated with income, with PIM institutions being, on average, weakest in LIDCs and strongest in AEs (Figure 10). Exceptions are national and sectoral planning, central-local coordination, and multiyear budgeting, where EMs or LIDCs score at least as well as AEs.



25. Average institutional strength tends to increase along the investment cycle, with planning being the weakest and implementation the strongest. Yet, there are important exceptions here too. AEs are relatively strong in the management of PPPs, regulation of infrastructure companies, and budget comprehensiveness and unity. EMs and LIDCs perform relatively poorly when it comes to availability of funding, management of project implementation, and monitoring of public assets.

26. Variations in institutional strength are largest among LIDCs and in the Asia-Pacific region. LIDCs in the sample have the overall largest variation in institutional strength, while AEs have the smallest (Figure 11a). While AEs perform better on average, some score worse than the best LIDCs and EMs for a majority of institutions. Overall scores by geographic region show PIM to be strongest in Europe and Latin America, weakest in countries in the Middle East and Central Asia, and characterized by considerable variation in the Asia-Pacific region (Figure 11b).

Figure 11. Overall Scores by Income and Region

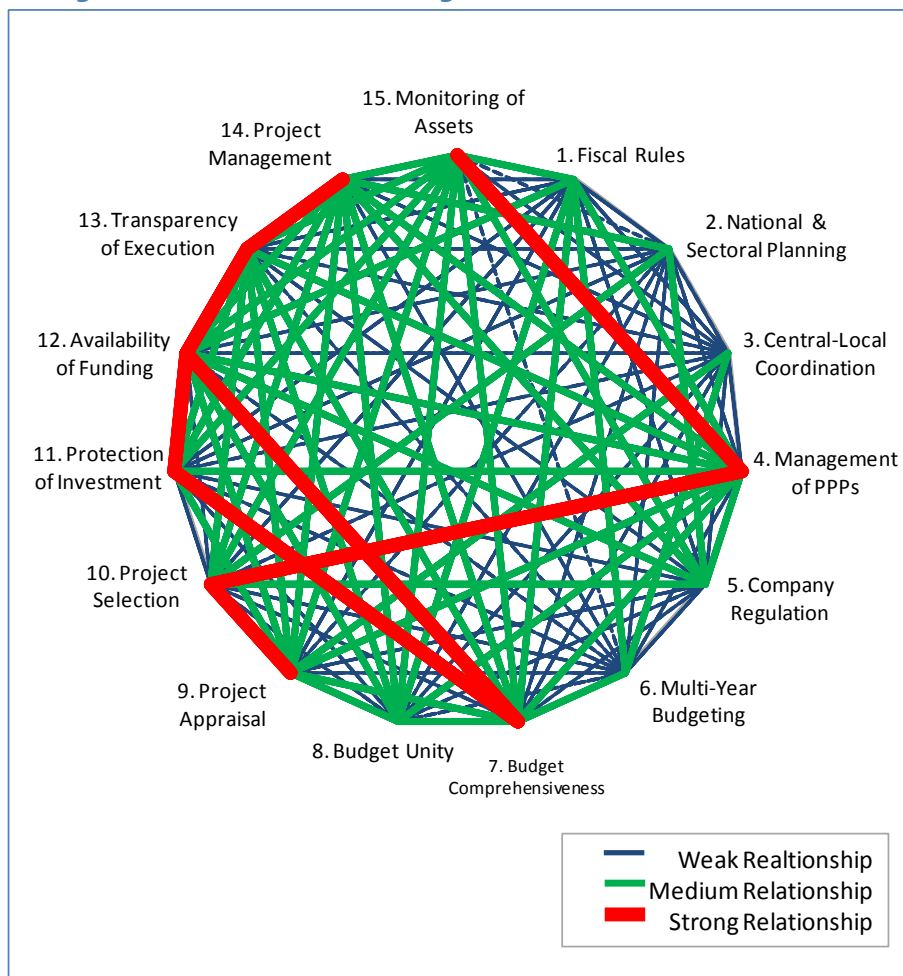
Linkages between PIM Institutions

27. Correlations in the strength of different institutions point to complementarities between different stages of the PIM process (Figure 12). Notably:

- Budget comprehensiveness, protection of investment allocations, and ensuring the availability of funding are strongly correlated, highlighting the complementarity between sound budgeting and the efficient financing of capital projects;
- Countries with strong institutions for project selection and project appraisal are generally also strong in the management of PPPs, underscoring the benefits of strong project evaluation across both conventional public and PPP projects;
- Implementation institutions, such as transparency of budget execution, management of project implementation, and availability of financing, tend to be developed in tandem as countries realize their importance for public investment performance;
- Countries that effectively monitor public assets also tend to have strong institutions for managing PPPs, indicating the role that the adoption of modern accounting standards plays in the recognition of both the physical assets of government and contingent liabilities associated with PPPs; and
- National and sectoral planning correlates relatively weakly with other institutions. This may suggest that national and sectoral strategic plans can sometimes be drawn up in a vacuum and in a manner that is not well integrated with budgeting. Box 6 provides examples of

countries where strategic planning has been strengthened in recent years with an eye to improving the strategic focus of both budget and PIM processes.

Figure 12. Correlations Among Public Investment Institutions



Source: IMF staff estimates.

Correlations are measured as simple correlations between each of the institutions. Weak relationships are in the range between 0.1 and 0.3. Medium relationships are in the range between 0.3 and 0.6. Strong relationships are correlations above 0.6.

Box 6. Public Investment and Strategic Planning

Many developing and emerging market countries have long-established centralized processes for investment planning. The strategic planning of investment fell out of favor in advanced economies in the 1960s and 1970s, during which time investment decisions were devolved to line ministries, agencies, and public corporations, but has recently been revived in a number of countries. The aim of this new wave of centralized investment planning is to target scarce funds to key infrastructure bottlenecks, ensure that investment projects comply with rigorous standards of evaluation; establish a pipeline of strategically important projects to be financed through public, private, or hybrid financing mechanisms; share expertise in project management; and track project execution.

Uganda. Investment projects are prioritized within *multiyear sector development strategies*, guided by an indicative medium-term budget framework (MTBF). A public investment programming (PIP) mechanism was established in 1994 to coordinate the prioritization and funding of postconflict reconstruction and rehabilitation, which was then almost entirely funded by donors. Since then, Uganda has institutionalized a transparent framework for planning, appraisal, and approval of capital projects. This framework integrates planning and budgeting requirements, and is coordinated by the Development Committee in Ministry of Finance, Planning and Economic Development. Although the framework is well defined, it is not always adhered to in practice.

Brazil. The Growth Acceleration Program (PAC) introduced in 2007 is a comprehensive rolling four-year plan that coordinates investment and PPPs made by central government, subnational governments, and state-owned enterprises. The program includes large infrastructure projects in the areas of energy, transportation, housing, water and sanitation, environment, and health. To be included in the budget a large project has to be part of the PAC. The Ministry of Planning and Budget created a dedicated unit to plan, coordinate, and supervise implementation, as well as a portal to provide information on the projects. The PAC has helped to boost investment from 1.6 percent of GDP in 2006 to 3.4 percent in 2010. The increase in investment is attributed to a better planning around a development strategy focused on key sectors, increased synergies between public and private sectors, and improved efficiency and transparency on regarding major investments.

Korea. Using a range of tools and procedures, the Ministry of Strategy and Finance (MOSF) manages an elaborate planning and project-selection system. The *Preliminary Feasibility Study* (PFS) evaluates whether a project is eligible for financing through the budget, taking into account both economic and policy analyses, risk assessment, and a regional evaluation. A comprehensive pipeline of investment projects is prepared by the MOSF, based on the results of the PFS, and used to select projects for inclusion in the annual budget and National Fiscal Management Plan.

United Kingdom. The UK government established Infrastructure UK, a dedicated unit within HM Treasury, to coordinate the planning and prioritization of investment in UK infrastructure. In 2010, the unit published its first *National Infrastructure Plan*, identifying the infrastructure investments needed to sustain and enhance economic growth. In September 2013, it published the first National Infrastructure Pipeline identifying the 600-plus public and private investment projects and programs that were planned and underway in seven strategic sectors together with their medium-term cost profile. This pipeline has provided the basis for the identifying projects to be funded in subsequent government budgets, and for securing financing from private sector partners.

IV. EXPLAINING PUBLIC INVESTMENT PERFORMANCE

28. This section considers the contribution of PIM institutions to public investment performance. It presents evidence for a relationship between the strength of PIM institutions, as measured by the PIMA, and various direct and intermediate indicators of public investment efficiency and productivity. It finds that:

- Countries with stronger PIM institutions have more stable, credible, efficient, and productive public investments and lower perceived levels of rent-seeking and corruption; and
- Strengthening PIM practices can reduce the public investment “efficiency gap” by around two-thirds, with the largest payoffs in EMs and LIDCs.

29. There are some important caveats to the analysis presented in this section. First, although efforts have been made to select a diverse group of countries for the study, the sample remains relatively small, introducing some degree of uncertainty as to whether the results also holds for a larger set of countries. Second, a robust causal relationship between the strength of PIM institutions and the indicators of efficiency and productivity is difficult to establish. Hence we complement the analysis with supporting country examples in various boxes. Third, both the PIE-X indicator and the PIMA are limited in terms of coverage and scope and do not necessarily provide the comprehensive picture of public investment quality, efficiency, and management.

A. Measuring Public Investment Performance

30. Public investment performance can be measured directly, through the impact of PIM on infrastructure quality and growth outcomes, or indirectly, through measures of the effectiveness of the intermediate stages of the investment process. In this paper, public investment performance is analyzed using two direct and six indirect indicators. The two direct indicators measure the efficiency of investment (using the hybrid PIE-X indicator described above) and the productivity of investment (using the relationship between investment and economic growth). The six indirect measures consider the efficiency of the investment process at each of the three key stages planning, allocation, and implementation. The eight indicators of public investment performance used in this section are defined below:

Overall Impact of Public Investment

- **Efficiency of public investment** - measured by the PIE-X indicators of the infrastructure coverage and quality estimated in Section II.
- **Productivity of public investment** – measured by the ratio of the average real rate of capital stock growth to the average real rate of economic growth.

Public Investment Planning, Stage 1

- **Level of public investment** - measured by general government (GG) investment as a percentage of overall GG spending.
- **Volatility of total public investment** - measured by the standard deviation of GG

investment growth.

Public Investment Allocation, Stage 2

- **Stability in the sectoral allocation of public investment** - measured by the average absolute year-on-year percentage change in the distribution of government investment spending between the nine COFOG¹² nondefense functions of government.
- **Growth orientation of public investment** - measured as investment in the economic affairs sector relative to total government investments.

Public Investment Implementation, Stage 3

- **Credibility of investment budget execution** - measured as the absolute difference between the budgeted and actual level of general government capital expenditure.
- **Integrity of the public investment process** - proxied by the International Country Risk Guide (ICRG) Corruption Index.¹³

B. PIM Institutions and Overall Public Investment Performance

Public Investment Efficiency

31. Countries with strong PIM institutions get a bigger “bang” for their investment “buck.” Figures 13 a-c shows a strong positive relationship between the overall strength of PIM institutions and the efficiency of public investment, both when using the survey-based indicator of infrastructure quality, the physical indicator for infrastructure access, and the hybrid indicator defined in Section II which combines the two. This relationship remains evident even after controlling for GDP per capita.¹⁴

32. Improvements in PIM can cut the public investment “efficiency gap” by around two-thirds. The average country in the 25-country sample faces an efficiency gap of 27 percent, and could close 66 percent of the distance from the efficiency frontier (discussed in Section II) by adopting the PIM practices of the best performer in the sample.¹⁵ Improving PIM institutions would have the largest payoff in EMs and, notably, LIDCs, where institutions are relatively weak.

¹² The international standard for the functional classification of government expenditure is the UN's *Classification of the Functions of Government* (COFOG).

¹³ The ICRG *Corruption Index* is a general measure of perceived corruption in society. The higher the score, the lower is corruption.

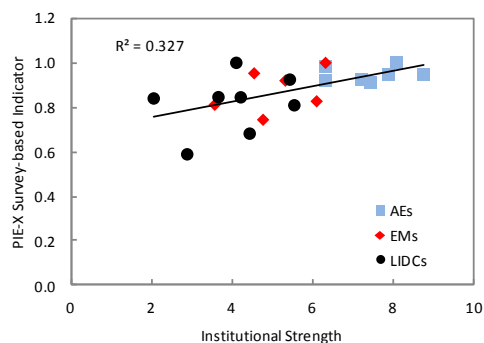
¹⁴ Where the relationship has been controlled for income, this is explicitly mentioned.

¹⁵ Regressions of efficiency on the overall PIM score, using the hybrid PIE-X indicator, suggest that an additional point in PIM overall score is statistically significantly associated with a 5 percent increase in PI efficiency. The result is consistent with other studies. For example, IMF (2014d) found that high public investment efficiency is generally associated with good institutional quality in oil-exporting countries.

Figure 13. Public Investment Efficiency and Productivity to Institutional Strength

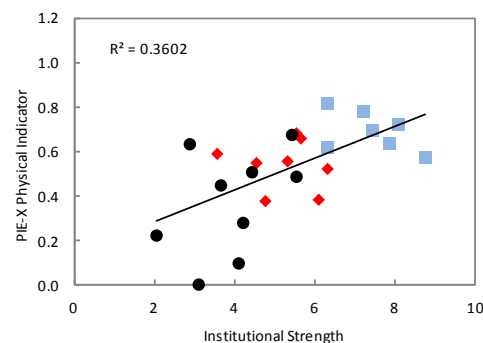
Stronger PIM institutions lead to more efficient public investment. This holds using either a survey-based indicator of infrastructure quality...

a. PIE-X (Survey-based) to PIMA Score



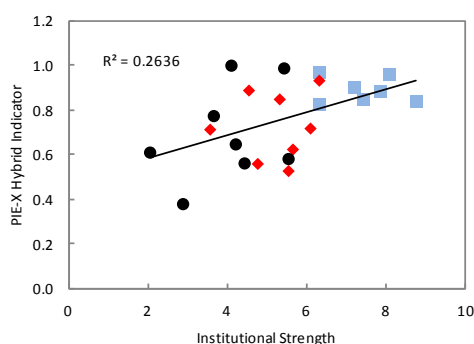
...or a physical indicator of infrastructure coverage

b. PIE-X (Physical Indicator) to PIMA Score



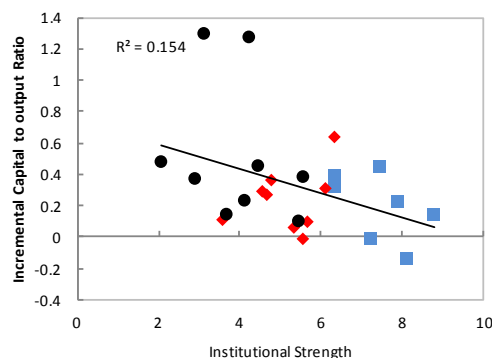
...or a hybrid indicator combining both infrastructure quality and coverage.

c. PIE-X Efficiency (Hybrid) to PIMA Score



Strong PIM institutions also increase the economic productivity of public capital

d. Incremental Capital Output Ratio to PIMA Score



Source: IMF staff estimates.

33. The strength of all three phases of the PIM process is significantly correlated with investment efficiency, both individually and in combination.¹⁶ Allocation and implementation institutions appear to be the most important, as indicated by their greater statistical significance in predicting investment efficiency. At the same time, the overall explanatory power of all 15 PIM institutions combined is higher than that of any individual institution, highlighting the mutually reinforcing nature of strong PIM institutions.

¹⁶ This is confirmed by comparing the explanatory power (R-squared) between bivariate and multivariate regressions of efficiency on each individual PIM institution, the group of institutions by stage of investment, and the PIM's overall strength.

Public Investment Productivity

34. The relationship between strong PIM institutions and the economic productivity of public investment is also positive. Countries with stronger PIM institutions tend to have lower average incremental public capital-to-output ratios (ICORs) and therefore get more growth “bang” for their investment “buck” (Figure 13d).¹⁷ While the correlation between ICORs and the strength of PIM institutions is significant, it is still weaker than for efficiency, underscoring the range of other factors that drive economic growth.

C. PIM Institutions and Other Performance Indicators

Levels of Public Investment

35. Stronger PIM institutions tend to go hand-in-hand with lower levels of public investment (Figure 14a). This may be explained by a number of factors. First, PIM institutions tend to be stronger in more developed economies with less need for additional public infrastructure. Second, stronger PIM institutions (especially more binding fiscal frameworks, stricter criteria for project appraisal and selection, and tighter controls over capital budget execution) constrain public investment by raising the threshold for financing new projects. Third, stronger institutions also mean higher efficiency, which would be expected to reduce public investment outlays.¹⁸ Fourth, the role of the public sector in providing infrastructure also tends to decrease with the level of GDP as key sectors are opened to private sector providers. At the same time, the negative correlation between fiscal frameworks and lower investment levels requires more detailed study, as the introduction of golden rules and other investment-friendly fiscal frameworks has been associated with increased investment in specific countries (Box 7).

36. Stronger PIM institutions are also associated with less use of PPPs. While there are substantial differences within country groups, overall, the data show a negative correlation between the strength of PIM institutions and the share of infrastructure investment in the form of PPPs (Figure 14b). Hence, strong PIM institutions temper the use of PPPs, which are generally considered to carry higher fiscal risks than budget financing. The relative popularity of PPPs in EMs and LIDCs may also reflect a generally weaker capacity for project implementation and tighter budget funding constraints.

¹⁷ The ICOR is the ratio of the growth rate of the capital stock relative to the GDP growth rate and the inverse of the economic productivity of capital.

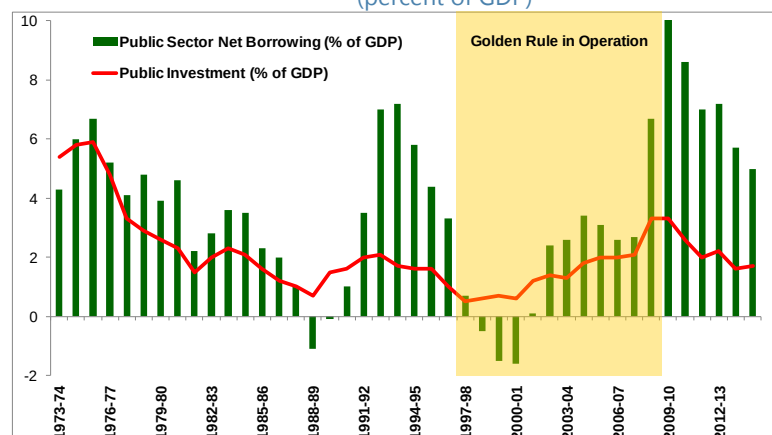
¹⁸ Grigoli and others (2014) have found the same, and view lower levels of corruption and rent seeking as prime reasons for lower investment levels in mature economies.

Box 7. Fiscal Frameworks and Public Investment

In the past two decades, fiscal rules have become increasingly popular and are now in place in more than 80 countries. Typically, these rules—the most common of which are debt and deficit limits and expenditure growth rules—do not treat public investment differently from recurrent expenditure and can contribute to greater procyclicality and lower overall levels of public investment, as shown in Section IV. Yet, some countries have adopted fiscal rules that explicitly protect public investment, including:

- **Structural balance rules.** These types of rules include deficit limits that vary with the state of the budget cycle, asset prices or resource income. The 2012 EU Fiscal Compact prescribes structural balances targets for EU Member States. The benefit of these rules is that they do not require procyclical adjustment during economic downturns. As such adjustments often fall on investment expenditures, structural balance rules can reduce the procyclicality of investment. At the same time, these require complex calculations and judgments regarding trends in GDP growth, the output gap, and elasticity of revenue and expenditure, which can make them difficult to implement in EMs and LIDCs.
- **Golden rules** allow governments to borrow only to invest, but not fund current expenditure. Japan, Spain, and the UK have all operated golden rules at some point. The UK's golden rule, in place during 1997–2009, helped public investment recover from historic lows in the late 1990s (see chart). However, to ensure transparency and fiscal sustainability, golden rules need to define capital and recurrent expenditure based on international standards and be combined with limits on total liabilities.
- **Other rules that exempt infrastructure investment.** Since 2004, India has applied a current balance target that excludes public investment and other priority spending from its expenditure ceiling. Argentina's Fiscal Responsibility Law requires all jurisdictions to balance revenue and expenditure, excluding investment in basic social and economic infrastructures and projects financed by multilateral development agencies. The lack of a transparent definition of the expenditure items that can be excluded from the rule can result in shrinking coverage over time and associated loss of fiscal control.
- **Investment floors.** Following the 1997 crisis, Thailand established a fiscal sustainability framework aimed at combining adequate levels of public investment expenditure with sustainable public finances. Capital expenditure must be at least 25 percent of the budget while public debt is limited to 60 percent of GDP. Thailand has, however, had difficulties meeting its investment target due to PIM bottlenecks.

Public Investment and Borrowing in the UK
(percent of GDP)



Source: HM Treasury, Public Finances Databank (2015).

Stability of Total Public Investment

37. Countries with strong PIM institutions tend to have more stable levels of investment. Figure 14c shows that strong PIM institutions are associated with less volatile investment flows, even when corrected for income levels. Various studies emphasize the importance of avoiding stop-go investment policies, given the consequences for the cost, timeliness, and quality of the resulting infrastructure asset.¹⁹ Rapid scaling up of investment, or efforts to use public investment for countercyclical purposes, have also typically failed to deliver the desired impacts on growth, in part, due to the substantial inefficiencies generated in the process (Warner, 2014). The scaling-up of public investment should be accompanied by efforts to strengthen PIM.

38. Strong implementation institutions seem to be most important to reducing the volatility of public investment. This applies especially to LIDCs, where project management tends to be weak, total public investment is more influenced by large-scale investment projects, and macroeconomic volatility can lead to funding and material shortages. This underscores the importance of strengthening project implementation in LIDCs.

Stability of Public Investment Allocation

39. Countries with strong PIM institutions also tend to have a more stable allocation of investment expenditure between sectors (Figure 14d). This reflects the benefits of strong multiyear planning and budgeting arrangements for the predictability of investment funding. Stability should, however, not turn to rigidity, and the literature does suggest that a number of advanced economies are attempting to introduce more “churn” (reallocation) in the sectoral allocation of public investment from year-to-year (Fainboim and others 2013).

Growth-Friendliness of Investment

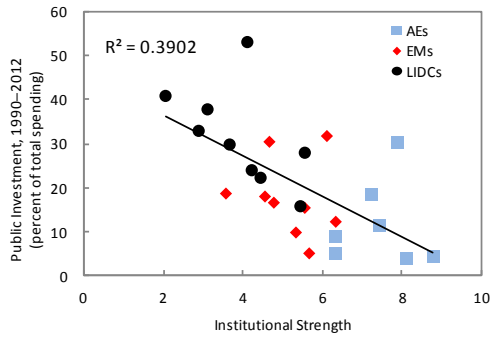
40. There is no evidence that stronger PIM institutions lead to a greater emphasis on “hard” infrastructure. The level of investment in the “economic affairs” sector, which includes transport, communications, and energy, does not appear to depend on the strength of PIM institutions. Health investment also shows no relationship to institutional strength. Only education investment seems to increase with institutional strength, even after compensating for income effects.

¹⁹ Stop-go investment policies were prevalent in the 1990s and early 2000s in many Latin American countries. See Perry, Servén and Suescún (2008).

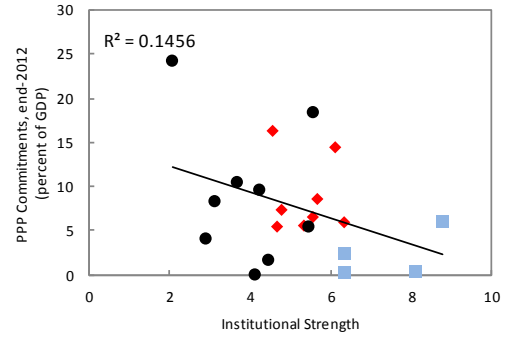
Figure 14. Institutions and Other PI Performance Indicators

Investment Levels and PPPs decrease with stronger institutions, reflecting in part lack of protection of investment in fiscal frameworks...

a. Average Public Investment to PIMA Score

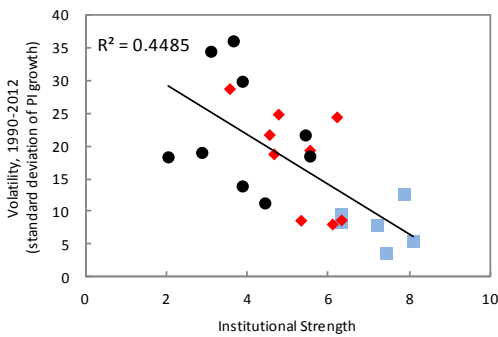


b. PPP Commitments to PIMA Score

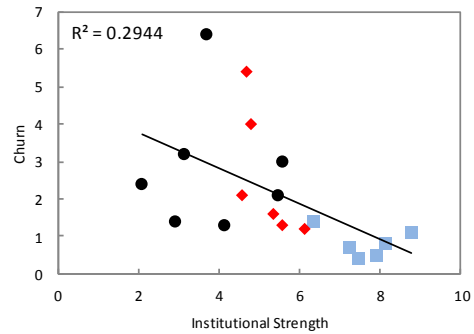


...strong institutions lead to more stable and predictable investment flows....

c. Volatility of Public Investment to PIMA Score

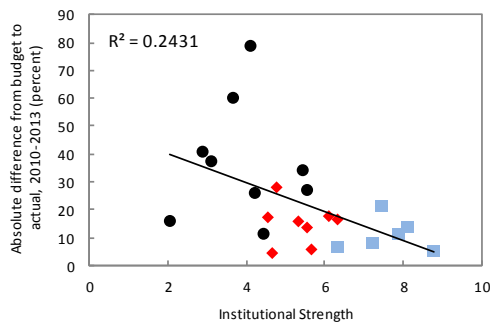


d. Churn to PIMA Score^{1/}

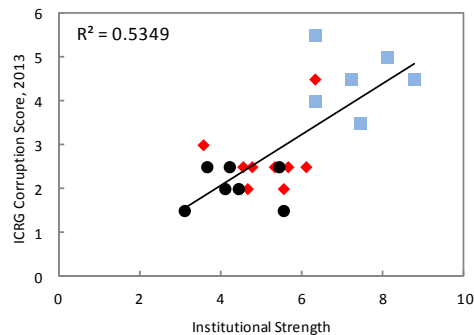


...while budgets become more credible and less prone to corruption.

e. Budget Implementation to PIMA Score



f. Corruption to PIMA Score



Source: IMF staff estimates; WEO.

1/ The average absolute year-on-year percentage change in the distribution of government investment spending between the nine COFOG nondefense functions of government, 2000-12, varies by country depending on data availability.

Credibility of Investment Budgets

41. Countries with strong PIM institutions have more credible capital budgets. EMs and LIDCs tend to suffer from underexecution of their capital budgets due to overly optimistic assumptions about how soon projects can break ground, lack of funding, and weak implementation capacity. By contrast, AEs tend to overspend on large investment projects due to incentives for executing agencies to understate project costs and risks as a means of inflating benefit/cost ratios and securing project approval. Overall, both over- and underspending, relative to the approved capital budget decreases with stronger institutions (Figure 14e). Independent appraisal of investment projects, in particular, can help reduce so-called “optimism bias” in estimates of project costs, benefits, and timetables (see Box 8).

Corruption and Investment

42. Strong PIM institutions are associated with lower perceived levels of rent-seeking and corruption. Public investment projects often provide lucrative opportunities for corruption and rent-seeking. Empirical studies have found corruption to be associated with higher overall levels of public investment and lower levels of public investment efficiency.²⁰ Figure 14f shows a positive relationship between the strength of PIM institutions and perceptions of government integrity as measure by the ICRG Corruption Index. This result holds even when adjusted for income. Open, competitive, and transparent procedures for allocating and implementing public investment projects are particularly important in limiting opportunities for corruption.

²⁰ Tanzi and Davoodi (1997) confirm anecdotal evidence that higher levels of corruption are associated with higher levels of public investment, lower levels of operation and maintenance expenditure, and a lower level of infrastructure quality. Abed and Gupta (2002) stress the impact on institutions and economic performance.

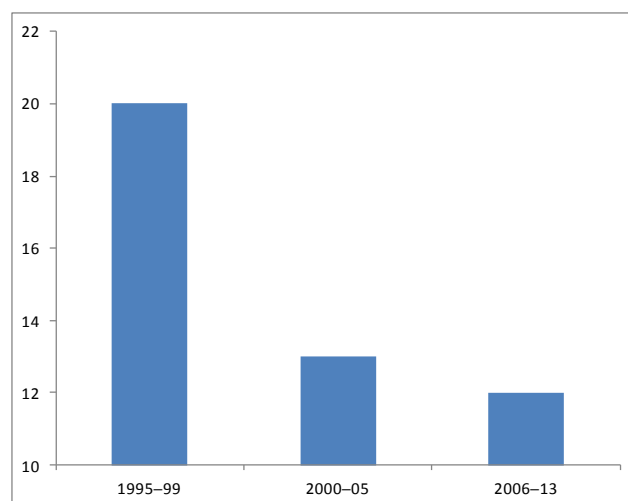
Box 8. Independent Project Costing in Norway

Cost overruns of large public investment projects are common in many countries. It implies that costs at the time of project appraisal were underestimated, which biases project selection and lowers investment rates of return, while degrading capital budget credibility. During the 1990s cost overruns in Norway were the norm rather than the exception, typically ranging from 20 to 40 percent. In 2000, the Norwegian government began an effort, known as QA2, to address this issue.

The focus of QA2 has been on improving project financial management and implementation. Its aim is to produce realistic cost estimates that can serve as firm benchmarks against which project managers can be held accountable. For each major project external experts, using statistical methods, estimate the likely final project cost with 85 percent and 50 percent probability. Parliament approves the project cost at the 85 percent probability level, referred to as the *cost frame*. The implementing agency manages the project using the 50 percent probability level, referred to as the *steering frame*. Because the cost frame is higher than the steering frame, the appropriated amount includes a risk-based contingency in excess of the cost limit that managers strive to achieve.

The results from the first 40 major projects completed under QA2 show that about 80 percent have been completed within the cost frame. Final costs were realized above and below the steering frame in almost equal amounts, meaning that the sum of the steering frames estimated is a good predictor of total capital spending. As a result, the variability of actual costs compared to estimated costs for individual projects has been greatly reduced, and the credibility of the capital budget improved (see chart below).

Norway: Average Deviation of Investment Spending from Budget
(percent)



Source: IMF staff estimates.

V. STRENGTHENING PUBLIC INVESTMENT MANAGEMENT

43. This section identifies priorities for reforming public investment management and the Fund's role in supporting these reforms. In particular, it suggests that:

- AEs would benefit most from strengthening their fiscal and budgetary frameworks and better coordinating investment across levels of government;
- EMs should adopt more transparent and rigorous procedures for project appraisal, selection, and management;
- LIDCs should focus on strengthening institutions related to project implementation;
- Most countries would benefit from better monitoring and controls over PPPs and closer integration between strategic planning and capital budgeting; and
- The Fund's new PIMA and related Fund tools, including the new P-FRAM and the new Fiscal Transparency Evaluation (FTE), can help countries evaluate their PIM strengths and weaknesses, identify priorities for institutional reform, and target related capacity-building.

A. Priorities for PIM Reform

44. The potential gains from improving PIM are substantial. Strengthening the PIM institutions of our sample group of countries to the level of the best performer in the sample could close around two-thirds of the average efficiency gap in carrying out public investment. Given the interdependence of the stages of the PIM cycle, addressing key weaknesses can have spillover benefits for the process as a whole.

45. AEs would benefit from strengthening medium-term fiscal and budgetary frameworks to improve investment planning and coordination across levels of government. Fiscal frameworks should protect investment spending against fiscal pressures in the near term, and make investment flows less procyclical and more fiscally sustainable in the longer term. The use of structural balance limits or investment floors, coupled with firm ceilings on overall indebtedness has proven helpful in some countries. AEs should also strengthen central-local coordination by sharing investment plans and providing subnational governments with greater multiyear certainty about capital transfers from central government.

46. EMs would benefit most from more rigorous and transparent arrangements for investment project appraisal, selection, and management. Finance or planning ministries should develop standardized methodologies and central support functions for project appraisal and risk analysis. All results should be made public, and criteria for project selection should be clear and transparent. It is also important to maintain an active pipeline of approved projects that can be funded in future budgets. Also, during project implementation, EMs would benefit from having in place standardized procedures for project adjustments that are applied systematically and, as needed, allow for a fundamental review of the project's rationale, costs, and expected

outputs. Ex-post evaluations of projects should be conducted to provide lessons for future investment projects.

47. In contrast, LIDCs would benefit from strengthening institutions related to investment implementation. The transparency of budget execution, openness of the procurement process, and efficiency of cash management are critical to the stability and predictability of investment and to reducing opportunities for rent seeking. Finance ministries should also focus on protecting investment expenditures within ministry and agency budgets by appropriating total project costs at the commencement of the project, preventing those budgets from being “raided” to meet current pressures, and allowing some carryover of unspent appropriations to future years.²¹ Greater transparency and accountability regarding project management, monitoring, and evaluation is needed to strengthen incentives to deliver projects on time and on budget and ensure value for money and integrity in the use of public resources.

48. EMs and LIDCs, in particular, would also benefit from strengthening the management of PPPs. A range of EMs have published strategies for the use of PPPs, but the selection of PPP projects should be more uniformly based on value-for-money reviews by a dedicated PPP unit and be guided by clear criteria for choosing between PPPs and traditional financing. PPP commitments should be systematically monitored, with overall limits on the accumulation of PPP liabilities, to minimize related fiscal risks.

49. Countries at all income levels would benefit from better integrating their institutions for strategic investment planning with subsequent stages in the PIM process. While most countries publish national or sectoral investment strategies, many are only weakly linked to the budget planning, project appraisal or project selection processes. However, Chile, Korea, and the United Kingdom provide good examples of integrated approaches to strategic investment planning and budgeting.

50. Strengthening PIM institutions can enhance the impact of public capital on economic and social outcomes and should be an integral part of any scaling up of public investment. Past investment surges have often taken place in weak institutional environments or been associated with the circumvention of established decision-making processes. Our analysis indicates that, in the absence of a comprehensive and cohesive set of PIM institutions, the potential benefits from a ramping up of investment are much diminished. Countries should therefore factor PIM diagnostics, reform, and capacity building into their plans for ramping-up investment levels.

²¹ There may be a trade-off between protecting investment and spending and accommodating revenue and financing volatility, for example in the case of a large fiscal shock that may also impact social spending needs.

B. Role of the Fund in Supporting PIM Reform

51. The IMF plays a key role in helping countries to strengthen their PIM institutions.

Improving public investment policies and management has long been an area of focus for Fund technical assistance (TA) and policy analysis. Working in collaboration with other multilateral institutions, staff would envisage the following further initiatives in the PIM area:

- Supporting further analysis of the drivers of public investment efficiency;
- Helping countries to strengthen public investment management and efficiency in TA, surveillance, and policy work, informed by the findings of this paper. This will be especially relevant for those EMs and LIDCs looking to finance a scaling up of public investment through nonconcessional sovereign borrowing. It will also be useful for AEs that want to use infrastructure investment to support their economic recovery;
- Developing the Public Investment Management Assessment (PIMA) into a standard diagnostic tool to support PIM reform efforts. Along with the Fund's FTE, the PIMA would also support and expand upon the public investment indicator included in the revised Public Expenditure Financial Accountability (PEFA) framework; and
- Finalizing the PPP Fiscal Risk Assessment Model (P-FRAM) as a tool for assisting governments and country teams to assess potential fiscal risks arising from PPPs. The P-FRAM (i) gathers relevant PPP project data; (ii) quantifies the short and medium-term impact of a PPP project on a government's deficit and debt under both cash- and accrual-based reporting standards; and (iii) performs sensitivity analysis of the potential fiscal impact of a PPP. In the coming months, the P-FRAM will be piloted in selected projects and countries in collaboration with other international organizations (see Annex V for more details).

52. The further development and piloting of the PIMA, as well as its subsequent application in TA, will be accommodated within FAD's budget.

In FY 2016, the PIMA will be piloted in a range of countries, including all G20 countries in the context of the G20 Infrastructure and Investment Working Group (IIWG), to help country authorities understand the strengths and weaknesses of their PIM institutions, identify priorities for PIM reform, and target associated capacity-building activities. A large-scale increase of PIMAs in response to country demand is not contemplated at this stage and would require additional resources.

VI. ISSUES FOR DISCUSSION

53. Public investment efficiency, infrastructure quality, and related PIM institutions deserve more attention in the Fund’s policy and technical assistance advice to member countries. Addressing these issues would require updating of the IMF’s diagnostic toolkit and expanding TA delivery in these areas. For these reasons, Directors’ views and guidance on the main findings of this report would be welcome. Specifically:

- Do Directors agree that there is considerable scope to improve the efficiency of public investment across countries and that strengthening PIM is important for maximizing the economic and social benefits of public investment?
- Do Directors agree that efforts to scale up public investment should be accompanied by improvements in PIM institutions to maximize the impact of the additional investment on infrastructure quality and economic growth?
- Do Directors agree that staff should develop the proposed PIMA into a comprehensive diagnostic and use it to evaluate PIM institutions, identify priorities for PIM reform, and target related capacity-building activities? Similarly, do Directors support staff efforts to develop the P-FRAM for assessing fiscal risks from PPPs?
- How do Directors assess the results from applying the PIMA to different country groups (AEs, EMs, LIDCs)? In this context, do Directors agree that:
 - AEs could benefit most from strengthening their fiscal and budgetary frameworks to ensure that they provide for adequate, well-targeted, and sustainable levels of investment across sectors and levels of government?
 - EMs could benefit most from adopting more transparent and rigorous systems for appraising, selecting, and approving individual investment projects?
 - LIDCs could benefit most from strengthening institutions related to the funding, management, and monitoring of investment project implementation?
 - All countries would benefit from stricter monitoring and firmer controls over PPPs and better integration between national strategic planning and capital budgeting?

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Annex I. Estimating Public, Private, and PPP Capital Stocks

This appendix describes the measurement issues, data sources, methodologies, and assumptions used in constructing the series of public and private capital stocks, as well as capital stocks from PPPs, for a comprehensive sample of 158 and 143 countries, respectively.

A. Measuring Public Investment

Disentangling the private and public sectors' contribution to total investment is challenging in practice. We measure public investment using gross fixed capital formation (GFCF) of the general government (i.e., central plus subnational governments).^{22, 23} This approach allows for the use of the comparable data available for a large number of countries but ignores alternative modes by which governments support overall investment including: (i) investment grants, which are transfers from central and/or subnational governments to public and private entities outside the general government to support investment in fixed assets;²⁴ (ii) loan guarantees;²⁵ (iii) tax concessions, such as those for mortgage interest, research and development, and municipal bonds; (iv) the operations of public financial institutions, such as development banks, which provide long-term funding at subsidized rates; and (v) government-backed saving schemes. Similarly, some governments contract the private sector to provide infrastructure services (e.g., through PPPs), with annual payments for these services classified as public current spending and investment spending classified as private. In addition, some entities controlled by the public sector—but outside the general government—undertake infrastructure spending that is not recorded as public investment. Typical examples include SOEs, parastatals, and entities involved in social housing, whose investments can be large. Similarly, special purpose vehicles linked to PPPs contracts are typically classified as private, even if they are controlled by the public sector. The data are constructed with these caveats.

B. Public and Private Capital Stocks

The methodology applied to the construction of public and private capital stocks draws, in large part, on that employed by Kamps (2006) and Gupta and others (2014). Specifically, the capital stocks are constructed following the perpetual inventory equation:

²² Gross fixed capital formation is measured by the total value of acquisitions less disposals, of fixed assets during the accounting period plus certain specified expenditure on services that adds to the value of non-produced assets, such as the improvement of land (System of National Accounts 2008, Chapter 10, 10.32).

²³ Hemming and others (2006).

²⁴ These transfers are typically classified as current spending, rather than capital spending. In 2013, general government investment grants averaged about ½ percent of GDP in the European Union, about half their 1995 level.

²⁵ In 2012–2013, government guarantees (including for investment) averaged about 12 percent of GDP in the EU, with considerable dispersion across countries (from 5.7 percent of GDP in France to 41.4 in Ireland)

$$K_{it+1} = (1 - \delta_{it}) K_{it} + \left(1 - \delta_{it}/2\right) I_{it} ,$$

where for each country i , K_{it+1} is the stock of (public or private) capital at the beginning of period $t + 1$; δ_{it} is a time-varying depreciation rate; and I_{it} is gross fixed (public or private) capital formation in period t , assuming that new investment is operational in the middle of the period.

The inputs required to apply this method are the investment flow series, the initial capital stock, and the size and time profile of the depreciation rate. All series (output, investment, capital stocks) are expressed in constant international 2005 prices (using purchasing power parity).

- **Investment series.** Several databases are used to ensure a comprehensive database of the public capital stock series covering the period 1860-2014.

Data for the Organization for Economic Cooperation and Development (OECD) countries are taken from the August 2014 version of the OECD Analytical Database,²⁶ and cover 26 countries for the period 1960-2013. Specifically, the series retrieved (in national currency and constant prices) is comprised of government GFCF (code IGV), private GFCF (code IPV), and real gross domestic product (code GDPV). The series are then converted to 2005 international dollars using OECD purchasing power parities. Data is filled to the extent possible from the April 2014 vintage of the IMF World Economic Outlook (WEO) database²⁷ whenever there are data patches in the OECD's database.

For non-OECD countries, data covering 132 countries for the period 1960-2011 are taken from version 8.0 of the Penn World Tables (PWT). The series retrieved consists of GDP (code Q_GDP) and total²⁸ gross fixed capital formation (code Q_GFCF) in 2005 constant prices. These are then converted to 2005 international dollars using PWT purchasing power parities. In the next step, total investment from PWT is disaggregated into private and public investments by using the WEO's database. Specifically, public and private investment shares, as percents of total investment, are calculated from the WEO database, and these shares are applied to the total PWT investment series.²⁹ Data is then extended to 2013 using the WEO database.

²⁶ Data for six countries (Austria, Ireland, Italy, Mexico, Portugal, and Spain) are no longer published in the latest OECD version; earlier vintages of the database are used instead.

²⁷ Specifically, annual growth rates from the WEO database are used for filling missing data. In addition, a few modifications are made to the WEO database to accommodate breaks or country-specific patches. Such methods include using older vintages, correcting cases with negative values or cases where private and public investment do not add up to the total, replacing data with missing values when there are large breaks in the series, and filling in one-year patches by taking the average of the one-year forward and backward data points.

²⁸ PWT does not publish national accounts data with a breakdown of total gross fixed capital formation into private and public.

²⁹ Modifications to the WEO database are made to accommodate breaks or country-specific data patches. These are explained in footnote 27.

- **Initial capital stock.** There is no official information on the magnitude of the initial capital stock for the vast majority of countries. Following Kamps (2006), the initial capital stock is set to 0 for all countries in 1860. Second, an artificial investment series is constructed between 1860 and the first available data point by assuming that investments grew by 4 percent a year to reach its five-year-forward moving average (first available) observed level.³⁰ As for public and private investment, two artificial series are constructed between 1860 and the first available data point by assuming that public and private investment grew at the same rate as total investment to reach their five-year forward moving average (first available) observed levels, respectively.
- **Depreciation rates.** Country-specific depreciation rates are not typically available but they are likely to increase with income assuming that the share of assets with a shorter life spans (such as technology assets) rises with income levels. Following the arguments in Kamps (2006), it is assumed that the depreciation rate for high-income economies rises monotonically from 2.5 percent in 1960 to 4.6 percent in 2013, and from 4.25 percent to 10.4 percent for government and private assets, respectively (see Annex Table A1.1).³¹ As shown in Table AI.1, different depreciation assumptions are made for middle-income and low-income countries following Gupta and others (2014).

Annex Table AI.1. Depreciation Rates (in percent)			
	1860	1960	2013
Public Capital			
Low-income	2.50	2.50	2.50
Middle-income	2.50	2.50	3.51
High-income	2.50	2.50	4.59
Private Capital			
Low-income	4.25	4.25	4.25
Middle-income	4.25	4.25	8.10
High-income	4.25	4.25	10.41
Note: Income classifications are based on the World Bank's <i>World Development Indicators</i> ' country groupings.			

³⁰ This ensures an equal treatment of all countries since historical information on public investment is not available. Kamps (2006) and Gupta (2014) show that different assumptions on the initial capital stock series do not affect the dynamics of the series to a great extent.

³¹ These assumptions were made using evidence from historical data from the United States, Australia, and Canada.

C. Capital Stock from PPPs

The methodology applied in the construction of the PPP capital stock is identical to the methodology described in Section B. Given an initial PPP capital stock, a depreciation rate series, and PPP investment flows, it is simple to compute the PPP capital stock following the perpetual inventory equation above.

- **Investment series.** It is difficult to compile a comprehensive comparable long time-series database for PPPs across countries since (i) project deals' databases do not always provide complete information; (ii) actual annualized PPP investment data are lacking for most countries; and (iii) there is no consistent publicly available framework to classify PPPs as public or private, such that the treatment of PPPs in the national accounts varies across years and countries. In spite of these challenges, the approach followed here is to rely on data for total PPP projects commitments (rather than annualized investment flows) taken from the European Investment Bank (Kappeler and Nemoz, 2010) for European countries and the World Bank Private Participation in Infrastructure (WB PPI) database for low- and middle-income countries.³²

Data from the EIB includes the total value of PPP projects³³ (in euro) for 18 countries covering the period 1990-2009. The project value measures total financing requirements at financial closure, meaning it is a stock variable. Similarly, information from the WB PPI database includes the total value of PPP investment commitments at contract signature or financial closure (in US dollars) for 125 countries covering the period 1984-2012.³⁴ We exclude divestiture projects (i.e., asset sales or privatizations) from the WB database to make it comparable with EIB data.

Following the EIB approach, annual PPP investments are derived by spreading the value of PPP project commitments over five years. The PPP investment series is then converted to constant 2005 international dollars using the GFCF deflators and purchasing power parities taken from the OECD, PWT, and WEO, depending on data availability. Finally, data are extended to 2013 by assuming PPP investment to GDP (both in constant 2005 international dollars) remained, for each country, at its latest three-year average.

³² Data on high-income or non-European countries such as the United States, Australia, Canada, China, Japan, etc. are not available.

³³ The EIB defines a PPP project as one that is "based on a long term, risk sharing contract between public and private parties based on a project agreement or concession contract." Investments made by regulated utilities, project refinancing, and privatizations are therefore excluded. Projects below 5 million Euros are also excluded from their database.

³⁴ See http://ppi.worldbank.org/resources/ppi_methodology.aspx for more details on the WB PPI database methodology.

While there are a few caveats regarding the PPP's database, it is still useful in providing an idea of the magnitude of PPP capital stock in comparison with the public capital stock. Caveats include: (i) some of the capital expenditures in the PPP's database may be recorded on the governments' balance sheets, and therefore, in the public investment figures; (ii) total PPPs projects commitments may include financing or maintenance costs and may thus overestimate PPP's annual investment figures; (iii) PPP project commitments may include only a proportion of financing placed on the bond market, rather than total investment costs (i.e., ignoring any government subsidies), and therefore underestimate PPPs' annual investment figures; (iv) PPPs commitment amounts represent commitments at the financial closure stage, not actual executed investments; and (v) the definition of what constitutes a PPP project may vary across countries and databases.

- **Initial PPP capital stock.** Due to the lack of a long-time series on PPPs, the initial PPP capital stock for each country is assumed to be 0 the year prior to the first available data point.
- **Depreciation rates.** For ease of comparability with the public investment capital stock, it is assumed that PPPs projects depreciation rates are the same as those of public investment projects (see Annex Table AI.2).

Annex Table AI.2. Data Sources

GDP and Public and Private Investment in 2005 International Dollars	OECD Analytical Database, August 2014 Version PWT, Version 8.0 WEO, April 2014 Version
PPP Investment in 2005 International Dollars	World Bank Private Participation in Infrastructure Database EIB (2010) OECD Analytical Database, August 2014 Version PWT, Version 8.0 WEO, April 2014 Version
Depreciation Rates	World Bank World Development Indicators Country Groupings

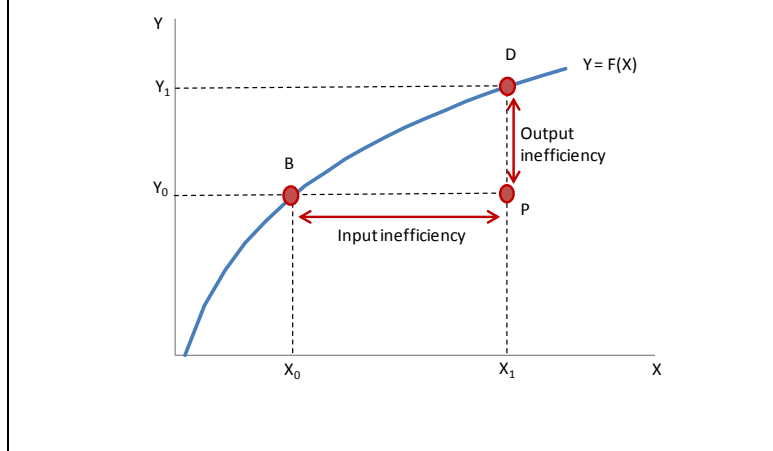
Annex II. Measuring Efficiency Using Frontier Methods

A. Introduction

The methodological framework for measuring the efficiency of production units has been widely used to estimate the efficiency of public spending. This framework is based on a production function approach where inputs are combined to produce outputs subject to a given technology. The production function represents the technical efficiency frontier and is the benchmark for measuring the relative efficiency of observed production units. In such a model, the distance between an individual observation (P in Figure AII.1) and the frontier is a measure of inefficiency.³⁵

Efficiency can be calculated based on input or output-oriented models. In input-oriented models, the efficiency score is interpreted as the proportional amount by which input consumption could be reduced while leaving outputs unchanged (distance BP in Figure AII.1). On the other hand, efficiency scores from output-oriented models are interpreted as the proportional amounts by which output could be increased while leaving input consumption unchanged (distance DP in Figure AII.1).

Figure AII.1. Inputs, Outputs, and the Efficiency Frontier



The application of this framework to the assessment of the quality of public investment has been limited. Currently, research is being conducted on assessing the efficiency of health and education spending (see Herrera and Gaobo, 2005, or Grigoli and Kapsoli, 2013). However, the use of this framework to assess the efficiency of public investment is scarce and, thus far, limited only to Albino-War and others (2014).

³⁵ Individual observations are called “decision making units” (DMUs) in the literature.

B. Methodology

There are two alternatives for estimating efficiency frontiers.³⁶ Efficiency frontiers can be estimated based on parametric or nonparametric methods. The first approach involves the estimation of an econometric model with the restriction that input-output combinations must lie below the efficiency frontier. The second is based on linear programming methods.

There is no established standard approach in the literature for estimating efficiency frontiers. Parametric methods require strict assumptions regarding the stochastic distribution of errors and the functional form underlining the model. They also typically require the use of control variables to control for the variation in output unexplained by the inputs. That said, nonparametric methods also have drawbacks because they are sensitive to the presence of measurement errors and outliers.³⁷

This paper uses the popular data envelopment analysis (DEA) methodology—the standard approach in the literature using nonparametric methods—to calculate the efficiency of public investment. DEA is a deterministic algorithm that calculates the efficient frontier through linear approximations enveloping all decision-making units (DMU) performance observations. Efficiency scores are then calculated relative to a peer group consisting of linear combinations of input-output observations for efficient DMUs. The original DEA model assumes constant return to scale which implies that all DMUs in the sample are performing at an optimal scale. This is a strong assumption when dealing with a heterogeneous set of countries. Therefore we use DEA with variable return to scale to guarantee that each DMU (country) is only compared to others with similar characteristics.

C. Empirical Application

In this paper, we calculate efficiency scores using an output-oriented DEA model. Efficiency scores should therefore be interpreted as the proportional amount by which countries could increase the quality of their infrastructure while leaving public capitals (and other inputs) unchanged.

Three different indicators are used to measure infrastructure output.

- A physical indicator. This indicator is a pure quantitative index. It attempts to capture the wide range of activities where public investment is involved. Traditionally, the literature has linked public investment to the construction of infrastructure (Calderón and Servén, 2004). However, as discussed in Section II, a sizeable share of public investment is devoted to

³⁶ See Murillo-Zamorano (2004) for a comprehensive review of the methods available.

³⁷ However nonparametric models could be complemented by introducing randomness in the sample selection, therefore limiting their weaknesses to the presence of outliers. See Albino-War and others (op. cit.) and Annex I for more details.

infrastructure related to the provision of social services such as health and education. The indicator considered here combines pure infrastructure indicators (length of the road network, access to an improved water source, and electricity production) and indicators related to the provision of social services (number of secondary teachers and number of hospital beds). All variables, with the exception of access to improved water source, are expressed in per capita terms. Each variable is averaged from its original time series since 2000 until the last observation available. After that, variables are standardized because they are measured in different scales (see formula below). Finally, they are combined using similar weights to obtain the output indicator (y_i).

$$y_i = \sum_{j=1}^4 \left(\frac{1}{5} \right) \left(\frac{x_{ij} - \bar{x}_j}{\sigma_{x_j}} \right)$$

where x_{ij} is the value of the variable j in country i , x_j and $\bar{x}_j$ and σ_{x_j} are the mean and standard deviation of variable j , respectively, over the considered period. As the above described procedure may result in negative values, the output variable is rescaled relative to its minimum.³⁸

- A survey-based indicator. This indicator is a survey-based index built on the World Economic Forum (WEF) pillar 2 sub-components focusing on the quality of key infrastructure services.³⁹ To make this index purely qualitative, all subcomponents based on hard data (airline seats, mobile and landline telephone subscriptions) are removed.
- A hybrid indicator which is simply the arithmetic mean of the two previously described indicators and provides a measure of both the coverage and quality of public infrastructure.

The main input variable is the public capital stock. The estimation of public capital stocks is described in Annex I. As in many cross-country comparisons we are assuming that the quality of inputs is similar among countries (factor homogeneity). This is a shortcoming as cross-country differences in factor quality could be significant. As this problem is mainly reflected in factors used more intensely in rich countries (see Herrera and Pang, 2005) we follow Jarasuriya and Wodon (2002) by using per capita GPD as a second input in the model as a control variable.

Estimated efficiency scores clearly show that there is substantial scope to improve efficiency particularly but not exclusively in low-income countries. The estimated average waste ranges from 20 to 43 percent depending on the efficiency measure. The survey-based infrastructure indicator yields the lowest efficiency gaps. This is mainly because the survey underlining the index has a limited range of responses (from 1 to 7 where 1 is lowest quality and 7 the highest). Based on the quantitative index, a country could, on average, increase

³⁸ Efficiency frontier analysis is based on a production function approach. Therefore, the amount of each output produced must be positive.

³⁹ WEF scores are based mainly on the Executive Opinion Survey which is a survey of a representative sample of business leaders in their different countries. They are also complemented with some hard data.

infrastructure quality by 43 percent without increasing the level of the public capital stock. This result, however, varies across country groupings. For example, the potential efficiency gain is around 27 percent for advanced economies, 40 percent for emerging, and 55 percent for low-income countries.

Efficiency scores based on nonparametric DEA models are correlated with the survey-based quality of the public investment index developed for this paper. The correlation between the two measures is 0.51 based on 24 observations. This correlation is statistically significant.

Efficiency scores presented in the paper seem robust to different specifications. Different alternative definitions of the output index are explored, including a pure infrastructure index (a principal component from a list of infrastructure indicators covering additional areas such as telecommunications based on the work of Calderón and others (2015)). We also used different additional health and education variables, like teacher-per-pupil ratios and MRIs. All efficiency scores are highly correlated (between 0.6-0.9).

Table AII.2. Data Sources

Outputs	
Length of the road network	World Development Indicators
Access to improved water	World Development Indicators
Number of secondary teachers	World Development Indicators
Number of hospital beds	World Development Indicators
Energy production	World Development Indicators and International Energy Agency
WEF Pillar 2 index and sub-components	World Economic Forum
Inputs	
Public Capital Stock	IMF staff estimation
GDP per capita	IMF WEO database

Annex III. Assessing the Impact of Investment on Growth

The empirical analysis described here illustrates the link between the impact of public investment on growth, and the public investment efficiency index level. The methodology used is similar to that in IMF (2014c) albeit with some differences which are described in detail below. Specifically, the econometric specification uses a fixed effects regression which allows for the estimation of varying effects of public investment on growth depending on the degree of public investment efficiency. The data sample is fully balanced covering 114 countries during the period 1970-2013. Accordingly, the first regression is specified as:

$$y_{i,t+k} - y_{i,t} = \alpha_i^k + \gamma_t^k + \beta_1^k G(z_i) \frac{I_{i,t}^g}{y_{i,t}} + \beta_2^k (1 - G(z_i)) \frac{I_{i,t}^g}{y_{i,t}} + \varepsilon_{i,t}^k$$

where y is the log of real GDP (ppp-adjusted), α_i are country fixed effects, γ_t are time fixed effects, I_t^g / y_t is the ratio of real government investment (ppp-adjusted) to real GDP (ppp-adjusted),⁴⁰ and $G(z_i)$ is a function varying between 0 and 1 to allow for differentiated responses on GDP growth across different groups of public investment efficiency (low and high).

Specifically:

$$G(z_i) = \frac{\exp(-z_i)}{1 + \exp(-z_i)},$$

where z_i is a time-invariant indicator of public investment efficiency defined according to the efficiency frontier approach⁴¹, normalized to have 0 mean and unit variance.⁴² The coefficients β_1^k and β_2^k can be interpreted as describing the system with very low public investment efficiency ($G(z_i) \approx 1$), and with very high public investment efficiency ($G(z_i) \approx 0$), respectively.

This regression is estimated separately for each $k = 1, 2, 3, 4, 5$ to show the impact on the level of GDP in percent for the first year (*i.e.*, $k = 1$), the second year ($k = 2$), etc.⁴³ Table AIII.1 presents regression results for each k .

This approach differs from that in IMF (2014c) in two ways. First of all, the estimation uses a novel index of public investment efficiency which measures the efficiency of translating inputs (government capital stock per capita) into outputs (roads, water, etc.) subject to a given technology. Second, IMF (2014c) assesses the impact of large government investment drives (*i.e.*, focusing on periods of booms), whereas this paper examines the average impact of public investment shocks. This is because the objective of the present paper is to establish stylized facts regarding the impact of public investment efficiency on output, regardless of the size of the

⁴⁰ See Annex I for a detailed description of data sources for real GDP and government investment.

⁴¹ See Annex II for a detailed description of the Public Investment Efficiency Index.

⁴² See IMF (2014c) and Auerbach and Gorodnichenko (2012), for more details on the function $G(z)$.

⁴³ The results are robust to the inclusion of private investment as a regression control.

investment shock.⁴⁴

Table AIII.1. Fixed Effects Regressions with Varying Public Investment Efficiency

	k=1	k=2	k=3	k=4	k=5
Estimated Coefficients (in percent)					
Public Investment - low efficiency	0.098[*] (0.07)	0.147[*] (0.11)	0.162 (0.15)	0.152 (0.18)	0.130 (0.20)
Public Investment - high efficiency	0.346*** (0.08)	0.583*** (0.14)	0.684*** (0.18)	0.719*** (0.21)	0.758*** (0.24)
R-squared	0.0982	0.1128	0.1163	0.1134	0.1082
F statistic	2.55	3.86	5.03	6.21	7.40
p-value (F)	0.0000	0.0000	0.0000	0.0000	0.0000
Observations	4641	4527	4413	4299	4185
Countries	114	114	114	114	114

Note: Dependent variable is the log k-difference of real GDP in international dollars. Standard errors in parentheses: [*] $p < 0.2$, * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

⁴⁴ In addition, note that the current analysis uses more updated databases than IMF (2014c) as described in Annex I.

Annex IV. The Public Investment Management Assessment

A. Basic Principles

The 15 public investment management institutions—and their key features—described in Section III.A provide the basis for a comprehensive evaluation of PIM practices in a sample of 25 countries. Each institution was assessed based on three indicators related to the key design features of that institution, resulting in a total of 45 indicators. The indicators were selected to characterize each institution, rather than as comprehensive descriptors of it.

Three possible scores were set for each indicator. The criteria for each score were intended to focus on key elements that contribute to PIM outcomes. While practices in a country rarely fit the scoring criteria exactly, the criteria provide valuable guidance to ensure that scoring is applied as consistently as possible. Scores were based on current practice. If current practice was very recently introduced, and thus had no opportunity to influence PIM outcomes to date, scores were calculated based on previous practice.

Criteria for each of the three possible scores within an indicator often accumulate key characteristics. In other words, the lowest score required the presence in a country of A, the next highest score required the presence of A and B, and the highest score required the presence of A, B, and C. Most indicators were intended to apply to all countries. In cases where B was not present, but C was, the middle score was given. A few indicators were not assumed to be present in every country. For example, a country that has not entered into any PPPs, and has no immediate plans to do so, was not scored on PPP-related indicators.

Institutions nominally in place are not equally effective across countries. For example, project appraisal procedures required by law, and reviewed by a dedicated unit in the Ministry of Finance, may be carried out better in Country X than in Country Y. In such cases, both countries would be scored equally if the project appraisal practices were broadly reasonable. However, if Country Y was nominally carrying out appraisal practices that were widely considered to be of low quality, the country would not be scored as if this practice was present. In short, the scoring was based on the assumption that practices were effective, and therefore present, unless there was clear evidence to the contrary.

The 45 indicator scores were aggregated using simple averaging. Averages were calculated for institutions, phases of the PIM process, countries, and classes of countries. If an indicator was judged to be inapplicable, as might be the case with PPP indicators, the indicator was removed entirely from the average calculation and thus affected the score only insofar as the total number of observations was reduced. Indicators and scoring criteria were designed with roughly equal weighting in mind.

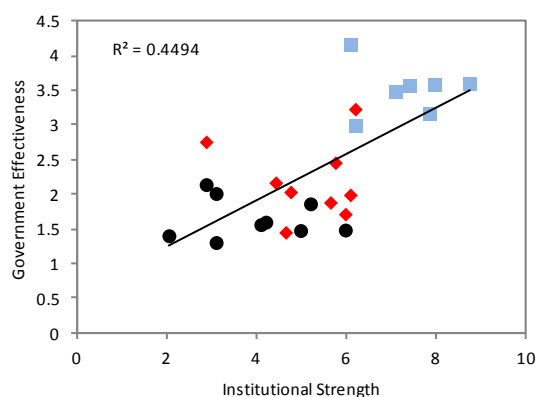
Scoring was performed by FAD staff members with knowledge of public financial management practices in each country. The desk economist in the respective IMF country team reviewed the scoring for each country. Countries were consulted directly regarding any factual questions about particular institutions. An internal review to ensure consistency of scoring across countries was conducted.

B. Comparison with Other Indices

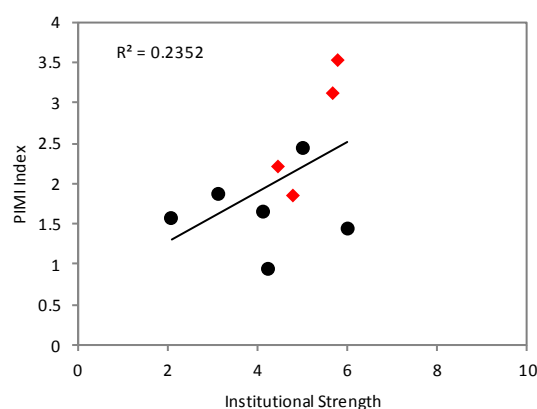
The above evaluation results are consistent with other measures of the strength of public institutions and investment management. The strength of PIM institutions, measured using the methodology described above, is highly correlated with wider measures of government integrity, such as the World Bank's Worldwide Governance Indicators (WGI) (Figure AIV.1.A).⁴⁵ The results are also correlated with the PIMI developed by the IMF and the World Bank for a range of emerging and low-income developing countries,⁴⁶ although the overlap between sample countries is relatively low (Figure AIV.1.B). It also compares well to the conceptual framework for PIM developed by the World Bank (see Box 5 above).

Figure AIV.1 Correlation with other Measures of Institutional Strength

A. WGI Governance Indicator to Overall Institutional Strength



B. PIMI Indicator to Overall Institutional Strength



⁴⁵ A principal component analysis confirmed the correlations between our framework and WGI, but not the PIMI.

⁴⁶ The PIMI was developed as a composite index of the efficiency of the public investment process for 71 EMs and LIDCs across four consecutive stages: project appraisal, selection, implementation, and evaluation. Each of the stages is made up of several individual components (17 in total).

C. The PIMA Questionnaire

A. Planning Sustainable Levels of Public Investment					
1. Fiscal principles or rules: Are there permanent fiscal principles or rules that support sustainable levels of capital spending?					
	1.a.	Is fiscal policy guided by one or more permanent fiscal principles, or rules?	There are no permanent fiscal principles or rules	Fiscal policy is guided by one or more permanent fiscal rules but they have not been adhered to over the last three years and there is no provision in the law allowing rules to be suspended in exceptional circumstances	Fiscal policy is guided by one or more permanent fiscal rules and they have been adhered to over the last three years or there is a provision in the law allowing rules to be suspended in exceptional circumstances.
	1.b.	Do fiscal principles or rules protect capital spending over the short term or medium term?	Capital spending is included under a target or limit for the overall fiscal balance or aggregate expenditure	Capital spending is included under a target or limit for the overall fiscal balance or aggregate expenditure, but these are expressed in structural terms	Capital spending is excluded from a target or limit for the balance (Golden Rule) or expenditure (Operating Expenditure Rule) or there is a floor on the overall level of capital spending
	1.c.	Is there a target or limit for government liabilities, debt, or net worth?	There is no target or limit for government liabilities, debt, or net worth	There is a target or limit for government liabilities, debt, or net worth	There is a target or limit for government liabilities, debt, or net worth with an automatic adjustment mechanism when the target is not being met
2. National and Sectoral Planning: Are investment allocation decisions based on sectoral and inter-sectoral strategies?					
	2.a.	Does the government publish national and sectoral strategies for public investment?	No national or sectoral public investment strategies are published	Either a national public investment strategy or sectoral strategy is published	Both national and sectoral public investment strategies are published
	2.b.	Are the government's national and sectoral strategies or plans for public investment costed?	The government's investment strategies or plans include no cost information on planned public investment	The government's investment strategies include broad estimates of aggregate and sectoral investment plans	The government's investment strategies include costing of individual, major investment projects

	2.c.	Do sector strategies include measurable targets for the outputs and outcomes of investment projects?	Sector strategies do not include measurable targets for outputs or outcomes	Sector strategies include measurable targets for outputs (e.g., miles of roads constructed)	Sector strategies include measurable targets for both outputs and outcomes (e.g., reduction in traffic congestion)
3. Central-Local Coordination: Is there effective coordination of central and sub-national governments' investment plans?					
	3.a.	Are there limits on subnational government (SNG) borrowing?	There are no limits on SNG borrowing	SNGs may borrow only for investments	SNGs may borrow only for investment and within limits set by law
	3.b.	Is capital spending by SNGs coordinated with the central government?	Capital spending plans of sub-national governments are not submitted to central government nor discussed with central government	SNG capital spending plans are consolidated alongside central government investments, but there are no formal discussions, between the central government and SNGs on investment priorities	SNG capital spending plans are consolidated alongside central government investments, and there are formal discussions between central government and SNGs on investment priorities
	3.c.	Does the central government have a transparent, rule-based system for making capital transfers to SNGs, and for providing timely information on such transfers?	The central government does not have a transparent rule-based system for capital transfers to SNGs	The central government uses a transparent rule-based system for capital transfers to SNGs, but SNGs are notified about expected transfers less than six months before the start of each fiscal year	The central government uses a transparent rule-based system for capital transfers to SNGs, and expected transfers are made known to SNGs at least six months before the start of each fiscal year
4. Public-Private Partnerships: Is there a transparent framework for the scrutiny, selection, and oversight of PPP projects?					
	4.a.	Has the government published a strategy for PPPs and issued standard criteria for entering into PPP arrangements?	There is no published PPP strategy or set of criteria for entering into PPP arrangements	A PPP strategy has been published, but there are no standard criteria to guide the choice between traditional financing and PPPs	A PPP strategy has been published and there are standard criteria to guide the choice between traditional financing and PPPs
	4.b.	Are PPPs subject to value for money review by a dedicated PPP unit prior to approval?	PPPs are not normally subject to value for money review	All or most PPPs are subject to value for money review but not by a dedicated PPP unit	All or most PPPs are subject to value for money review by a dedicated PPP unit

	4.c.	Is the accumulation of explicit and/or contingent PPP liabilities systematically recorded and controlled?	Explicit and/or contingent PPP liabilities are not systematically recorded and there are no overall limits for the accumulation of such liabilities	Explicit and/or contingent PPP liabilities are systematically recorded but there are no overall limits for the accumulation of such liabilities	Explicit and/or contingent PPP liabilities are systematically recorded and there are overall limits for the accumulation of such liabilities
5. Regulation of Infrastructure Companies: Is there a favorable climate for the private sector and SOEs to participate in infrastructure provision?					
	5.a.	Does the regulatory framework support competition in contestable markets for economic infrastructure (e.g., power, water, telecoms, and transport)?	Provision of economic infrastructure is restricted to domestic monopolies	There is domestic competition in some economic infrastructure markets	There is international and domestic competition in major economic infrastructure markets
	5.b.	Are there independent regulators who set the prices of economic infrastructure services based on objective economic criteria?	The prices for economic infrastructure services are generally set by the central government	The prices for economic infrastructure services are set by independent regulators, but the regulators do not have full organizational, financial and managerial autonomy	The prices for economic infrastructure services are set by independent regulators, and the regulators have full organizational, financial, and managerial autonomy
	5.c.	Does the government oversee the investment plans of infrastructure SOEs and monitor their financial performance?	The government does not review the investment plans and financial performance of infrastructure SOEs	The government reviews, but does not publish, a consolidated report on the investment plans and financial performance of infrastructure SOEs	The government reviews and publishes a consolidated report on the investment plans and financial performance of infrastructure SOEs

B. Ensuring Public Investment is Allocated to the Right Sectors and Projects

6. Multi-Year Budgeting: Does the government prepare medium-term projections of capital spending on a full cost basis?					
	6.a.	Is capital spending by ministry forecasted over a multiyear horizon?	No projections of capital spending are published beyond the budget year	Projections of total capital spending are published over a three-five year horizon	Projections of capital spending disaggregated by ministry or program are published over a three-five year horizon

	6.b	Are there multiyear ceilings on capital expenditure by ministry or program?	There are no multiyear ceilings on capital expenditure by ministry or program	There are indicative multiyear ceilings on capital expenditure by ministry or program	There are binding multiyear ceilings on capital expenditure by ministry or program
	6.c.	Are projections of the full cost of major capital projects over their life cycles published?	Projections of the cost of major capital projects are not published, or are only published for the budget year	Projections of the total cost of major capital projects are published	Projections of the total cost of major capital projects are published together with annual projections over a three-five year horizon
7. Budget Comprehensiveness: To what extent is capital spending undertaken through the budget?					
	7.a.	Is capital spending mostly undertaken through the budget?	Significant capital spending is undertaken by extrabudgetary entities with no legislative authorization or disclosure in the budget documentation	Significant capital spending is undertaken by extrabudgetary entities, but with legislative authorization and disclosure in the budget documentation	Little or no capital spending is undertaken by extrabudgetary entities
	7.b.	Are externally funded capital projects included in the budget documentation?	Externally funded capital projects are not included in the budget documentation	Externally funded capital projects are included in an appendix to the budget documentation	Externally funded capital projects are integrated into ministerial or sectoral investment budgets in the budget documentation
	7.c.	Is information on PPP transactions included in the budget documentation?	No information on PPP transactions is included in the budget documentation	Information on PPP transactions is included in supplementary information or in an appendix to the budget documentation	Information on PPP transactions is fully integrated into the tables on capital investment by ministry or sector in the budget documentation
8. Budget Unity: Is there a unified budget process for capital and current spending?					
	8.a.	Are capital and recurrent budgets prepared and presented together?	Capital and recurrent budgets are prepared by separate ministries and/or presented in separate budget documents	Capital and recurrent budgets are prepared by a single ministry and presented in a single document but without using a program classification	Capital and recurrent budgets are prepared by a single ministry and presented in a single document, using a program classification

	8.b.	Does the budget include appropriations of the recurrent costs associated with capital investment projects?	The budget does not include appropriations of the recurrent costs associated with investment projects	The budget includes appropriations of the recurrent costs associated with investment projects for the budget year only	The budget includes appropriations (or estimates) of the recurrent costs associated with investment projects for the budget year and the medium term
	8.c.	Does the budget classification and chart of accounts distinguish clearly between recurrent and capital expenditure, in line with international standards?	The budget classification and chart of accounts includes some recurrent expenditure in the definition of capital expenditure or some capital expenditure in recurrent expenditure	The budget classification and chart of accounts includes some capital expenditure in financing or some financing in capital expenditure	The budget classification and chart of accounts clearly distinguishes between recurrent and capital expenditures and financing, in line with international standards
9. Project Appraisal: Are project proposals subject to systematic project appraisal?					
	9.a.	Are capital projects subject to standardized cost-benefit analyses whose results are published?	Capital projects are not systematically subject to cost-benefit analyses	Cost-benefit analyses are usually conducted for major projects but not systematically published	Cost-benefit analyses are conducted systematically for major projects and the results published
	9.b.	Is there a standard methodology and central support for the appraisal of projects?	There is no published methodology or central support for project appraisal	There is either a standard methodology or central support for project appraisal	There is both a standard methodology and central support for project appraisal
	9.c.	Are risks taken into account in project appraisals?	Risks are not systematically assessed as part of the project appraisal	A risk assessment covering a range of potential risks is included in the project appraisal, but budgets do not include contingency reserves to cater for possible cost overruns	A risk assessment covering a range of potential risks is included in the project appraisal and budgets include contingency reserves to cater for possible cost overruns
10. Project Selection: Are there institutions and procedures in place to guide project selection?					
	10.a.	Does the government undertake a central review of major project appraisals before decisions are taken to include projects in the budget?	Project selection is largely made by the line ministry	Major projects are reviewed by Ministry of Finance (MoF) staff prior to inclusion in the budget.	All major projects are scrutinized by MoF staff with input from external experts prior to their inclusion in the budget

	10.b.	Does the government publish and adhere to standard criteria for project selection?	There are no published criteria for project selection	There are criteria published for project selection but projects are regularly selected without going through the required selection process	There are published criteria for project selection and generally projects are selected through a required selection process
	10.c.	Does the government maintain a pipeline of approved investment projects for inclusion in the annual budget?	Investment projects are included in the budget on an ad hoc basis	The government maintains a pipeline of approved investment projects but other projects may be selected for financing through the annual budget	The government maintains a comprehensive pipeline of investment projects, which is used for selecting projects for inclusion in the annual budget, and for the medium term

C. Delivering Productive and Durable Public Assets

11. Protection of Investment: Are investment projects protected during budget implementation?

	11.a.	Are total project outlays appropriated by parliament at the time of the project's commencement?	Outlays are appropriated on an annual basis	Outlays are appropriated on an annual basis, but information on total project costs is included in the budget	Total project outlays are appropriated upon commencement of the project, with adjustments being made to the budget appropriation on a year-by-year basis
	11.b.	Are in-year transfers of appropriations (virement) from capital to current spending prevented?	There are no limitations on virement from capital to current spending	The finance ministry may approve virement from capital to current spending	Virement from capital to current spending is allowed only by act of parliament
	11.c.	Can unspent appropriations for capital spending be carried over to future years?	Unspent appropriations for capital spending lapse at the end of the year	Unspent appropriations for capital spending may be carried over within certain limits	Unspent appropriations for capital spending may be carried over without limitations

12. Availability of Funding: Is financing for capital spending made available in a timely manner?

	12.a.	Are ministries/agencies able to plan and commit expenditure on capital projects in advance on the basis of reliable cash flow forecasts?	Cash flow forecasts are not prepared or updated regularly and ministries/agencies are not provided with commitment ceilings in a timely manner	Cash flow forecasts are prepared or updated quarterly and ministries/agencies are provided with commitment ceilings at least a quarter in advance	Cash flow forecasts are prepared or updated monthly, and ministries/agencies are provided with commitment ceilings for the whole year
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	12.b	Is cash for project outlays released in a timely manner?	The financing of project outlays is frequently subject to cash rationing, leading to significant delays in project implementation	Cash for project outlays is sometimes released with delays, leading to some delays in project implementation	Cash for project outlays is normally released in a timely manner according to the appropriation
	12.c	Is external (donor) financing of capital projects integrated into cash management and the TSA?	External financing is largely held in commercial bank accounts outside the central bank's government accounts/TSA	External financing is held at the central bank's government accounts but is not part of a TSA	External financing is fully integrated into a TSA
13. Transparency of Budget Execution: Are major investment projects executed transparently and subject to audit?					
	13.a	Is the procurement process for major capital projects open and transparent?	Few major projects are tendered in a competitive process, and the public has limited access to procurement information	Many major projects are tendered in a competitive process, but the public has only limited access to procurement information	Most major projects are tendered in a competitive process, and the public has access to complete, reliable and timely procurement information
	13.b	Are major capital projects subject to monitoring during project implementation?	Most major capital projects are not monitored during project implementation	For most major projects, annual project costs, as well as physical progress, are monitored during project implementation	For all major projects, total project costs as well as physical progress, are centrally monitored during project implementation
	13.c	Are ex post audits of capital projects routinely undertaken?	Major capital projects are usually not subject to ex post external audits	Some major capital projects are subject to ex post external audit, information on which is published by the external auditors	Most major capital projects are subject to ex post external audit information on which is regularly published and scrutinized by the legislature
14. Management of Project Implementation: Are capital projects well managed and controlled during the execution stage?					
	14.a.	Do ministries have effective project management arrangements in place?	Ministries do not systematically identify senior responsible officers for major investment projects and implementation plans are not prepared prior to budget approval	Ministries systematically identify a senior responsible officers for major investment projects, but implementation plans are not prepared prior to budget approval	Ministries systematically identify senior responsible officers for major investment projects, and implementation plans are prepared prior to budget approval

	14.b.	Has the government issued rules, procedures and guidelines for project adjustments that are applied systematically across all major projects?	There are no standardized rules and procedures for project adjustments	There are standardized rules and procedures for project adjustments that are generally applied but do not include a fundamental review and reappraisal of a project's rationale, costs and expected outputs	There are standardized rules and procedures for project adjustments that are applied systematically and if required include a fundamental review of the project's rationale, costs and expected outputs
	14.c.	Does the government systematically conduct an ex post review and evaluation of a project that has completed its construction phase?	Ex post reviews are neither systematically required, nor frequently conducted	Ex post reviews focusing on project costs, deliverables and outputs are sometimes conducted	Ex post reviews focusing on project costs, deliverables and outputs are conducted regularly, as are evaluations of project outcomes, in some cases
15. Monitoring of Public Assets: Is the value of assets properly accounted for and reported in financial statements?					
	15.a	Are surveys of the stocks, values, and conditions of public assets regularly conducted?	Asset surveys are conducted rarely or only on an ad hoc basis by external stakeholders	Asset surveys are conducted regularly by the government for some sectors or subsectors	Comprehensive asset surveys are conducted regularly by the government
	15.b	Are nonfinancial asset values recorded in the government balance sheets?	Balance sheets do not include non-financial assets	Balance sheets include some non-financial assets, which are revalued irregularly	Balance sheets include all or most nonfinancial assets, which are revalued regularly
	15.c	Is depreciation of fixed assets captured in government operating statements?	Depreciation of fixed assets is not recorded in operating statements	Depreciation of fixed assets is recorded in operating statements based on statistical estimates	Depreciation of fiscal assets is recorded in operating expenditures based on asset-specific depreciations

Annex V. PPP Fiscal Risk Assessment Model (P-FRAM)

P-FRAM, developed by the IMF’s Fiscal Affairs Department, is an analytical tool used to assess y the potential fiscal costs and risks arising from PPP projects systematically. There is a widespread consensus on the need to improve project evaluation techniques for PPPs to ensure that only the right projects are procured. However, better project evaluation techniques cannot, by themselves, ensure the budget affordability of a project. Typically, financing and funding conditions for projects are agreed upon under completely separate processes. Given the disconnect between project and financial evaluation techniques, governments may end up procuring projects that either cannot be funded within the existing budgetary envelope, or that expose the public finances to excessive fiscal risks. To address these concerns, P-FRAM has been developed as an analytical tool to quantify the macro-fiscal implications of PPP projects.

In practice, assessing a PPP project involves both gathering specific project information and making judgments about the government’s role at key stages of the project cycle. In making such an assessment, there are several key considerations that are difficult to disentangle in practice. The tool provides a structured process for gathering this information for a PPP project in a simple, user-friendly, Excel-based platform, following a four-step decision-tree:

- **Who initiates the project?** The impact of main fiscal indicators (i.e., deficit and debt) varies depending on the public entity ultimately responsible for the project (e.g., central, local governments, state-owned enterprises, etc.)
- **Who controls the asset?** Simple standardized questions assist the user in making an informed decision about the government’s ability to control a PPP-related asset—either through ownership, beneficial entitlement, or other means. If the government is regarded as controlling the asset, this typically impacts main fiscal indicators.
- **Who ultimately pays for the asset?** The funding structure of the project is what determines its implication on main fiscal aggregates. P-FRAM allows for three funding alternatives: (i) the government pays for the asset using public funds (e.g., periodic payments); (ii) the government allows the private sector to collect fees directly from the asset’s users (e.g., tolls); or (iii) a combination of the two.
- **Does the government provide additional support to the private partner?** Governments may not only fund PPP projects directly, but can also support private partners in a variety of ways, including providing guarantees (e.g., debt, and minimum revenues), equity injections, and tax amnesties, among others.

Once project-specific and macroeconomic data are introduced, P-FRAM automatically generates standardized outcomes. The latter include (i) project cash flows over the whole life cycle; (ii) fiscal tables and charts, both on a cash and accrual basis—i.e., government’s cash statement, income statement, and balance sheet; (iii) debt sustainability analyses with and without the PPP project; and (iv) sensitivity analyses of main fiscal aggregates to changes made within macroeconomic and project-specific parameters. These

standardized outcomes can be compared to the country-specific reporting standards of PPP transactions in order to evaluate how far/close they are from best practices.

While P-FRAM remains a work in progress, it is currently being pilot-tested in various platforms, and is expected to be fully developed by mid-2015. The tool is designed mainly for use by PPP units in finance ministries to advise on the potential fiscal implications of PPP projects. Yet, it is simple enough to accommodate analytical interests from a broader audience with little or no specific PPP knowledge, including Fund country desk economists, or project analysts in the public or private sector.