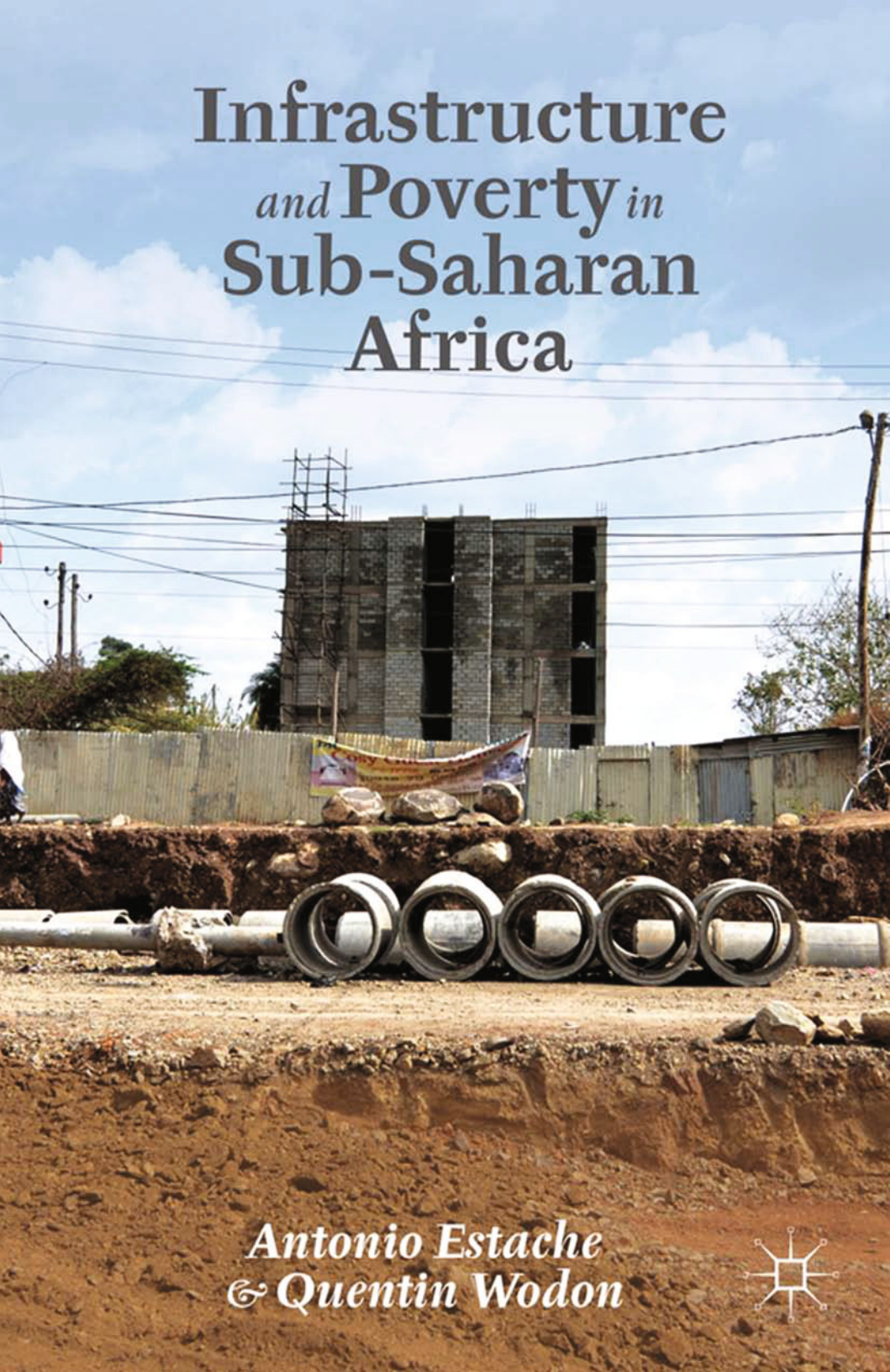
Infrastructure and Poverty in Sub-Saharan Africa



Antonio Estache
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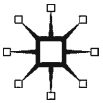

INFRASTRUCTURE AND POVERTY IN SUB-SAHARAN AFRICA

Softcover reprint of the hardcover 1st edition 2014 978-1-137-38149-1

First published in 2014 by
PALGRAVE MACMILLAN®
in the United States—a division of St. Martin's Press LLC,
175 Fifth Avenue, New York, NY 10010.

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ISBN 978-1-349-47964-1 ISBN 978-1-137-34848-7 (eBook)
DOI 10.1057/9781137348487

Library of Congress Cataloging-in-Publication Data

Estache, Antonio, author.
Infrastructure and poverty in Sub-Saharan Africa / Antonio Estache and Quentin Wodon.
pages cm
Includes bibliographical references and index.
1. Infrastructure (Economics)—Government policy—Africa, Sub-Saharan. 2. Infrastructure (Economics)—Social aspects—Africa, Sub-Saharan. 3. Poor—Services for—Africa, Sub-Saharan. 4. Poverty—Africa, Sub-Saharan. 5. Africa, Sub-Saharan—Economic conditions—21st century. I. Wodon, Quentin, author. II. Title.

HC800.Z9C348 2014
363.0967—dc23 2014022836

A catalogue record of the book is available from the British Library.

Design by Newgen Knowledge Works (P) Ltd., Chennai, India.

First edition: November 2014

10 9 8 7 6 5 4 3 2 1

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Preface

Since the early 2000s, the volume of academic and policy research conducted on the importance of infrastructure for Sub-Saharan Africa (SSA) is impressive. It is also to some extent partial in that it is somewhat biased toward more macroeconomic issues. We all know now how important infrastructure is for Africa's growth and competitiveness. However, excluding the literature on the water Millennium Development Goals (MDGs), a chapter for the Africa Infrastructure Country Diagnostic (AICD) diagnostic and the associated background papers, and a number of academic papers, still relatively little focus has been placed specifically on the infrastructure needs of the poor. Yet, visitors to any country of the region would be able to argue that the poor are not getting the infrastructure services they need. In the last 20 years, while technology has helped a lot for access to telecom services, progress has been slow in the other infrastructure sectors.

In this book, our aim is to provide a reminder of the evidence of infrastructure's role in accelerating growth and progress toward the MDGs and the scope for reforms with a focus on the needs of the poor. We discuss access rates to infrastructure services, as well as their affordability, quality, and cost, and how reforms have been a success or not for the poor.

Clearly, the poor should benefit from macroeconomic progress, and infrastructure has a strong role to play in this. There are many quotes for the investment needs of the infrastructure sectors, from initial rough estimates prepared for the Economic Commission for Africa to more recent estimates prepared for diagnostics conducted by all the major international development agencies involved in SSA (and some of the major consulting firms). The ongoing most common quote is that the region should spend about US$100 billion a year to meet the needs imposed by the growth targets underlying the MDGs, more than twice what it is currently spending.

At the country level, adding investment, operation, and maintenance requirements this represents a minimum of 9 percent of the gross domestic product (GDP), and could be up to 15 percent for many countries. For many countries, this means that the current average expenditure levels in the infrastructure sectors need to almost triple. This is a significant demand with potentially nontrivial consequences for the economy in general and the poor in particular. This is no longer news, but it is useful to keep it in mind since these numbers need to be matched with the financing and cost recovery or subsidy requirements for any infrastructure activity. What should be striking is that 15 percent of GDP is a very large figure and this is going to be a policy and political problem if the cost of access and consumption are progressively passed on to the poor.

This challenge is not going to concern only a few citizens in most countries. The baseline data on access rates and on the quality of access offered by the household survey-based data summarized in this book leaves little doubt that SSA's performance continues to be poor while costs appear to be high in most sectors. The average access rates at the country level (not taking into account country population weights) are at about a third of the population for electricity, less than a fifth for piped water, and a tenth for toilets. It may be higher for transport but this depends on how access is measured in that sector. For all services, rural areas enjoy much lower access rates than urban areas, and there are also large differences between the poor and the better off in terms of access as well as quality.

Affordability continues to be an issue as well despite the fact that many infrastructure services are priced at levels below those required for full cost recovery (especially in the case of water and electricity). Affordability is a more serious problem among households who do not have access to network-based services than for the minority of households who are connected to the networks because the cost of meeting infrastructure needs without access to network services tends to be much higher. Ultimately, although the share of total household expenditure allocated to infrastructure services is not necessarily much higher than in other regions, Africa's population is much poorer, so that what has to be given up to pay for the subsidies needed to deliver basic infrastructure services is a serious policy and political issue as well.

In an effort to improve access, affordability, and quality, many governments in SSA undertook some infrastructure reforms in the last two decades but excluding the telecom sector, which has largely benefited from a technological revolution rather than a policy revolution, less than

a third of the countries actually implemented major structural changes in electricity or water distribution. The reforms generally aimed at increasing competition in the markets and for the markets in the region, increasing the independence of the regulators of residual monopolies as well as increasing private participation in the financing and operations of the infrastructure sectors. There is a widespread feeling that many of the reforms have not worked as well and as fast as reformers had hoped for. Many countries are still trying to figure out the right model and in most countries the delays associated with the transition to a new model have negative social consequences. While there are some success stories, there are many more failures and many of the success stories have had a dark side that reformers are trying to address as part of contract renegotiations or fine-tuning.

In terms of their effectiveness in attracting private capital, the reforms did not deliver as much as expected to address SSA's large investment needs. In 2012 (the latest year for which data is available at the time of this writing), total investment commitments in all infrastructure projects in the region reached US$12.8 billion, which is roughly the annual average obtained between 2007 and 2012. About 80 percent of all private investment (US$9 billion) in infrastructure projects in Africa went to the telecom sector during that period, while water and sanitation hardly got any. The energy and transport sectors roughly split the rest. Moreover, most of the private money continues to be concentrated in some of the largest and most successful economies (such as South Africa, Nigeria, Ghana, Uganda, and Kenya).

When push comes to shove, very little of these private commitments go to the poorest countries, and in the richer countries of the region, very little seems to go to activities with a direct impact on the living conditions of the poor. Since the reforms started, growth in access has been only marginally higher than population growth in many countries, and when access rates have improved, this has mainly benefited the upper quintiles of wealth distribution. This simple observation seems to be quite robust and should be a matter of concern to the various actors trying to come up with new ways of raising funds to support Africa's needs. Cream skimming (i.e., getting funding to finance the needs of those with an ability to pay rather than those who need it the most) is an underestimated but recurring issue in the region.

Our analysis suggests that the failures of the institutional reforms so far have many sources. Many observers blame the design of the reforms, their poor implementation, or the weak political commitment to changes that would reduce major sources of long-term political rent.[1]

But this book also shows that the explanations may be more complex and that there are many other elements to consider in assessing what should be fair expectations from reform in SSA.

First, geography matters. There are differences in performance between landlocked countries and countries with access to sea. There are also differences in access and affordability of services within countries. Households living in poor areas do not have access to network-based services. This limits the gains for the poor from traditional ways of expanding access, especially for electricity, but to some extent also in the case of water. Balance also has to be achieved between the needs of various groups of population and businesses (which are located in different geographic areas) when funding investments and maintenance for roads.

Second, legal and cultural history also matters with, again, more research needed to clarify the factors at work. Anglophone countries have seen better increases in access to electricity and roads while non-Anglophone countries are better at speeding up access rates in telecom and in sanitation. Private participation in infrastructure (PPI) and independent agencies have tended to be associated with better improvements in access in Anglophone countries in general for all sectors except water, where there is no statistically significant difference in performance based on this criteria alone. There is no clear pattern on the impact of water sector reform, even if political instability and corruption are significant cost drivers in that sector regardless of the legal and cultural history.

In this book we suggest that solutions to SSA's infrastructure challenges must look beyond the PPI and independent agencies debate. It must be recognized that official development assistance (ODA), the private sector, and improved cost recovery are unavoidable, and that domestic capital needs to be tapped while also promoting the role of innovative solutions, including some that should involve the diaspora in the financing of the needs of their relatives. Differences in legal and cultural traditions should be addressed in future institutional and contractual arrangements and incentives for all actors to deliver on commitments need to be improved. To allow such incentives to work, governance and accountability need to be improved through institutional designs and basic accounting practices, especially when dealing with regulated monopolies and when decentralizing responsibilities for service delivery. The search for the solution will require more analytical work if the mistakes of the past are to be avoided. In the short run, however, a more systematic reliance on local small and medium enterprises

functioning under a competitive environment to avoid excessive mark-ups should help; so should better-targeted direct or indirect subsidies for the poor.

Ultimately, this book reminds us to be humble when considering the success so far of infrastructure policies in SSA. In spite of all the efforts and the significant progress observed since the major actors of the international community have decided to push infrastructure investment in the region, the results suggest that reforms have not yet made a significant enough difference for the poorest. They also show that there is much that we collectively still do not know about how things work in the infrastructure sectors and about the limits to certain types of reform. We clearly need to better assess the needs of the poor and the extent to which policies actually help them. This implies a commitment to better measurement in order to improve service delivery, simply because without such measurement, there is no accountability for service delivery.

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Acknowledgments

This book is the result of our genuine continued concern for the effectiveness of infrastructure aid in Africa. Some of the ideas developed here were born as part of work the authors carried out at the World Bank (where Antonio worked until 2007 and Quentin still works), but many others have been generated by additional independent work, mostly in an academic context. In working through these ideas, we benefited from discussions with many colleagues and friends, including Diego Angel-Urdinola, Emmanuelle Auriol, Daniel Camos, Prospere Backiny-Yetna, Elena Bardasi, Sudeshna Barnejee, François Bourguignon, Cecilia Briceno, Arnaud Desmarchelier, Amadou Diallo, Damien Echevin, Vivien Foster, Marie Gachassin, Ana Goicoechea, Emili Grifell-Tatjé, Nigel Ings, Kristin Komives, Mukami Kariuki, Peter Kolsky, Jean-Augustin Mapapa Mbangala, Michel Marchat, Sergio Perelman, Gael Raballand, Luc Savard, Richard Schlirf, Stephane Straub, Clarence Tsimpo, Liam Wren-Lewis, Tito Yepes, Cheikh Kane, Danny Leipziger, Marie-Ange Sainy, and Philip Verwimp for comments, inputs, discussions, and suggestions. Clearly, any mistake as well as all interpretations are our responsibility alone and should not be viewed as engaging any of the institutions we are affiliated with, including, in the case of Quentin, the World Bank, its executive directors, or the countries they represent.

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Acronyms

3ie	International Initiative for Impact Evaluation
AfDB	African Development Bank
AICD	Africa Infrastructure Country Diagnostic
AIDI	Africa Infrastructure Development Index
CGIAR	Consultative Group on International Agricultural Research
DAC	Development Assistance Committee
DBSA	Development Bank of Southern Africa
DEA	Data Envelopment Analysis
DFID	UK Department for International Development
DHS	Demographic and Health Survey
EAIF	Emerging Africa Infrastructure Fund
FDI	Foreign direct investment
FCFA	Franc CFA
GDP	Gross domestic product
GIE	Gini Income Elasticity
GNI	Gross national income
HIV-AIDS	Human Immunodeficiency Virus–Acquired Immunodeficiency Syndrome
IBNET	International Benchmarking Network for Water and Sanitation Utilities
ICAs	Investment climate assessments
ICSs	Investment climate surveys
ICT	Information and communication technologies
IDA	International Development Association
IPPs	Independent power producers
IBTs	Inverted block tariff structures
IFC	International Finance Corporation
IFIs	International financial institutions
IFPRI	International Food Policy Research Institute
IMF	International Monetary Fund

IMF-GFS	IMF government finance statistics
IRA	Independent Regulatory Agency
ITU	International Telecommunication Union
LIBOR	London Interbank Offered Rate
MCF	Marginal cost of public funds
MDGs	Millennium Development Goals
MGIE	Marginal Gini Income Elasticity
MIT	Massachusetts Institute of Technology
NEPAD	New Partnership for Africa's Development
OECD	Organization for Economic Cooperation and Development
ODA	Official development assistance
ODI	Overseas Development Institute
Omigsa	Old Mutual Investment Group
PIDG	Private Infrastructure Development Group
PPI	Private participation in infrastructure
PPPs	Public-private partnerships
PRSPs	Poverty Reduction Strategy Papers
RMI	Road Management Initiative
SEEN	Société d'Exploitation des Eaux du Niger
SMEs	Small and medium enterprises
SPEN	Société de Patrimoine de l'eau du Niger
SSA	Sub-Saharan Africa
SSATP	Sub-Saharan Africa Transport Policy Program
TFP	Total factor productivity
UNCTAD	United Nations Conference on Trade and Development
UNICEF	United Nations Children's Fund
USTIC	United States International Trade Commission
VDTs	Volume differentiated tariffs
WAEMU	West African Economic and Monetary Union
W&S	Water and sanitation
WACC	Weighted average cost of capital
WHO	World Health Organization

CHAPTER 1

Introduction

The main objective of this book is to analyze the extent to which, how, and how fast the infrastructure needs of the poor have been met in Sub-Saharan Africa (SSA). The book also documents the extent to which some key policies have hurt or helped progress in trying to speed up the coverage expansion so clearly needed in the region.[1] Whenever possible, we also point to changes that are needed to speed up the processes.

Our focus is on basic energy, telecom, transport, and water and sanitation services at the core of the day-to-day needs of a large majority of the population.[2] We tried to deal with what can be learned from the Sub-Saharan region as a whole and from individual countries in the region. We cannot address the issues specific to each country with the care each country deserves but clearly some of the issues we raise will be relevant to many of the countries in the region.

Our approach should also allow individual countries to benchmark their performance, at least roughly, in terms of some of the basic policy issues such as the accessibility and affordability of the services for users of various income groups. As much as possible, we provide country-specific examples when it helps us make a clearer argument and the analysis has been able to rely on good data available for that country.

This introductory chapter sets the stage for the more detailed discussions of the following chapters. To do so, it offers a brief overview of the sequence of events that have driven SSA's infrastructure to become an impediment to growth and progress toward the Millennium Development Goals (MDGs), and hence to poverty alleviation for many countries in the region. It concludes by explaining why and how the stock taking exercise of success and failures in Africa's infrastructure

policies provided in this book can be used to improve accountability of all actors involved in the region, while also providing a road map to the structure of the book.

A Bit of History and a Glimpse of the Future

Right after a majority of countries achieved political independence the infrastructure designed fitted Africa's economic structure, which was at that time oriented for exports of commodities and minerals. This infrastructure supported reasonably strong economic growth from the early 1960s until the 1970s oil shocks.[3] Between then and the mid-1990s, the economic situation became rather gloomy. This long economic slowdown combined with growing interest in regional trade or other economic agreements[4] and increased urbanization of the continent catalyzed change—albeit slow—in Africa's economic structure.[5] These changes led to a growing mismatch between the demand and the supply for infrastructure in the region. By the end of the 1990s, the gap grew significantly in spite of the good economic recovery achieved since the middle of the decade, which has for the most part continued in the last decade. This is probably why infrastructure is likely to be at the top of the region's reform agenda for the foreseeable future. Indeed, to achieve higher growth and meet the MDGs, the first part of the book shows that, in the short to medium term the average annual infrastructure expenditures (the sum of investment and maintenance expenditures) would need to be around 15 percent of Gross domestic product (GDP), more than twice what Africa has spent on the infrastructure sectors over the last 40 years or so.[6]

How the Infrastructure Gap in Terms of Access to Basic Services Came About

The household demand for infrastructure never stopped growing throughout the various economic cycles but the corresponding supply only grew very modestly on average, as shown in the second part of the book. This gap was not simple to deal with politically but neither was the gap associated with the evolution of the demand from the agricultural, industrial, and services activities in increasingly open economies. After independence, the progressive changes in the economic structure of the continent were instrumental in fueling not only the quantitative but also the qualitative mismatch between the supply and the demand for infrastructure. For instance, as early as the mid-1980s, there was a generalized sense that

there was too much emphasis on the paving of roads in sparse networks. The view was that the demand had switched to denser networks of lower-quality but better-maintained roads. Adjusting to this evolving demand, the rate of investment in paved roads dropped but the necessary improvements in network quality and coverage, including cross-country, did not follow in equivalent proportions. Similarly, in energy, the demand for cross-country transmission lines as engines of collective growth for various parts of Africa has long been recognized. The coordination of investment decisions in these networks has, however, proven to be much more complex than in other developing regions of the world and as a result, demand continues to be rationed in many countries.

Why the Affordability Issue Was Not Solved by Existing Subsidies Badly Targeted to the Poor

The household demand for infrastructure services was not met in part due to supply-side deficiencies but also because of an affordability problem best illustrated through the case of network-based services for water and electricity. First, even though the share of household expenditure devoted to infrastructure services, including utilities is only slightly higher in SSA than in other regions, the fact that households are so much poorer in Africa than elsewhere makes it more difficult for the population to deal with current costs of service. This is especially the case among those who are not connected to modern networks and have to rely on alternative less reliable service sources, because they tend to pay more for their services than connected households do. The cost advantage for connected households is due itself in part to existing subsidies (services are often billed at prices below full-cost-recovery levels), which are very badly targeted again simply because access rates to modern services are so low among the poor.

The recurring fiscal crisis and the "one size fits all" cuts did not help infrastructure. The mismatch between demand and supply has been amplified by the recurrent fiscal crises that accompanied the various economic crises. The policy responses to these fiscal crises, in particular from the mid-1980s onward, were often based on public expenditure adjustments set to address short-term fiscal concerns. This may not have been the optimal policy in a continent in which the long-term growth requirements needed a much more careful look at the relevance of the fiscal composition. These adjustments were too often blind to the sectoral allocations needed to support growth. They were also blind to the complementarity between expenditure categories within sectors—the

commitment to maintenance is a condition to ensure the cost effectiveness of most investment decisions in infrastructure—which is characterized by potentially much longer lived assets than other sectors.[7] The upshot is that fiscal shortfalls and/or cuts led to undermaintenance and underinvestment across infrastructure subsectors.

The inefficiency of many of the public enterprises responsible for the delivery of infrastructure services did nothing to help the fiscal situation. Instead, they contributed to inflate costs, hence increasing the severity of the budget constraints and ultimately the infrastructure gaps. The excessively mistargeted and contractionary policies aimed at addressing the infrastructure sectors' problems were counterproductive in many more ways—too many to cover here. Some of these actually further fueled the fiscal problem they were trying to address and contributed to the erosion of a potential tax base expansion much needed to finance the increasing capital and recurrent expenditure required by infrastructure sectors and others.

Infrastructure-specific policy choices did not help either. Africa's fiscal space problem was compounded by the unfulfilled hope that private sector financing would replace public sector financing—while addressing the public sector inefficiency problem. As discussed later in the book, at most 10–15 percent of the investments made in more recent years can be credited to private investors. This is not negligible but it is not significant enough to cover the reductions associated with the fiscal adjustments.

More importantly maybe, what the low level of private participation in infrastructure (PPI) reveals is that the way reforms were designed and implemented was also part of the problem since it did not manage to attract private capital in infrastructure—although the energy sector, and energy generation in particular, and the telecom sector did proportionately well. In many of the reforming countries, the restructuring intended to facilitate private sector participation also resulted in some degree of "cream skimming," with large urban zones considered the cream of the utilities' business, thereby increasing the gap between rural and urban access rates for public services. In some others, it increased the fiscal costs of the infrastructure sectors when the profit centers used historically to finance cross-subsidies were concessioned. This was done without significant fiscal compensation to the state, at least not enough to replace the cross-subsidies lost through the restructuring processes by direct subsidies when full cost recovery was not an option.

The main lesson so far may be that working with the private sector is a necessity for Africa but that a menu of cost effective solutions for public-private partnerships adapted to the continent has not yet been

identified. From the perspective of a large share of the population and for many potential investors, the last two decades may have been somewhat of a lost decade. Indeed, the evidence presented later in this book shows that unrealized policy hopes have unfortunately contributed to ration infrastructure investment and quality, with often dramatic distributional consequences.

Where Do We Go from Here?

The fact that today Africa is enjoying a high profile of its infrastructure activities as a result of various international initiatives provides a unique opportunity to try to get a better quantitative sense of what has been achieved so far, of what went wrong and what went right in the last two decades.[8] Without quantitative evidence, the history of policy effectiveness tends to be rewritten to suit the needs of the various stakeholders. The debates on the achievements in the last two decades are likely to be long and occasionally futile because few are likely to be grounded in solid evidence. The strong international political commitment to address Africa's needs for efficient, equitable, and fiscally sustainable infrastructure services demands the definition of a quantitative baseline of the needs, of the initial policy conditions, and of the relevance of institutional factors that may have been underestimated.

In recent years, the international community has recognized that without a much better analytical assessment of the needs, the policy issues, and the options to address them, there is a risk that many of the new solutions to Africa's infrastructure problems would be ad hoc and uncoordinated across donors, as they have sometimes been in the past. Moreover, the investment needs are so large that it may seem to some that there can be no bad project. However, the uneven performance of Africa's infrastructure in comparison to other regions, the increasing fiscal costs of the infrastructure sectors, the political frustration with the reforms (or lack thereof), and the strong impression that the poor have been left out of many of these reforms all argue against that vision. Too many mistakes have plagued the implementation of many of Africa's infrastructure reforms in the past. And the lack of a serious baseline has been detrimental to establishing clear benchmarks for measuring progress.

A baseline needs to be defined to increase accountability of all the actors. This was recognized as essential by the international community after a series of follow up meetings to the Commission for Africa. It led to an enormous collective effort managed by the World Bank on behalf and in close collaboration with all the main international agencies

committed to the development of Africa: the Africa Infrastructure Country Diagnostic (AICD).[9] This may be the largest study to date of Africa's infrastructure situation intended to generate new detailed information on it. It provides a baseline for monitoring progress and has triggered an effort to maintain its close monitoring as illustrated by the Africa Infrastructure Development Index (AIDI) now generated annually by the African Development Bank (AfDB) since 2011.[10]

What This Book Is All About

Part of the material in this book was actually prepared for the AICD study, although some of the material has been updated to reflect more recent developments. Our aim has been to set up an initial quantitative baseline performance and policy assessment, and to complement some of the work done for the AICD study. Thus, part of the objective of this book is to complement the AICD study on some of the key policy issues with a strong emphasis on the needs of populations rather than the needs of various sectors of the economy. More precisely, the book is structured as follows.

Part I covers the macroeconomics dimensions of infrastructure. This part of the book argues that the MDGs and the targets to be set in the post-MDGs agenda will not be achieved without achieving at least a 7 percent annual growth rate for the region. In turn, this 7 percent target will not be achieved without a significant increase in infrastructure investment. The evidence of the relevance of infrastructure for growth must be part of many of the strategic discussions in the region, including those concerned with the needs of the large shares of population living in poverty. Part I of the book also provides estimates of infrastructure needs that have been regularly updated since the Commission for Africa report and now include some types of infrastructures initially excluded (i.e., energy transmission and distribution, irrigation, ports, airports, and a minimum number of cross-country regional projects in power, energy, and information and communication technologies [ICT]). The surprisingly large size of these needs, their fiscal consequences, the macroeconomic capacity of countries to absorb these fiscal consequences, and the explicit accounting of these concerns in country development strategies including Poverty Reduction Strategy Papers (PRSPs) are also part of the focus of Part I of the book.

Part II elaborates on the poverty dimensions of infrastructure. This part gives a more detailed sense of the demand for and supply of infrastructure on the household side. On the demand side, this second part of the

book documents the extent to which progress achieved in expanding access to services for the population has been slow. It also shows how wide the disparity in meeting the demand is across income groups and how ensuring the affordability of the services for the poorest continues to be a challenge for policymakers in Africa. As a consequence, the poorest are often not in a position to use modern infrastructure services such as piped water and electricity. On the supply side, we show how quality continues to be very significant sources of concern in the region. We also show the extent to which cost levels should be a significant source of concern for policymakers in the region. Unfortunately, costs, including those of monopolies, are seldom monitored in the region. One of the main purposes of this discussion of quality and costs is to show that they are crucial for a continent concerned both with its ability to finance its needs and with tariff levels inconsistent with the poorest users' ability to pay. In other words, the needs of the population, in terms of access and affordability, are the focus of Part II of the book.

Part III discusses the policy dimensions of infrastructure. The requirements in terms of quality (both technical and economic), efficiency (both in terms of costs and technology choices), and institutional strength and capacity building needs in their various dimensions, including governance, as well as a preliminary assessment of the targeting performance of existing implicit or explicit subsidies in a small number of countries are the main focus of the third part of the book. We are particularly interested in the impact of the reforms of the last two decades, their achievements, and the challenges of the next wave of reforms. It starts with a snapshot of the current market structure and the reforms intended to change this structure as well as the institutions governing the infrastructure sectors. We show how reforms are associated with changes in access rates, quality, and affordability, providing a basic statistical analysis comparing the average performance of Francophone and Anglophone countries as well as landlocked and coastal countries. We summarize the results of academic assessments of the impact of infrastructure reforms in Africa, including an overview of the evidence available on the level of corruption in the infrastructure sectors and its impact on Africa's infrastructure performance. Finally, we discuss the main issues that need to be addressed in order to ensure that the next wave of infrastructure reforms meets the expectations much better than past reforms managed to do. The idea is not to provide a blueprint for reform; it is rather to contribute and to some extent fuel the discussion of some of the key policy issues any blueprint will have to address.

PART I

Infrastructure, Growth, and the MDGs

This first part of the book takes stock of what is known on why infrastructure in Africa is so central to the various efforts to support growth, reduce poverty, and improve the overall quality of life of Africa's populations. It also summarizes what is known on how much it will cost to meet the region's infrastructure needs. Chapter 2 is intended to shed some light from a theoretical and empirical viewpoint on the importance of infrastructure from a macroeconomic and strategic viewpoint as part of the implementation of the development agenda of African countries. It not only focuses on the interactions between infrastructure and growth but also on how infrastructure was taken into account (or not) in country strategies as illustrated by PRSPs (and especially in the first wave of these papers). Chapter 3 discusses the extent to which infrastructure would help countries to achieve the MDGs. Chapter 4 provides estimates of the investment needs implied by the MDGs and discusses some of the "macropolicy" challenges faced by the infrastructure sectors to meet existing needs.

CHAPTER 2

Infrastructure, Growth, and Country Strategies

Our collective understanding of the drivers of growth has evolved significantly over the last two decades (see box 2.1). Current theories and their empirical tests provided a strong case for an explicit recognition of infrastructure as an important driver of growth, and more so in the early stages of economic development. This should have been central to country strategies, including the PRSPs prepared by SSA countries since these were driving the allocation of resources across infrastructure sectors to sustain long-term development plans.[1] Yet the treatment of infrastructure issues in PRSPs has long been very weak. More generally, despite some progress, the specific treatment of the key policy and institutional reforms that need to be put in place to ensure the effectiveness of infrastructure investments in terms of growth is still relatively weak. This chapter provides a brief overview of the way in which infrastructure is being addressed by the new "macropolicy" tools adopted by the development community and how infrastructure has been treated in country strategies including PRSPs to date.

Box 2.1 A note on growth models

The traditional starting point for growth analysis has been to specify an aggregate production function that describes how domestic output flow is generated from a given stock of production factors ($Y = AF(K, L)$, where Y is the output, F is the function expression that explains how the capital stock K and the stock of labor L are

combined to generate the output, accounting for the productivity factor A that reflects the existing stock of knowledge and the resulting efficiency of capital and labor in producing the final output). In this framework, growth in output results (1) from the accumulation of production factors K or L (one could also include human capital H in addition to K and L); and (2) from increases in the productivity factor A, that is, from productivity growth. If the production function F is a homogeneous function of degree one, one can rewrite the above equation as: $y = AF(k, 1) = Af(k)$, where $y = Y/L$ is the per capita output flow and $k = K/L$ is the stock of capital per capita, and f displays decreasing returns to capital accumulation, that is, the more the capital that has already been accumulated, the smaller the increase in per capita output generated by accumulating one more unit of capital. In the absence of technical progress (no growth in A), per capita output y might grow in the short run but not by much in the long run.

New growth theory provided some additional insights by adding the potential role of human capital but it did not change the policy prescription much. It was only with the second wave of growth theory that a new important key growth driver was recognized. This second wave of endogenous growth theory is largely built around "innovation-based" growth models, which themselves belong to two parallel branches. One branch is the model of Romer (1990), according to which aggregate productivity is a function of the degree of product variety. Innovation causes productivity growth in the product-variety paradigm by creating new, but not necessarily improved, varieties of products. The other branch of innovation-based theory grew out of modern industrial organization theory, and is commonly referred to as "Schumpeterian" growth theory, because it focuses on quality improving innovations that render old products obsolete, and hence involves the force that Schumpeter called "creative destruction." The relevant point here is that this second wave of endogenous growth models puts not only innovation but also sectoral policies, incentives, and institutions much more centrally at the core of the growth debates (Aghion and Hewitt 2009).

We focus here on infrastructure policies as a driver of growth but we emphasize what it means for the poor as well as at the microeconomic level.

Why Infrastructure Matters for Africa's Growth

Why Too Few Macroeconomists Cared about Africa's Infrastructure for So Long

Until the mid-2000s, Africa had enjoyed a significant volume of literature on the engine of growth and on growth convergence. Despite some of the messages emerging from the latest developments in growth theory, most of this work ignored the role of infrastructure. A few reasons may be advanced. First, it may be that a strong correlation between human capital and infrastructure access rates resulted in decisions to ignore the variables on infrastructure in econometric models. Second, it may simply be because the data volume and quality was not up to the standards available for health or education. Or third, it may be that there was a strong sense that infrastructure variables were better dealt with in the context of structural models that had run out of fashion by the end of the 1980s when the new growth theory moved toward the center of macroeconomic research. Whatever the reason, the upshot was that infrastructure had disappeared from the macroeconomists' radar screen.

Yet infrastructure matters to growth! Whatever the reasons for ignoring infrastructure, most papers that made the effort to model infrastructure seriously found strong evidence of its importance for growth. Calderon and Serven (2004) opened the door for the debate on Africa. They provided a very simple intuitive illustration of the correlation between infrastructure and growth from the estimation of a linear trend in Africa over a 37-year period for each key subsector during which infrastructure was largely ignored by growth models for Africa. GDP growth per capita (y) is a function of a synthetic infrastructure stock index (x). The slope is clearly positive for all sectors, suggesting that more infrastructure stocks are associated with higher growth rates and there are very few outliers that would put the conclusion into doubt (Botswana, South Africa, and Mauritius are recurrent high-performing outliers. They are among the five richest countries of the region—the others are Namibia and Gabon).

While the analysis by Calderon and Serven (2004) was only illustrative, it provided a strong case for some of the initiatives taken by key donors to increase the visibility of the infrastructure subsectors. Ignoring important issues such as causality, lags, and other determinants of the interactions as well as the poor specification of this model, these figures could have already provided a very rough sense of the elasticity of growth to access rates in these sectors.[2] The highest "elasticity"

is for the water sector, probably capturing many of the other benefits associated with water. The lowest elasticity is for sanitation. This simple correlation has the highest explanatory power for telecom services and access to paved roads. It is also interesting to note that according to these simplistic regressions, access to paved roads seems to have a higher correlation than to the size of the entire road network.

Evidence of Infrastructure as One of Africa's Growth Engines

While there is a large volume of academic and nonacademic discussions on the role of infrastructure for growth, a search of the most widely read academic literature reveals few published studies addressing the issue quantitatively.[3] Whatever the approximation used for infrastructure, all these studies show that it influences positively either growth or growth convergence.[4] The strongest impact comes from the telecom sector, followed by roads and electricity. The evidence on the link of access to water or sanitation is more complex. This is probably because this sector has the highest correlation with health and education as well as with the other subsectors. Indeed, the importance of the water and sanitation (W&S) sector is particularly strong in Africa when it is considered in isolation from the effects of other sectors, although when it is considered jointly with any other public service its obvious importance is watered down.[5] The message from this research is that there will be no growth and no significant poverty alleviation in Africa without a major improvement in the level and state of its infrastructure.[6] Two of the studies provide easy to remember, relevant estimates. Estache, Speciale, and Veredas (2005) showed that infrastructure investments mattered for convergence across countries in the region since it accelerated the annual growth convergence rate by over 13 percent.[7] Calderon (2009) showed that across Africa, infrastructure contributed 99 basis points to per capita economic growth, versus 68 points for other structural policies. In other words, the social payoff to infrastructure investment and policy is about 50 percent higher than that of any other structural policy, on average. With these papers, there was no further scope to ignore the macroeconomic importance of infrastructure.

It is worth noting that a large share of the good policy research on the role of infrastructure in Africa is conducted by think tanks concerned with agriculture. This is not unexpected. Diao, Dorosh, and Rahman (2003), for instance, show that growth in African agriculture is critically constrained by high marketing costs in the region, largely

due to high transportation costs. In that context, an International Food Policy Research Institute (IFPRI) paper suggests that improving transportation infrastructure could increase agricultural income by as much as 10 percent.[8] And Iimi and Wilson (2007) found that in some African countries, a 1 percent improvement in key aspects of infrastructure could raise GDP by about 0.1–0.4 percent, and possibly by several percent in some cases. Aker and Mbiti (2010) show that the explosion of access to mobile phones in Africa has allowed farmers to find out faster and more precisely the value of their crops in various cities. There are many other studies conducted at the country level with similar conclusions. For instance, Dercon et al. (2009) show for Ethiopia that access to all-weather roads reduces poverty by 6.9 percentage points and increases consumption growth by 16.3 percentage points. Similar stories have been put together from a large number of countries (e.g., Gachassin, Najmanis, and Raballand [2010] for Cameroon, Aker [2008] for Niger, and Fakayode et al. [2010] for Nigeria). Many more are in the pipeline as many large donors (in particular UK Department for International Development [DFID]) are committed to support the increase in our collective understanding about what works and what does not in Africa.

Institutions associated with infrastructure investments matter too. Rodrik (2000) and Acemoglu and Robinson (2012) have long been pushing the importance of institutional factors in development. Many researchers concerned with infrastructure in Africa have included their suggestions in their research. For instance, in a study of the engines of growth during the 1970–1990 period, Naudé and Krugell (2003) find that over 50 percent of the variation in growth per capita in Africa is explained by institutional variables. They confirm previous results and illustrate the importance of the main findings of new growth theories for the African infrastructure sectors. This conclusion is particularly important since infrastructure sectors are often restructured to promote competition and improve governance—including the accountability of the regulatory function—with a view not only to improve efficiency but also to address corruption and other governance issues. However, the problem with the attempt to assess the relevance of institutional changes such as the creation of regulatory institutions in any sector is that it takes time to build these institutions. It also takes time to assess the sustainability of their impact, if any.

There are, however, a number of studies that look at the infrastructure sectors in general and find that the main institutional change that matters is restructuring in order to increase competition.[9] Some studies,

including one for Africa's telecom sector, also find that privatization alone is associated with few benefits, and is negatively correlated with connection capacity, but that combined with an independent regulator it is positively correlated with telecom performance measures.[10] This interaction between reforms and institutions building will be discussed in more details in chapter 5. The main point here is that any support to Africa's infrastructure will require not only a commitment to finance constructions but also a willingness to build the necessary institutions. The 18–24 months it takes to build a road may seem an eternity to some, but it is fast when compared to the time needed to undo wrong institutional incentives while trying to rebuild those needed to ensure the long-term viability of the roads.

Some Quantitative Sense of the Impact of Infrastructure

While growth and trade models are useful to give a general sense of the importance of the infrastructure sectors, it may be useful to try to focus the attention on a couple of more specific quantitative indicators of this importance. This section highlights three indicators. The first is the social rate of return from investment projects in the infrastructure sectors, which provides quantitative evidence at the microeconomic level. The second is an assessment of counterfactuals on the impact of infrastructure on growth, which provides a quantitative sense of its macroeconomic importance. The third is an estimate of the trade effects of infrastructure investment.

The Social Rate of Return on Investing Well in Infrastructure

The macroeconomic assessments provided by growth models can be complemented by evidence available from project-level data. All multilateral and most bilateral agencies tend to rely on cost-benefit analysis to assess the social returns on their projects. These returns are generated from an analysis of the costs and benefits to society of investment in an infrastructure project. In the most thorough assessments, the social benefits include the gains in productivity or in market access associated with the investment and a host of potential noneconomic benefits, such as better education or better health.

While there are methodological problems with this information—for example, not all sectors follow exactly the same approach and the

project managers have some discretionary power in the way they conduct their analysis—it still provides a useful benchmark. Information on ex-post rates of return as estimated by the World Bank's Operations Evaluation Department for World Bank projects for which 95 percent or above of the loan commitments had been disbursed between 1964 and 2003[11] suggests high rates of returns for those projects (Estache and Liu 2003). The average rates of return were 18.4 percent for energy and mining projects, 21.5 percent for telecom and ICT, 25.4 percent for transport, 19.2 percent for urban projects, and finally 9.2 percent for W&S. In addition, the rates of return for projects in Africa were not very different from those in other developing countries, and, maybe more surprising, market enlarging sectors—telecom, transport—enjoyed significantly higher returns than the more "welfare"-oriented sectors—such as energy and W&S.[12] Note also that in recent years, the economic impact of these projects may have improved further.

The Cost of Not Investing in Infrastructure

Interesting work has been done on assessing quantitatively the opportunity cost in terms of growth of infrastructure gaps. Two studies stand out as particularly useful for Africa. Esfahani and Ramírez (2003) estimated that if Africa had had East Asia's growth rate in telephones per capita (i.e., 10% vs. 6%) and in electricity generation (i.e., 6% vs. 2%), its per capita growth rate would have been at least 0.9 percent higher. Calderon and Serven (2004) did a similar exercise but with a synthetic indicator of infrastructure services and generated counterfactuals of what the growth rates of a large set of countries (including over 20 African countries) would have been under various scenarios of infrastructure levels. For instance, if Niger had the infrastructure stock of South Korea, its average growth rate between 1996 and 2000 would have been 1.9 percentage points instead of –1.6 percentage points. More generally, the results for a larger set of 21 African countries, using South Korea as comparator, suggest that for these countries the average growth in GDP per capita would have been 1.04 percentage points higher than observed. Note that these are, of course, rough estimates. In a more recent work Calderon (2009) suggests that the growth payoff of reaching the infrastructure development of the African leader in terms of infrastructure (Mauritius) is 2.3 percent for SSA. Calderon makes the important point that about 10 percent of the gains to be achieved come from improvements in quality.

The Trade Effect of Infrastructure Investment

Given that infrastructure is so important for the trade-oriented development strategy adopted by the majority of African countries—in particular the landlocked countries, two research results should be quite illustrative for policymakers. Limao and Venables (2001) estimate that the median transportation costs for trade within Africa are twice those estimated for East and South Asia and that those costs contribute to Africa's poor growth performance. According to Longo and Sekkat (2001), 1 percent increase in the stock of transportation and telecommunication infrastructure would boost intra-African exports by 3 percent. Richaud, Sekkat, and Varoudakis (1999) suggest that 25 percent of the total gains from improving infrastructure in the region accrue to neighboring countries, mostly from trade and foreign direct investment (FDI). While the policy advice is obvious from this research, its implementation is not likely to be an easy exercise as indicated by Simuyemba (2000).

Buys, Deichmann, and Wheeler (2006) show that a continent-level upgrade of the road network would expand overland trade by about US$250 billion over 15 years, with major direct and indirect benefits for the rural poor. Financing the program would require about US$20 billion for initial upgrading and US$1 billion annually for maintenance. United Nations Conference on Trade and Development (UNCTAD), taking stock of the drivers for intra-African trade has also expressed a strong concern with the current stock of infrastructure in the region. Despite growth of road networks, intra-African trade flows are low in comparison to those in other regions and relative to Africa's trade potential. According to the report, Africa's poor performance reflects some key constraints, particularly infrastructure. Buys, Deichmann, and Wheeler (2006) concluded that regional trade within the West African Economic and Monetary Union (WAEMU) would increase threefold if all intrastate roads linking WAEMU countries were paved. Arvis et al. (2010) and Raballand, Macchi, and Petracco (2010) also validate the importance of the transport infrastructure for the growth and trade prospects of the region.

Infrastructure Impact on the Distribution of Growth within Countries

With the growth in decentralization of decisions on investment, the importance of the risks of underfunding infrastructure investments that generate benefits mostly through the integration of regions has

started to attract the attention of policymakers. Place-specific investments in infrastructure have become an integral component of territorial development policies. Lall, Schroeder, and Schmidt (2009) illustrate how this debate applies to Africa as well. Using the case of Uganda, they examine regions where investments generate the highest economic returns ("spatial efficiency") and identify whether there are trade-offs when infrastructure coverage is made more equitable across regions ("spatial equity"). Their empirical analysis is based on models of firm's location choice, drawing on insights from the new economic geography literature. They show that availability of power supply, transport links connecting districts to markets, and the supply of skilled workers attract manufacturing activities. Combining all these factors gives a distinct advantage to existing agglomerations along leading areas such as around Kampala and Jinja. Infrastructure investments in these areas are likely to produce the highest returns compared with investments elsewhere. This means that public infrastructure investments in other locations are likely to attract fewer private investors, posing a spatial efficiency-equity trade-off. In other words, infrastructure will help aggregate growth, but it may do so at a spatial distributional cost that should be considered by policymakers as they decide on the specifics of their territorial policies.

The recent explosion of data to assess regional policies is actually allowing researchers to deal with crucial discussions on the optimal technology choices that need to be addressed in the context of the expansion of services in the region. Consider access to electricity—it currently reaches only about one-third of households. At a time when climate change costs of traditional sources of energy are making the headlines, it seems interesting to explore how economic development might be reconciled with the need to keep carbon emissions in check. Deichmann et al. (2010) developed a geographically explicit framework and used spatial modeling and cost estimates from engineering studies to determine where stand-alone renewable energy generation is a cost-effective alternative to centralized grid supply in Africa as a way to ensure some convergence between rural and urban electrification. The results suggest that decentralized renewable energy will likely play an important role in expanding rural energy access. However, it will be the lowest cost option for only a minority of households in Africa, even when likely cost reductions over the next 20 years are considered. Decentralized renewable energy installations are competitive mostly in remote and rural areas, while grid-connected supply dominates denser areas where the majority of households reside.[13]

Treatment of Infrastructure in Country Strategies and the MDGs

For most African countries, country strategies including the PRSPs have been quite central to the way sectoral resources have been allocated to support growth and poverty reduction in the last decade and a half. This is why even though the importance of PRSPs for country strategies has been reduced in recent years, it is still useful to monitor the extent to which and the way infrastructure needs were addressed in PRSPs.

A search on the Internet on public speeches by key African politicians suggests that infrastructure is at the top of the list of concerns for many of them. Previous studies such as the *Voices of the Poor* book by Narayan-Parker and Walton (2000) revealed that politicians in this respect are in tune with the poor who also list access to better infrastructure services as critical to their quality of life. Yet, the PRSPs initiated in the mid-1990s have not always been consistent with these information revealing mechanisms.

Infrastructure Coverage in PRSPs

In most PRSPS, at least up to the mid-2000s (the role of PRSPs has decreased since then, as countries did not need them anymore for debt relief), infrastructure concerns tended to be defined in relatively general terms or in ad hoc ways—often as a demand derived from very specific, sometimes very local, growth or poverty reduction concerns without enough regards to global visions of needs.[14] Even when explicitly dealing with infrastructure, the PRSPs tended to be partial. The role of infrastructure in agricultural growth and rural poverty reduction dominated the infrastructure coverage of the PRSPs in many countries. For some, this was complemented by a discussion of the importance of infrastructure for the promotion of small enterprises or for the effective use of local job markets.[15] But few PRSPs yielded clear and specific support for an encompassing infrastructure strategy—with countries such as Ghana or Mali standing out as exceptions in this respect.[16]

This mismatch between PRSPs and alternative preference revelation mechanisms—whether public speeches or root-level consultation processes—is puzzling and has no simple explanation. It may reveal possible weaknesses in the PRSP consultation mechanisms. It may also reflect the difficulty of internalizing planning processes for a sector in which economics impose a long-term view—large sunk costs to maximize opportunities for returns to scale and long amortization periods,

as opposed to the need to rely on consultation processes in which shorter-term concerns may prevail. When infrastructure was considered, the focus was on access even if this implied high costs with a lack of cost recovery designs, and thereby implicit commitments to subsidies to account for the users' ability to pay. These sorts of inconsistencies increased the transaction costs of infrastructure interventions, which, combined with the hope that the private sector would become a major actor in the infrastructure sectors, probably contributed to reducing the support of the international donor community to public sector financing for it.

The Incompleteness of the MDGs

The introduction of the MDGs did not do much to address the PRSPs' failures to deal with infrastructure, with the exception of access to water. But even on that front, the situation is far from ideal. During 1990–2010, the proportion of people with access to an improved drinking water source, such as piped supplies or protected wells increased from 56 percent to 66 percent. Yet even though 35 out of 42 countries reported gains, the rate of progress has been too slow to be able to reach the continentwide 78 percent target by 2015. Access in urban areas has in fact peaked at 86 percent or even dropped as a result of rapid urbanization and an increase in the population living in slums.[17] And access to piped water has not increased much, as will be documented in subsequent chapters.

Maybe the highest payoff of the MDGs has been to manage to focus the international and local communities' attention on key development issues; however, the framework failed to make the interdependence of these MDGs transparent enough. The consequence is that resource allocation decisions may have been biased in some cases, penalizing infrastructure, including the infrastructure MDGs. For instance, better access to sanitation (which continues to be a major challenge in the region) can be a cost-effective solution to help achieve the health and educational goals. The same may apply to a comparison of the allocation of resources between communication technologies and education.

The more general point, however, is that the emphasis on the MDGs also failed to lead to a proper appreciation of the role of some activities left out of these highly visible targets, such as transport and energy. Yet, these are major inputs into many of the MDGs. Indeed, there is plenty of evidence suggesting that health and education improve when infrastructure improves: indirectly, simply by improving access, and often

quite directly, for example, because medication can last longer if it can be put in a fridge that runs on electricity. Between 1960 and 2000, the correlation between average education levels of Africa's population and the various infrastructure subsectors ranged from 0.51 (roads) to 0.70 (telecom).[18] This somewhat naive argument for the relevance of infrastructure is in fact quite robust and has been confirmed by more cautious econometric studies of the engines of growth in the region and across the world.

Transport—the Omitted MDG

Substantial research points to the crucial role of transport—the omitted MDG. While the transport sector has been largely ignored in the MDGs debate, it is quite present in PRSPs. In that respect, the PRSPs are proving to be better at internalizing the empirical evidence on the engines of growth, in particular for landlocked countries. Indeed, in addition to the few studies on the role of transport in growth, there are many studies on its importance for trade—another engine of growth in the region.[19] Most of these studies find that the landlocked characteristic matters to growth and implicitly or explicitly argue that this increases the demand for transport services. A series of studies including Amjadi and Yeats (1995), Longo and Sekkat (2001), Limao and Venables (2001), Buys, Deichmann, and Wheeler (2006), and more recently USITC (2009) and World Bank (2012) show that the lack of transport networks is hurting intraregional and international trade.[20] Arvis, Raballand, and Marteau (2007), Raballand, Kunaka, and Giersing (2008), Raballand et al. (2009), and Gachassin, Najmanis, and Raballand (2010) have all shown the essential role of transport in the debates on poverty alleviation. Yet they argue that this role is a lot more subtle than often argued in general policy statements. For instance, Gachassin, Najmanis, and Raballand (2010) show with a case study of Cameroon that investing uniformly in tarred roads is likely to have a much lower impact on poverty than expected. Isolation from a tarred road is found to have no direct impact on consumption expenditures. The only impact is an indirect one in the access to labor activities. Their punch line is that access to roads is only one of the factors contributing to poverty reduction (and not necessarily the most important). Considering that increase in nonfarming activities is a key driver for poverty reduction in rural Africa, the results suggest that emphasis on road investments should be given to locations where nonfarming activities could be developed when budget is constrained.

Getting There

The development community now seems to be getting there. These historical process failures are now being corrected. A more encompassing vision of the needs of the poorest and a stronger emphasis on infrastructure are now increasingly integrated in the countries' development strategies and in the commitments made to Africa by the international community. For example, macroeconomic assessments of the infrastructure needs are emerging in major policy documents. The New Partnership for Africa's Development (NEPAD) outputs, the Sachs papers, the Commission for Africa report, the 2005 Global Monitoring Report, the Organization for Economic Cooperation and Development (OECD) Development Assistance Committee (DAC) report on infrastructure for the poor, the UNCTAD (2009) annual report, and the AICD Foster and Briceno-Garmendia (2010) study all offer estimates of infrastructure needs, at least at a fairly aggregate level to support growth or for specific purposes (such as trade development). For a while now, infrastructure seems to be on the agenda in Africa.

However, the repeated failures to achieve the expected poverty reduction impact derived from various forms of infrastructure interventions have in recent years justified the concern of many donors for a more systematic monitoring of these interventions, both ex-ante and ex-post. During the last decade many donors have started to rely on formal impact evaluations to rank interventions in terms of their social impacts, with an explicit recognition of the circumstances under which the results are achieved (see box 2.2 for a very brief introduction to modern impact evaluation techniques and Estache [2010] for a survey of impact evaluations in infrastructure).

Box 2.2 Modern impact evaluation techniques in a nutshell

Impact evaluations aim to assess the specific outcomes attributable to a particular intervention. They do so by comparing an outcome where the intervention is applied against an outcome where the intervention does not take place (i.e., by establishing a counterfactual in the form of a control group to be compared to the treatment group). The quality of the comparator or counterfactual is essential to get a good sense of what would have happened without the intervention. The main output of a good evaluation exercise is a sound comparison of outcomes for the two groups.

Table 2.1 Possible observations

Space	*Time*	
	Before intervention	*After intervention*
Places without intervention	A	C
Places with intervention	B	D

This is then used as evidence of the extent to which an intervention changes outcomes.

The most common forms of comparison are over time, using the difference in difference approach (comparing [C – A] vs. [D – B] in table 2.1). But ex-ante comparisons are not uncommon, and can be useful to assess the extent to which an intervention has a good chance of getting the kind of results expected. Differences in the evidence from impact evaluations across sectors are due to various factors. First, data collection efforts could vary across sectors, for example, data collection tends to be easier in hospitals and schools than from dispersed farmers or road users. Second, impacts could take longer to become visible in some sectors, for example, impacts such as growth due to infrastructure interventions, say from road construction, take a lot longer to be observed than improvements in educational achievements or children's health due to interventions such as conditional cash transfers. A possible third factor could be the corruption incidence in the sector, for example, an explanation for the smaller number of impact evaluations in infrastructure than in human development is that corruption rankings show that infrastructure activities tend to be larger sources of rent for politicians and, therefore, the incentive to increase transparency and accountability is lower than in other sectors.

The assessment of the impact of infrastructure on the poor significantly lacks similar evaluations for health or education interventions. The International Initiative for Impact Evaluation (3ie) has now developed an impact evaluation database. It is quite a useful resource for policymakers and researchers looking for evidence on the actual effectiveness of a wide range of policy experiments. As of mid 2014, it included over 2,500 evaluated projects.[21] The key producers are

the World Bank, MIT, The Inter-American Development Bank, and Consultative Group on International Agricultural Research (CGIAR) centers. Most of these evaluations have been conducted in the health and education sectors. The count for infrastructure is more complex because the projects are spread across various categories and are often part of the interventions evaluated in, for example, agriculture (roads and water access) or health (water, sanitation, and sometimes energy). Many of the infrastructure evaluations are still in their early stages, but the results from earlier evaluations in terms of the assessment of the impact of rural roads, the impact of privatization, and sector regulations are encouraging. They show that impact can be assessed and corrected if needed for a wide range of infrastructure interventions, just as in any other sector. Part II of this book builds on this evidence on the infrastructure sector policy interventions' effects on the poor.

Summing Up

The main contribution of this chapter has been to show that there is very little evidence to argue against the relevance of infrastructure for growth in Africa. The initial capital stock is insufficient to support growth or trade and is likely to be so for quite a while. Also, while in the past infrastructure investments have been used for "white elephants," that is, unaffordable project types with poor project quality, this is less likely to be the case in the future in the context of better-prepared country strategies. In short, the opportunity cost in terms of growth, and hence in terms of poverty alleviation, is simply too brutal to have to argue the case. The main issue is how to make sure that the poor get a fair share of the benefit from more and better infrastructure.

CHAPTER 3

Infrastructure and the MDGs

The only infrastructure sectors formally covered by the MDGs are W&S and the access to phone services. With respect to access to phone services, the progress in terms of fixed telephone lines has been slow between 1990 and 2011, with only nine countries registering significant increases in their numbers. This is, however, linked to the rapid adoption of mobile telephony by the population, and it has proven to be good for both growth and the poor. Technological innovation in the use of cellular phones has exploded as seen in money transfers, mobile banking, and bill payments.

With respect to water, the good news is that two years before the 2015 target, the target on sustainable access to water (89%) had been surpassed by 1 percentage point.[1] The bad news is that the region still has major distributional and quality problems with respect to this indictor. There are significant rural-urban disparities in access to improved water sources, for instance. Moreover, the quality and frequency of access continues to be a problem and the slow progress on sanitation has contributed to outbreaks of diseases such as cholera and diarrhea. In addition, access to piped water has not increased much. Growth has proven to be insufficient to reach the MDGs in substance, not just in form. The complementarity between the various infrastructure sectors is essential, however, and has an impact on many of the other MDGs. In this chapter, we review some of the evidence on the relationship between infrastructure and the MDGs, with a focus on poverty and health indicators.

Infrastructure and Poverty

Macroeconomic Impact of an Increase in Infrastructure Investment on Poverty Reduction

The first MDG relates to poverty and hunger. We will discuss the issue of malnutrition below; but we first focus on more standard concepts of income and consumption poverty. The impact of infrastructure on the reduction of poverty is central to the international efforts to support Africa. The anecdotal evidence on the importance of the infrastructure sectors for the poor is large and so is the evidence generated by donor agencies based on their project work. In an overview of the drivers of rural development in Africa, Mwabu and Thorbecke (2004) cover a wide range of country-specific studies, which add up to very convincing evidence on the relevance of access to infrastructure for the African rural poor. In the range of impacts covered, they include linkages to gender or human development concerns, such as the significant positive impact of rural transport and water access on women's life and improved access to better education or health. They also point to the impact of infrastructure's increased access on the poor through self and wage-based employment opportunities.

Yet somewhat surprisingly, after so many years most of this evidence still tends to be anecdotal or country, and sometimes region, specific. We know very well that there is no education without roads, no education for girls without better service coverage in general since in many countries, girls bear the burden of the incidence of service delivery failures—they walk hours to get to market, to find wood and/or water (see Blackden and Wodon [2006] for a detailed analysis of time use patterns in Africa). We also know that mortality rates among the poorest are also related to bad access to infrastructure services. In spite of this wide coverage of experiences documenting these facts and establishing a very strong presumption of accuracy, there is still very little strong, cross-country, analytical evidence on the direct impact of infrastructure on poverty in Africa.

To some extent this is because the main message of the economic literature is that poverty is reduced by growth and that the focus should therefore be on the impact of infrastructure on growth. It may, however, be useful to put things in perspective to get a sense of what this indirect effect means in quantitative terms. While the calculations may be somewhat naive and not very analytically rigorous, they are anchored into standard public finance concepts, which tend to be relatively widely used in the infrastructure sectors in the context of project evaluation.

Essentially, the idea is that the poverty reduction effect can be estimated by combining an assessment of the growth effect of a project with the poverty reduction effect of growth. The growth effect can be assessed through the social rate of return of an investment project weighted for the size of the project in the economy while the poverty reduction effect of growth can be approximated by the elasticity of poverty rates to growth. This simple calculation can be expressed as follows:

Poverty reduction effect of infrastructure (in %)
= Average Social rate of return of infrastructure (in %)
× Relative Importance of infrastructure (Infrastructure investment/total GDP) (in %)
× Elasticity of poverty reduction to growth

Evidence from World Bank projects suggest that the average social rate of return on infrastructure projects in Africa may be in the 30–40 percent range, with a midpoint of 35 percent. On average, infrastructure investments need to increase by at least 3–4 percent of GDP (much more in many countries). The final variable needed, the elasticity of poverty to growth, is subject to much debates. Unfortunately, the literature suggests that the poverty-reduction payoff of growth in Africa is lower than in other regions,[2] but this is in part simply because the poverty estimates are higher in Africa than elsewhere, so that lower elasticities may in fact return the same magnitude of reduction in poverty. A number of estimates offer elasticities in the range of 0.5–1.00. This implies that by increasing infrastructure investments by 3–4 percentage points of GDP and assuming a social return of the order of 35 percent, we obtain an impact on growth of the order of 1 percentage point per year, which in turns translates into a reduction in poverty of about 0.5–1.0 percentage point per year. While this alone would not be sufficient in many countries to achieve the MDG of reducing extreme poverty by half by 2015, it is still a significant contribution, which tends to have been underestimated by the international community.

Empirical Evidence on the Value of Utility Services for the Poor

Timilsina and Toman (2014) provide a review of the evidence on the relationship between energy access and poverty reduction. The studies they cite include Ngepah (2011) who suggests that access to energy increases industrial productivity and reduces poverty in South Africa, as well as Arndt, Pauw, and Thurlow (2012), Boccanfuso et al. (2013),

Cassin and Zolin (2009), Satagopan and Ravindran (2011), and Yadoo and Cruickshank (2012) who document the potential contribution of renewable energy to poverty reduction. As noted by Modi et al. (2005), access to modern energy can also be beneficial for a range of targets covered by the MDGs, including girls' education (Daka and Ballet 2011) and literacy (Kanagawa and Nakata 2008).

Hedonic regressions can also be used to assess the value of utility services for various household groups including the poor. Traditionally, poverty measures and access to basic infrastructure services have been presented as alternative measures of well-being, as if there was no common metric through which the impact of access to basic services on poverty could be measured. Yet the poverty reduction impact of basic services can be measured indirectly by estimating the gain in the implicit rental value of owner-occupied houses when access to a basic infrastructure service is provided. This gain can then be added to the consumption of the household in order to have a rough measure of the impact of access on poverty. The gain in rental value due to access to basic services can be estimated from a model in which the rent paid is explained by the characteristics of the house and its location. Box 3.1 provides the technical details and shows how hedonic semilog

Table 3.1 Impact of access to water and electricity on poverty, selected African countries

	Electricity			*Water*		
	Mauritania	*Rwanda*	*Sao Tome*	*Mauritania*	*Rwanda*	*Sao Tome*
Percentage increase in rent (%)	39.80	56.26	21.36	31.10	67.96	21.40
Percentage increase in consumption (%)						
Quintile 1	3.80	5.16	1.61	2.30	6.09	1.17
Quintile 2	2.20	3.37	0.70	1.40	3.97	0.72
Quintile 3	1.80	2.80	0.52	1.30	3.40	0.74
Quintile 4	1.50	2.51	0.30	1.30	3.09	0.72
Quintile 5	1.20	1.83	0.19	1.40	2.99	0.52
Impact on extreme poverty (points)						
All sample	NA	−1.56	−0.29	NA	−2.01	−0.11
Households without access	−1.20	−1.65	−0.62	−0.50	−2.07	−0.16
Impact on poverty (points)						
All sample	NA	−1.40	−0.49	NA	−1.63	−0.56
Households without access	−1.30	−1.48	−1.05	−0.70	−1.68	−0.78

Source: Authors, based on data from the early 2000s.

rental regressions generate the desired information. Indeed the parameter estimates from the regressions indicate the impact of an electricity connection and other infrastructure services on the rent for those who pay a rent (and on the imputed rental value of the house for those who do not pay a rent). This information can then be used to compute the expected percentage increase in the rent paid from an access to improved infrastructure. Table 3.1 gives the coefficient estimates in the rental regressions for the access to electricity and water for a sample of African countries.

Box 3.1 Estimating the value of a connection using hedonic rental regressions

In order to estimate the gain in rental value from access to electricity and W&S installations, one may estimate traditional log-linear regressions with the logarithm of the rent paid regressed against a set of independent variables including geographic location variables and dwelling characteristics as well as access to electricity or water (this can be achieved through a connection to the public network, or through another provider). The vector of dwelling characteristics would include the type of housing, namely, whether it is a house or apartment, shack, room, and so on; the type of material with which the walls and ground were built, namely, stone, cement, wooden, earth, and so on; the type of access to water, namely, public service, well, river, and so on; the type of access to sanitation, namely, indoor, latrine, and so on; and the number of rooms. Other variables may be included depending on the information available on the dwelling. The parameter estimates can then be used to assess the proportional increase in rent paid associated with any given characteristic of the dwelling. The regression estimates can also be used to assess the rental value of owner-occupied dwellings, and the increase in rental value that would be associated with access to basic services for those households without such current access. This increase in rental value when combined with the observed consumption aggregate of the household determines the new poverty estimate after access to the service has been provided.

There are two important caveats and both caveats may reduce the actual value of a connection. First, for those households who are tenants and pay rent, the method may not work because the

value of a connection is a benefit for the owner rather than for a tenant. In a competitive rental market, an owner may increase the rent after receiving a connection, in which case the tenant has no gain of its own. In practice, however, especially in poor rural areas, a good number of the poor are owners, even if their house is very modest. Second, for owners, while the value of a connection is received once at the time of connection, the benefit is continuous. In other words, one could compute the one-shot value of the connection as the discounted stream over time of its benefits, and this one-shot value could be realized if the owner were to sell its house and move. At the same time, if the price of electricity includes a fixed term, this fixed term may have been computed to offset the cost of the connection for the utility over time. In this case, there is no additional benefit from the connection, apart from the fact that there is no more rationing for the household for that good. Thus, if the fixed term of the tariff structure is taken into account, the value of the connection could be lower than what has been estimated.

In table 3.1, the percentage increase in rent with access to basic services varies between 20 percent and 70 percent. This value of access to basic services is computed at the household level as the regression parameter β times the expected rent without access.[3] Typically, the absolute value of access to electricity is going to be larger for the nonpoor (who pay higher rents) than for the poor. In relative terms, however, when compared with the level of per capita consumption of the households, the impact of access to electricity or piped water may be higher for the nonpoor than for the poor, especially when the value of access is expressed in percentage terms of the per capita consumption of the household. If we consider the households in the bottom three quintiles as being poor, the value of access to electricity and water varies typically from 1–6 percent of per capita consumption, which is not negligible. The poverty reduction brought about through the provision of these services ranges from 1–2 percentage points (although for some countries that were not included in the table where the cost of housing is higher, such as Cape Verde, the estimated impacts have been higher). While such estimates are limited in magnitude in comparison to the high levels of poverty in African countries, they do not take into account the dynamic effects of growth of infrastructure provision.

Infrastructure and Time Poverty

What Is the Time Value of Access to Infrastructure Services to the Poor?

It is now common knowledge that access to infrastructure services reduces the time spent for collecting wood or water (see, e.g., Toman and Jemelkova 2003; Barnes and Toman 2006; Blackden and Wodon 2006; and Barnes, Khandker, and Samad 2011). Although there is no systematic effort to collect this information, the case studies addressing this issue are increasingly sophisticated. This can be illustrated with an example from Mauritania where less than 60 percent of all working time of household heads is spent in productive or paid activities. The remaining time is mostly spent in domestic work, transportation, and nonpaid volunteer work. Thus, up to 40 percent of the time of household heads may well be spent on comparatively less-productive activities than their main activity. Similar statistics are obtained when considering all household members. The differences between poor and nonpoor households, as well as between urban and rural households, tend to be small, but because the poor typically have more family members, they spend a larger total amount of time than better-off households on domestic chores for which economies of scale should apply.

In order to estimate how much time would be saved if households had better access to modern infrastructure services, it is feasible to conduct a regression analysis of the time spent on domestic chores as a function of a range of variables, including access to infrastructure services. In most countries, estimates of the time savings in hours per day that would be gained with access to electricity and water tend to be highest for the poor who need these time savings the most in order to increase their earnings through productive work.

Women Are More Penalized by Poor Access to Infrastructure

In most of SSA, women perform most of the domestic chores. This can be illustrated with data from Guinea provided by Bardasi and Wodon (2006a; 2010). Time use estimates for a variety of activities are presented for children and adults, by sex and by urban versus rural areas. Adult women spend much more time than adult men in domestic chores (cooking, cleaning, washing, ironing, going to the market), especially in rural areas (18.3 hrs./week for rural women vs. 2.6 hrs./week for rural men). In urban areas the differential, albeit smaller, is still substantial (15.5 hrs./week for urban women vs. 2.4 hrs./week for urban men).

Table 3.2 Time use ratios for adults (age 15+) by gender (women over men) in Guinea

Activity	*Urban*	*Rural*
Collection of wood	1.0	1.5
Collection of water	3.0	4.7
Other domestic chores	6.5	7.1
Aid to other households	2.0	0.9
Community activities	0.7	0.5
Work for a wage	0.7	0.7
Work in a farm/family business	0.7	0.9
Total time	1.2	1.2

Source: Computed from data in Bardasi and Wodon (2006a).

Women also spend more time than men fetching water and wood; this differential is particularly large in rural areas where women may have to walk long distances to reach the sources of water and wood. The total time spent in paid and unpaid work is very substantial for women living in rural areas, about 54 hours/week, almost 30 percent more the amount spent by men (42 hrs./week), in part because of a lack of access to basic infrastructure services. In urban areas women work much less, about 39 hours/week, but still more than men (34 hrs./week), and this is again related in part to the time domestic chores take in the absence of access to basic infrastructure services. Overall, women work about 20 percent more hours than men, as shown in table 3.2.

A Lack of Infrastructure Services Leads to Time Poverty

Individuals can be defined as time poor if they work above a certain threshold of hours (Bardasi and Wodon 2006a). Different threshold in number of hours per week can be considered for defining time poverty in absolute terms (such as 60 hrs./week) and in relative terms (such as 1.5 times or twice the work time of the median individual for work- and domestic-related tasks). Using a relative time poverty line set at 1.5 times the median work time in the sample, Bardasi and Wodon estimate that time poverty is much higher for women (24.2%) than men (9.5%); it is also higher in rural areas (18.8%) as compared to urban areas (15.1%). More women living in rural areas are time poor (26.5%) than women living in urban areas (18.6%) are. The time poverty rates for men by area are not too different, but urban men are still more time poor than rural men (11.7% for urban men vs. 8.3% for rural men). With a higher threshold of twice the median, the time poverty rates are

much lower (the overall time poverty rate drops to 4.8%), but the patterns remain similar in that the differences between men and women are even larger—moving from the lower to the higher threshold makes time poverty rates for women decrease by three times, while time poverty rates for men decrease by almost five times. It can also be shown that poorer households are more likely than richer households to have members who can be considered time poor. Finally, it is also possible to consider definitions of time poverty that combine criteria to take into account the choices faced by individuals, as done in Bardasi and Wodon (2010), with again women and poorer individuals being much more likely to be time poor.

Part of the high rates of time poverty among women are due to the time it takes to complete domestic chores, including fetching water and wood, in the absence of basic infrastructure services. In addition time poverty often goes—at least for certain groups—together with poverty measured using income or consumption. The consequence is that not only are long hours spent for domestic chores to the detriment of productive activities that could increase incomes and consumptions, but in addition because of the long hours already worked, very little additional time resources are available to increase the consumption (income) further when opportunities to do so arise. By providing better infrastructure services the time necessary for domestic chores could be reduced, so that households would benefit from an increase in time allocated to productive work that could in turn decrease poverty substantially, as illustrated with simulations for Guinea by Bardasi and Wodon (2006b).

Infrastructure and Health Outcomes

Performance in health is clearly influenced by the income levels of countries, as measured by their per capita GDP, simply because richer countries have more resources to allocate for public health service delivery, and households have more resources to purchase health services, whether provided by the public or private sector. Yet large differences in health outcomes between countries with similar levels of development suggest that income is not the sole determinant of health indicators: others factors play a role. Jayasuriya and Wodon (2003) show that GDP per capita is an important input for the MDGs "production function," though other inputs as well as the efficiency with which countries use their available resources to achieve better outcomes are also important. In terms of the link between infrastructure and the MDGs, it must

be emphasized that apart from contributing to better health outcomes through growth, infrastructure provision also has a direct impact on health outcomes.

Household surveys provide insights on the health-infrastructure interactions. Clear links between infrastructure provision and health outcomes have been established in studies based on household surveys. Esrey et al. (1991) reviewed 49 such studies showing an average 22 percent reduction in diarrheal morbidity from improved W&S. In Argentina, the impact of the privatization of close to one-third of the country's municipal utilities (covering 60% of population) was analyzed by Di Tella, Galiani, and Schargrodsky (2002). According to the authors, child mortality fell 5–9 percent in areas with privatized water services. The impact of access to electricity is not as well documented, perhaps in part because it is rarely used for cooking in SSA (with the exception of South Africa). Yet traditional fuels are known to have negative health impacts due to indoor air pollution. Electricity also allows refrigeration, which is important for the preservation of medicine and vaccines in clinics, and there is also some evidence that rural electrification reduces fertility (probably in part because mechanization reduces the need for additional household members).

More technical assessments confirm the basic statistic insights. Beyond common wisdom and plenty of anecdotal evidences that suggest that the poor stand to gain the most from significant health improvements associated with better access to infrastructure, there is also analytical evidence that this is the case. One example is the work of Fay et al. (2005), which relies on SSA countries for a large share of their data sample. The authors outline a conceptual framework in which exposure to illness depends on access to infrastructure, as well as on the mother's education, breastfeeding, and immunization. The severity of an illness is a function, among others, of nutritional status (in addition, diarrhea can lead to malnutrition when children can't benefit fully from the food received due to frequent stools). Access to care such as oral rehydration solutions, antibiotics, rehabilitative feeding, and antimalarials can reduce the risk of mortality. Household welfare (consumption, income, or wealth) affects many of the determinants of illnesses and mortality, but the education of the mother typically mediates the relationship between income/wealth and child-level outcomes.

In order to assess the determinants of child health and the incidence of infrastructure investment, Fay et al. (2005) use a quintile-level database from Demographic and Health Surveys conducted in 39 developing countries. Child health outcomes consist of infant and child mortality

rates as well as malnutrition rates (height-for-age, z-score for capturing stunting or chronic malnutrition). The infrastructure variable is a principal component index based on whether households have access to piped water, improved sanitation, and electricity, and whether they have sand or pounded-earth floor in their dwelling. Other key variables include the female literacy rate (proxy for the mothers' education) and as a proxy for access to health care, a principal component index for access to health care using data on child vaccination rates, the share of pregnancies with antenatal care, and the share of births attended medically. Fay et al. find that infrastructure is a statistically significant determinant of stunting and child mortality, but not infant mortality (which is more affected by care received by the mother and the child before and after delivery; note, however, that infrastructure may matter for infant mortality through malnutrition.)

The estimates obtained by Fay et al. (2005) suggest that improving access to care could generate a reduction in infant and child mortality of 26–27 percent, and a reduction by 10 percent in stunting. Improving access to infrastructure could yield an 8 percent decline in child mortality and a 14 percent decline in stunting. Reducing chronic malnutrition from first quintile to fifth quintile levels could lead to decline in infant and child mortality by 30–40 percent. These impacts from better access to health and infrastructure are larger than the direct impact from increasing GDP per capita, since tripling income levels would reduce infant and child mortality by only 13 percent and 5 percent, respectively. Subsequent work by Ravallion (2007) generated lower estimates of those gains. Still, the results attest the potentially beneficial impact of infrastructure on health outcomes under the right conditions. However, increasing W&S access levels from the levels observed for the bottom quintile of the population to those observed in the top quintiles would represent an enormous implementation challenge. More specifically, the fiscal costs associated with infrastructure-based policies to improve child health outcomes are likely to be significant since few of the poor are likely to be able to afford the connection costs.

The Underestimated Role of Transport

One of the major failures of the MDG approach may have been the omission of an explicit monitoring of the achievements of the transport sector. The failure to recognize that transport is an essential input for many of the MDGs continues to be a source of concern in the design of poverty reduction strategies in many African countries.

Indeed, many households do not have good access to education and health facilities due, in part, to poor transportation systems. The relationships between transport, poverty, and the MDGs have been reviewed, among others, by Gachassin (2012), who found that better transport contributes to easier access to health care and schools, and easier staffing of health and education facilities. In urban areas, better transport can also reduce air pollution, which is especially harmful to children.

In this section, we focus on the issue of distance to education and health services, and the role that public transportation plays in increasing the demand for education and health services. The data are obtained from poverty reports prepared at the World Bank for Mali, Niger, and Senegal. In all three countries, a substantial share of the population in rural areas is isolated, without easy access to a wide range of services.

What Simple Surveys Can Teach Policymakers

While a diagnostic covering all countries is not yet available, it may be useful to see how surveys can help policymakers identify specific priorities and set benchmarks that can be used to measure progress. Consider the case of Mali. Using a 2001 national household survey for that country, estimates of the distance to a range of services within urban and rural areas, as well as the time it takes to get there, were obtained by consumption quintile.

As expected, most households in urban areas are located closer to markets, schools, health centers, and public water systems. In rural areas, by contrast, many households are isolated, especially among the poor, but also among wealthier quintiles. The same split between urban and rural areas is observed for the necessary time to travel. In rural areas about half of the rural population lives more than 15 kilometers away from a daily market, and half live more than 5 kilometers away from a weekly market. Among the bottom 2 quintiles, 20 percent of the rural population lives at least 15 kilometers away from a primary school, and another 30 percent live between 3 and 5 kilometers away from the nearest school. Distances to health centers are even larger, with two-thirds of the bottom 2 quintiles in rural areas without a health center in a radius of 5 kilometers. Public and private transportation are also lacking, with three-fourths of the population in the poorest quintile without access to a taxi, bus stop, or similar transportation system within 5 kilometers. Finally, one-third of the poorest 20 percent of the

rural population does not have access to a public water system within 5 kilometers of their dwelling.

The time necessary to travel depends, of course, on the distance to the facility or service, but it depends also on the topology of the area, the transportation means available to the household, and the quality of roads or tracks, among others. The data suggest that for 40 percent of the households, primary schools are more than one hour away from the dwelling, and the proportion is even higher for the bottom quintiles. For all quintiles, secondary schools are located more than one hour away for 90 percent of the population. For two-thirds of the households in the bottom quintiles, public transportation is located more than an hour away; the same is true for access to health care. Food markets are more than half an hour away for 50 percent of the population.

The time it takes for households to reach various facilities depends on the distance to these facilities, but it also depends on the proximity of public transportation systems and on the level of consumption of the households, which can be used as a proxy for the ownership of means of transportation and the ability to pay for public transportation. A regression analysis of the relationship between time and distance, as well as other household-level variables suggested that the availability of public transportation is important in determining the time necessary to reach a secondary school or a health facility. For the time necessary for households to access markets, distance and transportation had a similar impact on travel time.

The household survey data also suggest that the distance to health care facilities is one of the reasons for not seeking health care among the poor when it is required. In Mali, as elsewhere, the likelihood of an individual suffering from a sickness or injury to seek care is much lower for the bottom quintile than for the top quintile of consumption. After accounting for the fact that in all quintiles, a large share of households state that sickness or injury did not require care, the distance to the facility was cited as the main reason for not seeking care in the bottom quintile, followed by the cost of care. Out of the episodes that required care according to the households, about half the time the distance to health care services prevented the households from seeking care, especially in rural areas.

Finally, the survey points to the fact that the distance to schools is also a reason for not going to school, although not the main one. A lack of interest on the part of parents (or the fact that the child has completed primary school), a failure at school, and the need to work to contribute to the household resources are the main reasons for not going to school.

Distance to school is less important, but it is still cited in 7 percent of cases as the main reason for not going to school among the bottom 2 quintiles. Also, because schooling could be done part time, the impact of distance is perhaps higher than what appears in the survey. If schools were located close enough to villages, children might be able to go to school while still contributing to income generating activities, or completing chores at home, in order to help with the livelihood of the household. Although not shown here for lack of space, the results in terms of the distances to facilities, the access to public transportation, and the reasons for not using health care services or not going to school are similar in Senegal and Niger to those obtained in Mali.

Better Transport Services' Education and Health Payoffs for the Poor

Table 3.3 provides the estimates of the impact of the distance to school on primary school enrollment and primary school completion, and the distance to public transportation in rural areas, for boys and girls separately in Mali, Niger, and Senegal using national surveys for those countries. All estimates are gains in percentage terms versus having a school or public transportation system more than a given distance from the dwelling. Many controls are used in the regressions apart from the distance to schools/health centers and public transportation; these include the geographic region of the household, the education of the parents, the age of the child, and variables on the family size and structure as well as the level of welfare of households.

Consider, for example, the estimates for schooling in Mali. Proximity to schools is a key determinant of school enrollment, and the impacts are especially significant for boys. For example, a coefficient of 0.32 for rural boys for school enrollment when the primary school is located less than 1 kilometer away means that the probability of enrollment for boys is 32 percentage points higher than if the primary school were located more than 15 kilometers away. Impacts are not linear. That is, the gain in having a school located between 5 and 15 kilometers away from home, as compared to having a school more than 15 kilometers away, is small (8 percentage points for boys, and the impact is not statistically significant for girls). By contrast, for every drop of 1 kilometer in the distance to school when this distance is below 5 kilometers, there is a gain of roughly 3 percentage points for boys, and about half that for girls. This nonlinearity in the impact of the distance to schools on enrollment is important for decisions regarding the location of new

Table 3.3 Distance to schools, public transport, and demand for services—marginal effects

Distance/travel time	*Primary school enrollment*		*Primary school completion (ages 15–25)*	
	Rural boys (%)	*Rural girls (%)*	*Rural boys (%)*	*Rural girls (%)*
Mali primary school				
< 1 km	0.32	0.19	0.04	0.02
1–2 km	0.28	0.16	–	–
3–4 km	0.22	0.14	–	–
5–15 km	0.08	–	–	–
Mali bus stop				
< 1 km	0.04	0.06	0.06	0.03
1–2 km	0.08	0.12	0.05	0.06
3–4 km	–	0.05	0.03	0.02
5–15 km	–	0.05	–	0.01
Niger primary school				
< 1 km	0.21	0.18	0.58	0.20
1–2 km	–	0.14	0.60	0.25
2–5 km	0.13	0.16	0.46	–
5–10 km	–	–	0.26	–
Niger transport				
< 1 km	–	–	–	0.06
1–2 km	–	0.09	–	0.10
2–5 km	–	–	–	0.05
5–10 km	–	–	–	0.09
Senegal primary school				
0–14 min.	0.31	0.27	0.11	0.05
15–29 min.	0.27	0.22	0.05	0.03
30–44 min.	0.28	0.24	0.08	–
45–59 min.	0.22	0.12	–	–
Senegal bus stop				
0–14 min.	0.03	0.05	0.03	0.03
15–29 min.	–	–	0.06	–
30–44 min.	–	0.06	–	0.04
45–59 min.	–	0.04	0.12	–

Source: Authors; only coefficients statistically significant at least at the 10 percent level are shown.

schools. The gains in terms of school completion from a lower distance to schools are much lower—they are statistically significant only when the school is located within a 1-kilometer radius from home. This may be because completion rates for primary school are very low (i.e., drop-out rates are high), so that even when proximity to a primary school

helps to boost enrollment, it does not bring the same gain in terms of completion. Probably more importantly, many schools may not provide the full cycle of primary studies, so that children can be enrolled for a few years, but this does not mean that they can complete the cycle if in order to do so, they need to travel further away to another school.

The gains from a lower distance to public transportation are lower in terms of enrollment, but still significant, and here they are slightly higher for girls than for boys—probably because parents are reluctant to ask girls to walk for long distances to reach a school, so that public transportation makes a larger difference. Interestingly, public transportation does make a difference to the completion of the primary cycle, with a similar result for both boys and girls. As already mentioned, this result is probably due to the fact that many schools provide only a few years of instruction, especially in the case of rural community-based teaching, the children need to travel far away to complete their primary studies, and this is feasible only with public transportation being accessible.

The results and the magnitudes of the impacts are fairly similar for Niger and Senegal. Similarly, the demand for health care also depends on location, but here the ability to find public transportation is even more important than the distance to health facilities. Indeed, regressions fairly similar to those for education enrollment and primary school completion were estimated to assess the determinants of the decision by households to seek care when sick or injured. It turns out that in rural areas, the impact of the distance to health facilities has only a very small impact (e.g., the probability of seeking care is increased by 4 percentage points when the health center is located within 1 kilometer of the dwelling, as opposed to more than 15 kilometers away). By contrast, the availability of public transportation is crucial. When public transportation is within a 5-kilometer radius as opposed to more than 15 kilometers away, the probability of seeking care increases by 13–20 percentage points, depending on the exact distance in Mali. In other words, because falling sick or being injured is an isolated occurrence, the key to seeking care is not so much whether the health facility is nearby, but rather whether the household can get there, which depends on transportation (for a sick or injured person, walking 2 or 15 kilometers does not make much of a difference—even 2 kilometers may be too far away anyway). Similar results have again been obtained for other countries. Most of the gains from better access to transport are to be reaped by the poor, since as shown in more details in chapter 5, the poor are those who tend to be located the furthest away from a range of services such as schools and health centers.

Summing Up

Income levels and the delivery of education and health services are clearly important for poverty reduction and for achieving other targets proposed in the MDGs. Yet growth and social sector service delivery are not enough. For example, there is ample micro- and macroeconomic evidence that poverty, education, and health outcomes are influenced by the availability of access to infrastructure services apart from the delivery of education and health services. Enabling a larger share of students to complete their primary education may well depend as much on improving transportation networks in rural areas as on increasing the number of classrooms and teachers. By the same token, a reduction in child mortality may well depend as much on the provision of clean water as on the vaccination of the children.

In fact, there is some evidence that it is by combining interventions that the gains from these interventions may be largest. Multiple interventions in infrastructure may well yield economies of scale. Also, improved W&S will typically have a larger impact on the reduction of diarrhea, child malnutrition, and child mortality when accompanied by behavioral changes regarding hygiene, and well, a better education for mothers. As noted by Fay et al. (2005), such multisectoral linkages have long been recognized, but they deserve renewed emphasis in the context of the discussions of how to achieve the MDGs in SSA. In this book, we do not analyze multisectoral linkages, but we do assess the extent to which Africa's infrastructure needs are met, and what has been the record of reforms especially from the point of view of improving access and affordability for the poor.

CHAPTER 4

Africa's Infrastructure Investment Needs

For anyone traveling to Africa, the physical evidence of an infrastructure gap is hard to deny. Demand is unmet and this is also what is shown by models estimated to explain why SSA is growing, trading, and reducing its poverty less than it should. The natural follow-up question should then be how much does Africa need to allocate to the infrastructure sectors to meet its growth, trade, and social targets. There are a number of approaches to measure these investment needs in any given sector. The most common approach at the sector level is a bottom-up approach in which information collected at the local level can be added up to get a sense of the total figure needed. In that context, investment requirements are assessed for each sector for a targeted coverage rate, for a given service quality level at a standard local or an international best-practice cost. This type of effort had been conducted for the water MDGs in 2003 but it had not been done for the other infrastructure sectors until recently. One of the main contributions of the AICD study has been to update the estimations for the water sector in 2008 and to conduct similar assessments for a very wide definition of infrastructure needs. Readers interested in the details of the approaches followed for each sector are invited to read the summary report of that study.[1] The main focus of this chapter is not only to summarize the information available but also some of the main policy issues it raises.

How Much Are the Investment, Operations, and Maintenance Needs?[2]

Africa needs about US$100 billion per year to build the infrastructure it needs (US$93 billion per year to be precise according to the AICD report)! Several estimates made since the Commission for Africa have tried to assess the infrastructure investments and associated maintenance expenditures needed to support average growth rates of over 7 percent. These growth rates were those expected to be needed for the MDGs to be met by 2015.[3] Most of the estimates conducted up to now were based on demand models that tended to generate conservative assessment of these needs. The work conducted in the context of the AICD has generated the most precise estimates to date based on detailed assessments for each sector and country, considering new investments and refurbishment of existing infrastructure as well as ongoing operations and maintenance requirements. Taken together, these give the aggregate picture of the amount that would be needed to be spent each year in SSA on infrastructure.[4]

The total of investment needs for ICT, irrigation, power, transport, and W&S yields average annual requirement of about US$60 billion for the next 10 years. Adding annual operation and maintenance needs of US$33 billion results in annual expenditure needs of about US$93 billion between 2006 and 2015 (Foster and Briceno-Garmendia 2010:58). The largest investments are for the power sector, where regional projects represent an important share of the total. The next important items are W&S and transport, respectively, which together add up to about the same financial requirements as the power sector. As shown in table 4.1, in relative terms, when normalized to GDP, these amounts are simply huge at about 15 percent of GDP.

Table 4.1 Africa's annual expenditure needs to meet the MDGs (2006–2015)

Sector	*Infrastructure needs (investments, operations, and maintenance) as a share of GDP (%)*
Power	6.6
W&S	3.6
Transport	3.0
ICT	1.4
Irrigation	0.5
Total	15.0

Source: Estimated from Foster and Briceno-Garmendia (2010) with corrections to their normalization to GDP.

The needs imply, on average, close to a doubling of investment trends. According to Foster and Briceno-Garmendia (2010:8), total infrastructure expenditures of the region were around US$45 billion when budget, off-budget expenditures (including state-owned enterprises and extrabudgetary funds), and private and donor external financing were accounted for. That's about 7 percent of GDP. In other words, infrastructure expenditure needs to be increased very significantly (maybe by as much as 100 percent unless some significant efficiency gains are achieved) to meet the demand.

One of the main difficulties with the case made for more infrastructure is that it ignores Africa's basic infrastructure dilemma. Indeed, however good the recent growth performances may have been, they appear to be unable to generate the resources needed for most countries. Anecdotal evidence suggests that in many countries, growth has indeed been insufficient to even generate the matching public revenue requested by donors as part of their aid commitments in the infrastructure sectors, even thought this is more than most countries have been able to achieve in recent years. This implies that something has to change. Drastic policy decisions need to be identified by the key stakeholders concerned with the well-being of Africans, and in particular Africa's poorest, if the infrastructure expenditure levels needed to achieve the MDGs are to be reached.[5]

Private financing is not likely to be the norm. Based on the information available on private sector commitments since 1990, the private sector allocated about US$6 billion on an annual basis to infrastructure—this refers to the foreign private sector but it is the only data we have on private sector participation. Since 2006, the annual average commitment has been around US$12 billion. This is about 20 percent of the annual investment needs estimated by Foster and Briceno-Garmendia. This is significant but it would have to be increased significantly to contribute in any major way to the financing needs of the continent. Moreover, 65 percent of these commitments went to 5 countries (all of them Anglophone) and over 80 percent were shared by 12 countries. South Africa (30%) and Nigeria (23%) added up to 53 percent of the total. This suggests that many of the smaller countries are hardly able to benefit from the opportunity to rely on private sector support in a significant way. To mitigate this conclusion somewhat, it may be worth pointing out that it is based on the fact that we do not really know the actual economic importance of the domestic private sector. There is anecdotal evidence on its importance in delivering where noone else does. Unfortunately, how large a contribution this may be is, for now, anybody's guess.

Based on the World Bank's PPI database, in terms of FDI in infrastructure, telecom sector is the most attractive to private investors in the region with about 77 percent of the commitments made to the region between 1990 and 2012, followed by electricity with about 13 percent, and transport 10 percent. The presence of the private sector is, as expected, the highest in absolute and relative terms in the most stable and developed and in the most resource rich countries of the region. It may be worth to point out that the acceleration in PPI in the region can largely be attributed to the fast-growing role of China and India as important actors in the region.[6]

And public sector financing has declined. Although AICD has started to produce more reliable data source on the level of expenditure in the various infrastructure sectors, we are still far from having a robust picture of public sector accounts associated with infrastructure activities. There is however no perfect way of monitoring the evolution of the role of government in infrastructure sectors over time. One way of doing this is to rely on partial information on government expenditures—which excludes, for instance, public enterprise expenditures on fuel and energy, housing, and transport and communications statistics covered in the IMF government finance statistics (IMF-GFS). While this approach does not reflect well the importance of decentralized expenditures or the expenditures by public enterprises, it does give a sense of the evolution of the composition of public expenditures. For 11 African countries for which the data are available since roughly the mid-1980s for a 20 year period, government expenditures on health increased from 1.6 percent to 2 percent of GDP and education expenditures remained relatively stable. Infrastructure expenditures, however, as approximated here, declined from 4.2 percent to 1.6 percent of GDP.[7] It is unlikely that this reflects a major improvement in public sector efficiency. In short, much of the fiscal adjustment has been absorbed by infrastructure. In fact, based on more country-specific anecdotal evidence, the adjustment would have been even more dramatic if the current situation had been benchmarked against the 1970s.

So what's Africa's baseline expenditure level? Once more, AICD provides the best possible answer, given our limited knowledge on the topic. According to their detailed audits of expenses, the sum of operational and capital expenditure by the public sector—that is, government and public enterprises—in infrastructure represented about 4.7 percent of GDP while the total amount spent in the infrastructure sectors, accounting for other sources of financing, was 7.1 percent of GDP. This figure establishes the baseline from which the increased government

commitments to infrastructure can be assessed. Keeping that in mind expenditures approximately equivalent to 15 percent of GDP would be ideal—the financing gap is likely to be a major challenge for African politicians and the international community.

How Should Africa's Infrastructure Needs be Financed?

There are two ways of looking at the financing issue: ex-ante and ex-post. Most of the sector-specific literature and policy discussion tends to take an ex-post perspective. This ex-post approach focuses on how the providers recover their costs. That is, it focuses on the distribution of financing responsibilities between users (i.e., direct cost recovery) and today's taxpayers (subsidies from the state) or tomorrow's taxpayers (if the government contracts loans). By contrast the ex-ante approach looks at financing from a more macroeconomic perspective. The debate is on the distribution of financing between the taxpayers and the operator. When the operator is public, in general, the financing takes place through a budget transfer—hence today's taxpayers prefinance the users—or through loans from donors or private sources. When the operator is private, it prefinances the user mostly from equity, borrowing, or bonds—the cost of which is, of course, recovered through tariffs and subsidies ex-post. In this chapter, we focus on the ex-ante concerns of macropolicymakers; we address the ex-post view, including the importance of cost recovery from a financing as well as from an efficiency and equity viewpoint, later in the discussion of the affordability of the service.[8]

Concessional Sources of Funds

Nothing beats concessional sources of funds. Multilateral-development banks lend money at a margin over the 6-month LIBOR (London Interbank Offer Rate). Taking account of commitment fees and front-end fees, the equivalent interest spreads typically vary from about 30 to 150 basis points depending on the development bank. If the 6-month LIBOR for US dollar stands at, say, 2 percent, the effective interest rate for a US dollar variable-spread loan from a development bank would then range from 2.5 to 3.5 percent. Using illustrative lending terms, Warlters (2005) calculated the social cost of borrowing from the World Bank Group at a concessional rate. Each repayment was calculated under the terms of the loan, and then converted into a social cost by multiplying it by the country's average marginal cost of public funds.

The present value of each of these repayments was then calculated using country-specific market interest rates as government's discount rate. The result was the sum of the present values of all the repayments. The analysis suggests that, for example, by borrowing US$1 from the World Bank's International Development Agency (IDA), the government of Kenya imposes a social cost on the country of 6¢. This is a very low social cost for Kenya because as an IDA country it does not pay interest, has a long grace period, and in addition its government has a high discount rate. The social cost of South Africa's borrowing was found to be higher than that of the other countries because it pays interest, has a shorter grace period, and has a lower discount rate than the other African governments. But in general, for virtually all countries, the social costs were very low.

The point is that, for most countries, as expected, if concessional loans are available, they are, in general, likely to be the cheapest source of funds available. Hence, ignoring for a moment the debt sustainability issue as well as the sector-specific and total absorption capacity issues, when looking at this specific sector, it is in the interests of most African countries to borrow as much as possible from donors offering concessional rates. In most African countries, the difference in the public cost of capital from donor funding is likely—on average, under current country- and sector-risk levels and under current levels of tax systems distortions—to be larger than any cost reductions that private financing can offer by reducing the volume of investment funds required.[9]

Concessional financing may be cheap, but infrastructure funding has dropped! If concessional sources are so cheap, it would make sense to assume that borrowers would try to maximize their use in the financing of infrastructure services. It did not happen that way in the last two decades. The excess international supply of capital gave many governments the hope that private sector financing would become the main source of financing for the infrastructure sectors. Under that assumption, it made sense to try to use the concessional sources of funding for other sectors.

It seems that donors and borrowers both agreed. The upshot is that the sum of resources allocated by donors offering concessional terms to infrastructure fell dramatically, falling far short of needs. For example, during the 1990s, it is estimated that they represented at most 8 percent of infrastructure financing.[10] This share has in fact been declining as a result of the drop in the interest of donors in allocating official development assistance (ODA) for infrastructure in SSA. Although infrastructure ODA continues to be quite widely spread throughout

the continent with 40 countries receiving some of it, the infrastructure share in ODA to SSA has dropped steadily. Within 10 years, it dropped from 25 percent of total ODA to SSA to roughly 10 percent in early 2000s.[11] In absolute terms, the volume of ODA commitments—not disbursements and we have no estimate of the size of the difference—for infrastructure in SSA peaked during the 1980s at around US$4 billion per year (at 2002 prices). The highest share of ODA has gone to transport (over 50%), which is also where the largest investment needs have been identified. The W&S sector came next with about 25 percent.

Why would donors be pulling out of a sector with a rationed demand? The main explanatory factors are probably the following. First, the donors have total as well as de facto sector-specific caps in their total lending programs to developing countries—most developed countries have continuously failed to meet their commitment to allocate 0.7 percent of their GDP to aid. As total resources allocated to aid by developed economies were limited and often shrinking and as priorities were moving toward social sectors, the relative share as well as the total effective allocation to infrastructure dropped. Second, some donors have strengthened their matching funding requirements since the mid-1980s—that is, they want more local resources to match aid contributions and they also tend to impose more noncash conditionality, which reduces actual disbursement when compliance becomes a problem.

African Economies' Financing Cost of Losing ODA Financing

The relative merits of public and private ownership and operation of infrastructure depend on many trade-offs, including governance and other similar institutional issues that will be discussed later. An important consideration, however, is the cost of investment financing under public and private ownership. This means that it is useful in comparing public and private financing options to assess the cost of public versus the cost of private funds. While this may seem to be reducing the discussion to a simple fiscal calculus, it provides a useful quantitative perspective to a debate that often tends to appear ideological.

The way to approximate the cost of private funds is widely viewed among modern regulatory economists as a relatively standard approach for PPI transactions, including in Africa, where public consultations have taken place on its assessment, for instance, in Kenya, South Africa, or Uganda. The cost of private funds is usually a weighted average cost of capital (WACC), which, adjusting for the financing structure adopted, gives the returns that private investors would require to make just normal

returns on their capital, adjusted for sectoral and country risks. While the implementation of the approach is not trivial, it is relatively simple in comparison to the calculation of the cost of public funds.

The cost of public funds is best approximated by estimates of the marginal cost of public funds (MCF). The MCF measures the ratio of the additional welfare cost imposed on society as a result of a small change of tax rates, to the amount of additional tax revenue raised. When the MCF associated with a small simultaneous increase of several tax rates is 1.30, it means that if the government raises an additional dollar of tax revenue, consumers are worse off by not only the additional US$1 they have just paid in taxes, but also by 30¢ of welfare that is lost due to the additional distortions of the economy. If the government simply gave the US$1 back to consumers as a transfer, consumers would be 30¢ worse off than they were before the tax and spend operation. So economically justified public expenditure in this country should have a minimum social rate of return of 30 percent. For a sample of 38 African countries, Auriol and Warlters (2005) find an average minimum social rate of return requirement for tax financed expenditures as 17 percent (with a spread going from 5% to 37%).

Revisiting the Comparison of Public and Private Financing Options in Africa

Data on the social rates of return of infrastructure projects suggest that, on average, infrastructure investments with which the World Bank has been associated generated returns higher than the average costs of public funds. But this conclusion does not imply that public funding is necessarily the optimal solution for the countries of the region. The real question is how the cost of public funds compares to the cost of private funds for achieving these rates of return. Warlters (2005) provides this comparison for a few African countries for which data were available.[12] While ignoring the differences between public and private returns is likely to bias the choice in favor of public financing, the cost comparison shows that only in Ethiopia, Mali, and South Africa does public financing require a higher rate of return than private financing for all sectors. This is mostly driven by large distortions caused by the tax systems of these countries. For Cameroon, Côte d'Ivoire, Kenya, Mauritania, and Mozambique, the preferred financing choice should be public financing because it requires a lower rate of return for all sectors and would be preferred to private financing unless private involvement generates offsetting costs reductions in the amount of finance required.[13]

While it is tempting to have the simple comparison of costs rank the preferred prefinancing of the sector—public versus private sector financing—it is important to recognize that there are limits to this somewhat mechanical approach. First, these estimates of the cost of public and private funds are rough approximations. While reasonably reliable when the wedge between public and private costs is high, they require much more analysis when this wedge is modest. Second, and probably even more importantly, there are limits to how much government can tax without hurting the economy or social stability. There is, thus, and maybe surprisingly so under the current political environment, some role for the reliance on a partnership with the private sector as a way to reduce the social pressure of taxation—ignoring for now the efficiency savings that the private operations can bring to some sectors.

So, What Is the Best Financing Model for Most African Countries?

The relevant policy message is that there is a lot of value in the fiscal case made for reforms but not only from a fiscal viewpoint—that is, reducing the deficit—but also from a social viewpoint. If there are limits on concessional borrowing options, increasing the role of the private sector could reduce the social costs of relying on tax financing—if infrastructure projects are implemented carefully with all the appropriate safeguards to ensure that short-term payoffs are not traded off for longer-term fiscal costs resulting from renegotiations of arrangements with the private operators. But the main message of this simple fiscal calculus is that the current desire to promote concessional financing of infrastructure as much as possible seems to be rational. Similarly, once the limits to concessional borrowing have been reached, it will make sense to try to go for private sector financing as long as tax financing continues to suffer from the current distortions that characterize most African tax systems.

Scope for New Sources of Financing

The sustained growth enjoyed by Africa at a time when many of the OECD countries are suffering from just as sustained quasi-nil growth rate is stimulating the interest of investors in the region. In 2012 and 2013, many countries have managed to place sovereign bonds with medium-term tenure. This includes Ghana (US$750 million 10-year bonds), Rwanda (US$400 million 10-year bonds), and

Zambia (US$750 million 10-year bonds). Some countries have managed to secure private placements of equivalent amounts and hardly shorter terms (7 years) (e.g., Tanzania, US$500 million, and Angola, US$1 billion). Nigeria has been able to issue with the International Finance Corporation (IFC) a 5-year local-currency bond equivalent to US$75 million and Kenya has already issued 6 infrastructure bonds (the latest one in September 2013 for US$230 million).[14] Moreover, many of the countries without credit rating possibility yet, but with natural resource revenue have been able to set up wealth funds that can be used to finance development projects.

Increasingly in fact, infrastructure specific funds are appearing. Three examples involving major development agencies are illustrative of the commitment to support infrastructure while helping the development of local capital markets. First is the AfDB Africa50Fund announced in May 2013 to finance infrastructure investment in the continent. The fund hopes to draw investment from sovereign wealth funds, pension funds, and the African diaspora. Second is the US$320 million African Infrastructure Investment Fund, a joint venture between the Old Mutual Investment Group (Omigsa), Macquirie Capital with investments from the IFC, the Netherlands Development Finance Company, and the Development Bank of Southern Africa (DBSA). A third example is the Emerging Africa Infrastructure Fund (EAIF), an initiative of a group of European nations who collectively call themselves the Private Infrastructure Development Group (PIDG) and include the United Kingdom (Department for International Development), the Netherlands, Switzerland, and Sweden.

The scope to deepen sovereign and multilateral bond issuance and expand corporate and project finance in Africa seems to be significant. To put things in perspective, it is useful to remember that at the very beginning of the twenty-first century, Africa attracted less than US$100 million in private equity. This is currently around US$1.5 billion and significant, but it is useful to keep in mind that these are stocks and not flows. Hopefully, there will be less cream skimming than with public-private partnerships (PPPs) but this is far from guaranteed. Most managers of these funds are risk averse and unlikely to support infrastructure mostly needed to support social needs. The users' ability to pay and the minimization of the need to rely on subsidies is a key characteristic of the revenue flows expected from these funds. This is, maybe, where the diaspora could help by ensuring a guaranteed flow of funds to reduce the perception of risks.

Can Africa Absorb a Major Increase in Infrastructure Aid?

Although there is a lot of talk about Africa's needs, little concrete evidence is available on Africa's capacity to absorb new massive inflows of aid—for example, the doubling of resources to be allocated to infrastructure argued for by the Commission for Africa report. While the relevance of this concern will clearly vary across countries, any country-specific assessment will have to look into two decision margins: (1) the macroeconomic limits—both short run and long run; and (2) institutional constraints. There may be more margins of relevance—including more political aspects or even distributional aspects as discussed by Bevan (2005)—but these two are the most likely to be in anyone's checklist to assess the absorptive capacity of any given country under any scenario scaling up donor contributions to prefinance investment requirements.[15]

The Macro Limits to Absorptive Capacity

One of the first things ministers of finance and macroeconomists of the international financial institutions (IFIs) are likely to do when specific commitment figures and associated disbursement and repayment patterns would be known for every country, is to assess the fiscal sustainability of the new financial commitments associated with any increase in aid to the public sector for infrastructure. This assessment is crucial and in the interest of the countries. However, current rules may be contributing to distortions that penalize growth as well as the poor by discriminating across sectors.

Under current fiscal rules adopted to assess the fiscal sustainability of significant additional borrowing, sectors such as infrastructure tend to be penalized. Indeed, under such rules, the limits are driven by short-term fiscal considerations. These concerns distort the desirable allocation of resources in three ways.

First, they favor sectors that generate quick positive cash flows or at least minimize short-term negative cash flows, without regard to other considerations, including growth effects or bottlenecks. This penalizes many infrastructure investments, which take 18–24 months before they generate any cash flow at all; moreover, because they tend to be built to address demand forecasts 15–10 years ahead of time (this is often the most cost-effective solution with lumpy investments such as

roads, electricity generators, or water treatment stations), the positive cash flows they generate tend to grow much slower than hoped for by analysts concerned with short-term fiscal performance indicators. When the absorptive capacity is driven by these cash considerations, infrastructure aid often looks problematic and certainly much worse than if accrual accounting rules were adopted rather than the current cash accounting rules.[16]

Second, these rules assume that growth is exogenous. By ignoring the fact that growth is endogenous, that is, the fact that growth is driven by the composition of public expenditure, these rules fuel an absorptive capacity problem when they ignore the actual growth payoffs of an increase in aid for a sector. Consider the case of investments on road projects. There is a plethora of evidence showing that road investments can be critical to improvement of incentives to increase agricultural supply. This means that roads can not only contribute to improvements in exports but also to the ability to meet the local demand at prices more consistent with the ability to pay. Both of these effects imply that when aid is rejected on the basis of a cash flow–driven rule, growth and demand are both rationed.[17]

Third, these rules ignore that the sequencing of resource allocation across sectors or within sectors matter, in particular when there are bottlenecks. Indeed, in many countries, it is often the case that education expenditures have the highest social rate of return. The implementation of the policies required to capture the benefits of investment in education may, however, start with investment in transport. Similarly, even when the returns on investment in improvements in health are seen to be the highest, it is not uncommon to find out that implementing improvements in sanitation is one of the most cost-effective solutions, apart from possibly also one of the most effective solution to alleviate absorption capacity in the health sector. Within sectors, sequencing also matters. For instance focusing all efforts on improving access to electricity from large utilities will not help if transmission capacity is not sufficient.

The main point is that the assessment of the absorptive capacity has many dimensions and many of these tend to be overlooked. There are short- and long-term dimensions. There are sector-specific and cross-sectoral dimensions. There are also sequencing issues across sectors and within sectors. Failing to account for these dimensions may lead to decisions that tend to postpone growth. Postponing growth means failing the poor in addition to reducing the solvency of the country, a critical dimension of a minimum absorption capacity assessment.

The Institutional Limits to Absorptive Capacity

Among many observers, there is a concern with the managerial ability of public sector administrations in many countries to deliver significantly higher levels of service at equal or improved levels of service quality. A related element is the concern with the risks associated with the impact of dramatic aid levels on the government capacity and incentive to generate domestic resources needed for the long-term sustainability of the operation and maintenance of infrastructure sectors. There is also a clear concern with the need to ensure that governments have a stronger incentive to rely on improved cost recovery, not only as financing instrument but also as a demand management instrument. Mismanaged aid in this respect would be institutionally damaging since it would create more dependence in infrastructure instead of more independence in the long term.

There are other more complex institutional elements that limit the full value of the usual fiscal calculus associated with the debates on absorption. These include many incentives problems—political interference, corruption, and other governance concerns—which contributed to the deterioration of the public provision of infrastructure services since the mid-1970s. It is quite important to not to forget that these incentive and fiscal problems were the main catalyzers of the search for alternative sectoral organizations and other reforms, including the search for more collaboration with the private sector—as discussed later in the book in more details. The next wave of reforms cannot afford to ignore that a return to the prereform situation is likely to be an undesirable situation.

These institutional limits are also relevant to the assessment of the idea suggested by many participants in the debate on the financing of Africa's needs that aid in loans or grants may be the more cost-effective solution to help Africa. Indeed, it is quite crucial to recognize at this stage that any scaled-up ODA flows and long-term commitment will require major changes in the ways the public sector does its business in infrastructure. The new environment requires an exceptional commitment to institutional changes by African countries and by donors. It also requires a very concrete workable game plan to achieve improved governance, capacity, and institutions. Indeed, there is a fundamental dilemma to address as part of the debate on how to meet Africa's financing needs. Once it is accepted that the public sector will be the main actor and that donors will have to scale up their commitments, everyone needs to accept that the dramatic scale-up in aid risks overwhelming

fragile institutions. The ideal would be that the efficiency and effectiveness of greater aid flows improve the delivery of public services and be coordinated with the development of good institutions that increase the accountability of all the parties involved.

Summing Up

The main point of this chapter is possibly the simplest one of this book: the infrastructure gap is still huge. The analytical evidence of a major infrastructure gap only puts a figure on what very simple pictures tell quite explicitly. One such common picture is the one taken at night from a satellite showing that only a few spots are actually lit. The continent is dark simply because access to energy is so limited. A second important point is that the solution is not simply to pour money into the continent. How investments are financed matters. More importantly, assessing how fast new investment can be absorbed is also relevant. There is a lot of space for a lot of money but it is in the interest of the individual governments to make a fair assessment of their ability to use additional resources rationally and in the interests of all. This implies the development of a medium-term strategy for infrastructure recognizing explicitly the macroeconomic context. But the poverty context also imposes an explicit monitoring of what happens to the poor at all stages of this strategy implementation. This monitoring of the needs and constraints of the poor is the focus of the next part of this book.

Main Messages of Part I

The main messages of Part I can be summarized as follows.

Most African countries are still at the development stage where infrastructure and growth dramatically need each other. Rough estimates of the average elasticity of GDP to infrastructure over the last 40 years range from 0.4 to 1.5 depending on the sector.

Apart from being key for growth, the role of infrastructure for achieving the MDGs is also clear from the literature, especially for poverty reduction (not only through growth, but also through improvements that access to infrastructure provides in the allocation of time of households) and health (including indicators such as infant and child mortality and malnutrition).

In the last two decades, fiscal adjustments cut average government expenditures on infrastructure (while health expenditure increased and education expenditures were maintained); PRSPs and the MDGs helped to correct this but tended to underestimate the importance of transport and other infrastructure services as revealed by both macro- and microeconomic analytical evidence on Africa.

If Africa is to meet the 7 percent annual growth rate built in the MDGs, it needs to more than double its total expenditure on infrastructure (government plus public and private enterprises) to reach about 15 percent of GDP. Depending on the population growth estimates, that is about US$80 per year per capita. A commitment to support infrastructure institutional building would be an essential complement to any monetary commitment, and realism and pragmatism should dominate the financing decisions.

Concessional donor financing and private sector prefinancing will help but the bulk of the funding will continue to come from today's or tomorrow's taxpayers. During the 1990s, for example, 85–90 percent of the needs were prefinanced by the public sector from taxes or loans.

Macroeconomic fiscal capacity and institutional capacity will drive the assessment of the absorptive capacity for any major increase in donor contributions to Africa's investment requirements. Unfortunately, there is a serious risk that the assessments will be based on short-term cash-driven instruments, which tend to underestimate the absorptive capacity of aid to infrastructure.

The overall accountability of the international and national communities for their collective effectiveness in meeting Africa's needs is limited in part due to lack of data. The data available on ODA are on commitments, not disbursements. The data on government finance are at best an approximation. Finally, the data on infrastructure monopolies' expenditures and costs, whether public or private, are generally weak.

PART II

Are Household Needs Being Met?

Africa's infrastructure market structure is different from that of other regions because there are more poor households to serve, a higher share of the population lives in rural areas, and there is therefore a larger spread of population and production hubs. In addition, foreign and domestic investors do not always agree on infrastructure priorities, and the priorities are also likely to be different between investors and poor households. This second part of the book focuses on the level of coverage of the needs of households, and on issues related to affordability and quality of service. The water decade (in the 1990s) and the MDGs probably contributed to improvements in the water sector (although not in terms of access to piped water). For telecom sector, the explanation of the improvement in access rates is more on the side of the global payoffs of a technological revolution. Electricity, sanitation, and transport, however, are all lagging. In those sectors, access rates are hardly following the pace of population growth. Apart from a lack of access, there are also serious issues of affordability, actually more for households without access to formal networks than for households with access. In some areas small-scale providers are closing the infrastructure gaps for households but often at high production costs and at high profit margins, collected from poor households who are left out of the services provided by low-cost producers. Finally, quality is also poor in many countries, and production costs are an issue as well. For monitoring and evaluation, there is widespread lack of data on quality of service for the poor; hence, this is an area where data collection efforts are needed.

CHAPTER 5

Where Do We Stand on Service Coverage for Households?

This chapter focuses on the evidence available on the extent to which the residential demands are being met in Africa. The overview focuses on quantitative cross-country comparisons and hence leaves out a very large volume of anecdotal or country-specific case studies on the evolution of access rates. This is because the emphasis in this book is on data that can be reasonably compared across countries.

The best approximation of the household demand for infrastructure is given by the access rate. For some indicators like water, sanitation, and electricity, when access is not 100 percent, it seems reasonable to presume that the policy target is to eventually get it as close as possible to 100 percent. For telecom sector, it would be ideal to get a sense of the share of the population with access to either a fixed or mobile phone, but the data provided here is limited to landlines. We focus in this chapter on these four infrastructure services—water, toilets, electricity, and landline telephone—because these are the services for which extensive data are available for cross-country comparisons.

What Is the Level of Access to Services?

Trends in Access to Basic Infrastructure Services

The best data on access levels for households to basic infrastructure services such as water, electricity, landline telephones, and toilets comes from household surveys that can be considered as nationally representative. While integrated household surveys such as the Living Standard

Measurement Surveys tend to be the most comprehensive, they are not implemented in many African countries, and they are also not always comparable between countries in terms of survey questionnaires. This is why it is better to rely on data from Demographic and Household Surveys (DHSs) to measure access rates, since these surveys are available for many countries and are also comparable between countries thanks to a standardized questionnaire.

Banerjee et al. (2009) provide estimates of access levels to basic infrastructure services at the country level using DHS data. The focus is on piped water, flush toilets, electricity, and landline phones. The authors find a clear relationship between access rates and economic development. In poor countries such as Burkina Faso, Burundi, Chad, Ethiopia, Kenya, Madagascar, Malawi, Mozambique, Niger, Rwanda, Sierra Leone, Tanzania, and Uganda, more than 80 percent of the population does not use any modern infrastructure service. At the other extreme is high-income and urbanized Gabon where only 16 percent of the households do not have any of the services. The two richest countries (South Africa and Gabon) have the highest access rates to piped water and electricity. South Africa also has the highest coverage rate for flush toilets and landline phones. Simple univariate regressions suggest that more than 50 percent of the variation in access rates is accounted for by the variation in gross national income (GNI) per capita. These regressions suggest that an increase in GNI per capita of US$1,000 is associated with an increase in access rate at the national level of 15 percent for piped water, 11 percent for flush toilets, 18 percent for electricity, and a much lower 6 percent for landline phones (but this does not take into account the impact of income on the rapidly rising mobile phone sector).

While there is a strong correlation between GNI per capita and access rates, some countries are performing better than suggested by their level of economic development. For example, Lesotho, Namibia, and Senegal perform well for landline phones, while Namibia, Senegal, and Zimbabwe do well for flush toilets. At the same time, some countries do not perform as well as expected. This is apparently the case, among others, for Lesotho and Cameroon for access to piped water, these two countries plus the Republic of Congo for access to flush toilet, Namibia and Lesotho again for electricity, and finally Cameroon and the Republic of Congo for landline phones. Of course, all these results based on univariate regressions should be interpreted as simple descriptive statistics given that the relationship observed between economic development and access rates does not control for other potentially

important determinants of access rates, such as the rate of urbanization, the population density per squared kilometer in the country, the type of service provider, and regulation system in place, among others.

Banerjee et al. (2009) also show, as expected, that coverage in urban Africa fares better, especially in comparatively richer countries. Access rates are highest in capital and other major cities. By contrast, in most countries the rural population is almost completely left out of the modern infrastructure service coverage. The provision of sewerage service lags behind other network services such as piped water and especially electricity.

Are Things Getting Any Better over Time?

The fact that a majority of Africans are left out of modern infrastructure service leads one to wonder if access has improved in Africa despite the impetus in the past decade to step up infrastructure investments and the focus on pro-poor service delivery. That is, has the infrastructure expansion policy resulted in more people being covered in this decade starting from a low base in the early 1990s? To answer this question at the country level, Barnejee et al. (2009) plot the access rates in 2001–2005 against the access rate in 1995–2000. The results suggest that in a few countries, access has increased but the increase has been lower than one would have hoped. In both rural and urban areas, evolution of access as expressed by the regression coefficient has been barely positive (i.e., the coefficient for the slopes of the regression lines is often not very different from unity, at least for water, sanitation, and electricity; the coefficients are higher for landline phones, but this is from a very low base in 1995). The intercept term is also important. One likely path for improvement over time would be rapid expansion in the countries where coverage was particularly low in the base year, with slower expansion in the countries where coverage was relatively high in the base year because further gains are more difficult to achieve when coverage is already high. In such a case, we would observe a slope coefficient below one together with a positive and potentially large intercept term, which is indeed what is sometimes obtained, at least in urban areas where coverage is higher.

One should note again that the estimates provided for telephones are very partial. There has been a revolution in the availability of communications services in Africa in the past decade. Governments have issued licenses for mobile operators and competition has spurred private investment and competition. Telecommunications, particularly

mobile phones are now part of everyday life in most African countries. Although this is not discussed here, it can be shown using other data sources (household expenditure surveys rather than DHSs) that mobile phone coverage is higher than landline use in all the countries for which information on both services is available.

Banerjee et al. (2009) continue their analysis by providing estimates of trends in access rates for SSA as a whole. One difficulty in doing so stems from the fact that the panel of countries available through the DHSs is not balanced for each period. Countries have observations for different years. Therefore the authors consider three alternative methods to estimate overall access trends. The first method includes only the 11 countries for which data for three periods, 1990–1995, 1996–2000, and 2001–2005, are available. The second method includes countries with data for only one or two periods. For countries with data for only one period, the data are used for all three periods, assuming no change over time in access. If data are available for two periods, the annual growth rate in coverage between the two periods is used to estimate the rate for the third period. The third method is similar but assumes that access rates cannot fall more than population growth. If access rates in the third period drop by more than what would be observed assuming no growth in the total number of connections, the survey data for the third period are replaced with the coverage rate in the second period times the ratio of the population in the second period divided by the population in the third period. In the case of landlines, due to a smaller number of observations, and increasing access in most countries, only the second method is applicable.

Given some issues of comparability between surveys in selected countries and the resulting need to correct for some outliers, the authors' preferred estimates for the analysis are obtained from the third method, and these estimates are the ones summarized here (the results obtained from all three methods are broadly similar). The estimates (see table 5.1) suggest that access rates for electricity have improved over time while access to piped water and flush toilets has not. For most services, access

Table 5.1 Trends in access to basic infrastructure services in Africa 1990–2005

Sector	*National trend (%)*
Piped water	Flat at 17%–18% (flat in rural areas and decrease in urban areas)
Electricity	Increase from 23% –31% (flat in urban areas and increase in rural areas)
Flush toilet	Flat at 9%–10% (flat in rural areas and decrease in urban areas)

Source: Adapted from Banerjee et al. (2009).

rates within urban areas have either declined or remained stable and access rates in rural areas have not changed much or increased, but only slightly. Migration from rural to (peri-)urban areas does, however, tend to contribute to higher access rates within fast-growing peri-urban areas, in general served first when expanding access.

How Far Away Is Universal Access?

While talking about universal access may seem to be a misplaced question given the low coverage rates for many services in most countries, it helps in showing how slow progress will be if substantial investments are not made in order to improve coverage faster. The predicted year of universal access is computed by Banerjee et al. (2009) in a very simple way by taking into account the difference for each country and each service between the growth rate in coverage (in terms of number of connections made available) and the growth rate of the population over time. The average Africa-wide annual growth rates in coverage for the different services in the countries in the sample is 5 percent for electricity, 1.4 percent for piped water, 7 percent for flush toilet, and 12 percent for landline telephones during the period 1996–2005.

It is striking that for piped water and flush toilets, around a quarter of the countries in the sample actually show evidence of negative growth rates in coverage, while another third report only modest growth rates of 0–4 percent per year. The strongest performers in terms of piped water service expansion are Benin, Burkina Faso, Chad, Ethiopia, Mali, and Senegal, all showing growth rates of 4–8 percent per year. A significant minority of countries are expanding flush toilet service at a rate in excess of 12 percent per annum. A subset of these countries are performing well for piped water service expansion: Burkina Faso, Chad, Ethiopia, and Mali. However, this growth is taking place from a very low base, and hence does not amount to a great deal in absolute terms.

The rate of expansion of electricity service is more encouraging, with almost half of the countries reporting average annual growth rates in the 4–8 percent range. The fast expanding countries, once again, show considerable overlap with some countries registering rapid expansion of piped water service: Benin, Burkina Faso, Chad, Madagascar, Mali, Senegal, and Tanzania. The most rapid rates of coverage expansion are for landline service, where about half of the countries are expanding at over 12 percent per year, albeit from a very low base. The list of high-performing countries is somewhat different in this case: Ethiopia, Ghana, Guinea, Kenya, Madagascar, and Mali. The household surveys

do not yet provide a time series for cellular telephones; however, it is known from sector statistics that the rate of expansion for that service is much higher than for landlines. At the other extreme, one country that stands out as falling behind demographic growth in expansion of all its modern infrastructure services is Zambia, which reports a negative growth rate for piped water, flush toilet, and electricity, and has been expanding landline service slowly.

When will everyone get service? Using the data on the annual growth rates in coverage at the country level, it is possible to project the year in which each country would reach universal access for each of the modern infrastructure services, based on the assumption of continued expansion at "business as usual" rates. The projections indicate that under these conditions fewer than 20 percent of countries would reach universal access for piped water by 2050, while fewer than 40 percent of countries would reach universal access to electricity by the same year. In a third of the African countries surveyed, universal service for piped water and electricity (if historic trends continue) would not be reached during the current century. The projections for flush toilet and landlines are less credible in the sense that both services are currently experiencing very high growth rates from very low base levels, and these growth rates are bound to slow down as penetration increases, particularly given the high cost of these services relative to the purchasing power of the population. Hence, the estimates provided for those sectors regarding the time to reach universal coverage are bound to be too optimistic.

To What Extent Does Demography Affect Access Rates?

Part of the reason why access rates in terms of households as opposed to connections have been improving only marginally in most SSA countries relates to the high levels of demographic growth, which increases needs. But in addition, the demographic transition to smaller household sizes in many developing countries adds to the demand for infrastructure services. This transition itself is due to many factors, including lower rates of fertility for women, higher rates of urbanization and related changes in behavior, the adoption of nuclear as opposed to extended family structures, and the impact of HIV-AIDS.

In order to look at the effect of the demographic transition to smaller household sizes on infrastructure needs, Diallo and Wodon (2007) estimate the average household size in DHS data for 40 countries. While there has been an increase in household size for a few countries over time (e.g., this could happen if a country experiences hard times, so

that households have to combine forces to cope with a degradation in their living conditions; other reasons may also lead to larger household sizes over time, even if fertility is decreasing), these are rather exceptions. In most cases, household sizes have decreased between surveys, as expected. Consider, for example, the first two countries in the authors' sample. In Burkina Faso the average household size has decreased from 6.65 in 1993 to 6.47 in 2003. The decrease in Benin is larger, from 5.99 in 1996 to 5.18 in 2001. For the sample as a whole there is a relationship between the country's level of GDP per capita and the reduction in household size per year. On average, developing countries may expect a reduction in their household size of 0.05 persons per year, but as suggested by a logarithmic curve that approximates the relationship between the 2 variables, the decrease is typically slightly larger in the countries that are richer and therefore presumably further along in their demographic transition.

How does the increase in the number of households due to the demographic transition to smaller household sizes compare with the increase due to population growth? Consider Burkina Faso again as an example. Over the 10 years separating the 2 surveys the country's population increased by 34 percent. This translates into an annual population growth rate of 2.93 percent. For Benin, over 5 years, the increase in the population was at 16 percent, which translates into an annual population growth rate of 3.02 percent. Taking into account the average household size computed from the DHSs, the authors provide an approximate value for the cumulative increase in the number of households in each country (defined as the ratio of the population in the first survey year divided by the household size in that year, to the population in the second survey year divided by the average household size in that second year). In most countries, since household sizes have been reduced, the cumulative growth rate in the number of households is larger than the cumulative population growth rate.

Diallo and Wodon (2007) provide the annual rate of growth in the number of households in each country, and the annual growth rate in the number of households minus the annual population growth rate for each country between the two surveys—this is thus the impact of the transition toward smaller household sizes. In Burkina Faso, the estimates suggest that the reduction in household sizes has added 0.29 percent to the population growth rate of 2.93 percent, so that the increase in basic infrastructure needs in terms of the number of connections to the network required for keeping access rates constant is 3.22 percent. Of that total, about one-tenth is due to the demographic transition to

smaller household sizes. In Benin, due to a sharper reduction in household size over a shorter period, half of the annual increase in the number of households between the two surveys is due to the reduction in household size. For the sample as a whole, the average rate of population growth is 2.09 percent, and the average increase in the number of households is 2.99 percent, so that the impact of the transition toward smaller household sizes (0.90%) represents about one-third of the total needs in terms of new connections to the network required to keep access rates constant. In the case of African countries, which account for about half of the sample, the average rate of population growth is 2.47 percent, and the average increase in the number of households is 3.18 percent. Thus, the impact of the transition toward smaller household sizes is smaller (0.71%), but still far from being negligible.

Income Growth versus Population Growth

Finally, Diallo and Wodon (2007) show that as per capita GDP increases (in US dollars), the population growth rate of the country tends to decrease, thereby reducing the need for investments in new connections for households. By contrast, it is clear that the needs from changes in household sizes are larger at higher levels of economic development, probably due, among others, to faster urbanization rates, faster declines in fertility, as well as higher economic resources, which enable households to move toward nuclear family settings because they do not need to rely as much on the economies of scale provided by larger household sizes in order to survive. As mentioned earlier the growth in the number of households is on average at about 3 percent, one-third of which comes from the impact of the transition to smaller household sizes. But it is striking that, in general, countries with higher GDP per capita may not expect a smaller increase in needs than poorer countries, because the residential infrastructure connection gains from lower population growth are offset by the faster changes in household sizes as countries grow richer.

Summing Up

This chapter has provided a description of the trend in access rates to basic infrastructure services in SSA using data mostly from DHSs. The results are not encouraging. Access rates for electricity and flush toilets have improved slightly over the last decade. Increase in electricity coverage appears to be driven by rural electrification. Urban electricity

coverage has declined slightly in the last 10 years and rural coverage has increased by 3 percentage points. Landline telephone is the only service where coverage has unequivocally improved, irrespective of geographic location. The decline in water supply coverage is starker in the urban areas while the coverage has remained almost constant in the rural areas in the past 15 years. Furthermore, beyond broad averages, a large number of countries are failing to ensure that service expansion even keeps pace with population growth. For piped water and flush toilet, close to half of the countries are expanding coverage too slowly to keep pace with demographic growth. For electricity and landline telephones, around 80 percent of the countries are managing to expand coverage faster than they are expanding population. But even for these countries, under a continuation of current trends, it would take a very long time to reach universal or even widely shared access. These results point to the need for increased efforts by governments and donors to progressively increase access to basic infrastructure services to Africa's population.

While the overall results are not encouraging, the wide diversity of performance across countries suggests that there are valuable lessons to be learned. These aggregate statistics conceal substantial variation in performance across countries. Some countries have succeeded in expanding the population served with water, electricity, and sanitation by an annual average of 5–10 percent, which is fast enough to make substantial coverage gains within a reasonable time frame. Further investigation is warranted to explain what determines the superior performance of these countries.

Moreover, the very positive experience of cellular telephony in the last decade highlights the possibility of making rapid progress under the right circumstances. Much of the explanation for the progress obtained with cellular telephony lies in factors that are unique to cellular technology, including the relatively low fixed investments, the novel and high-value nature of the service, and the commercial innovation in terms of low entry charges and prepayment facilities. While not all of these things can be directly applied to other infrastructure services, they nonetheless provide pointers in terms of directions for change that could help to support faster coverage gains for other services. These include lowering capital costs, reducing up-front connection charges for households, and providing alternative and more flexible payment methods to the traditional ex-post monthly bill used for electricity and water.

CHAPTER 6

How Big a Problem Is Access for the Poor?

The first step in refining the evidence on an access problem and in particular testing the extent to which the poor are worse off than the rest of the population is to try to unbundle the data on access rate in infrastructure into income, consumption, or wealth groups. This raises a significant issue. The data on income and consumption are not available for all countries on a comparable basis. Fortunately, data on access by level of wealth can be provided and the sample is large enough to generate a relatively reliable sense of the level and distribution of access rates for the various infrastructure sectors across wealth groups.

Who Has Access to Infrastructure Services Now?

DHSs Can Be Used to Assess Access by Wealth Level

In spite of the widespread focus on poverty, the distribution of access rates to infrastructure services by level of well-being had not been addressed systematically by international databases until recently. To provide cross-country comparisons of access to basic infrastructure services by level of well-being, the best sources of information are, again, the DHSs. Country-level estimates are available in Banerjee et al. (2009), and summary estimates for Africa as a whole by quintile of wealth are provided in table 6.1. Recall that the authors consider three methods outlined in the previous chapter to aggregate country data into regional averages. The first method includes only 11 countries for which there are data for three periods. The second method includes countries with

Table 6.1 Trends in access to basic infrastructure services by wealth quintile 1990–2005

Quintile group	*Infrastructure service access trend (%)*
Piped water	
Poorest	No access at all
Second	Virtually no access
Third	Substantial increase in access from 8% to 18%
Fourth	Reduction in access from 33% to 21%
Top	Stable access at about 50%
Electricity	
Poorest	Virtually no access
Second	Substantial increase from 6% to 35%
Third	Substantial increase from 12% to 25%
Fourth	Substantial increase from 27% to 41%
Top	Stable access at slightly above 70%
Flush toilet	
Poorest	No access at all
Second	Virtually no access
Third	Substantial increase from 4% to 12%
Fourth	Stable access at about 15%
Top	Stable access at slightly above 30%

Note: "Virtually no access" refers to access rates below 5 percent.

Source: Adapted from Banerjee et al. (2009).

data for only one or two periods, with simple interpolations when data are missing. The third method, in addition, assumes that access rates cannot fall more than population growth with corrections made to the data if this is the case. This is the preferred method and the table 6.1 refers to estimates as per the third method.

Access to Basic Services Remains Extremely Limited among the Poorest

As expected, coverage is virtually inexistent among the very poor in most countries and as a result for the region as a whole as well (in quite a few countries, coverage is low even in the top quintile). As somewhat better-off households (typically located in the third quintile) who do not yet have modern infrastructure services are likely to benefit first from potential increases in access, it follows that coverage among the very poor will remain very low in most countries for quite some time. The data imply that the main beneficiaries of efforts to increase access tend not to be in the bottom quintiles. This seems to be a relevant

consideration when assessing the returns of public expenditure allocations from the point of view of providing services to the poor. Thus, in most countries, the reforms implemented so far have not been successful to address the needs of poor and those only slightly better off.

Who Benefits from Improvements in Access?

Improving access is an important concern among the poor. We hinted in the previous section at the fact that the poor may not have benefited very much from the reforms implemented in SSA to increase access to infrastructure services. This suggestion is documented more systematically in this section. But first, it is worth highlighting that better access to infrastructure services is indeed an important priority for the poor. This can be illustrated by data gathered in 1998 in Niamey, the capital city of Niger, one of the poorest countries in the world. In a survey of current and potential users of piped water, households were asked about their main priorities. About two-thirds of those in the two bottom quintiles of wealth distribution indicated that the first priority of the government of Niger (among other alternatives including improving sanitation, storm water drainage, disposal of solid waste, the health system, and the education system) should be to improve water supply (table 6.2). In the top quintile this percentage was much lower, at 39 percent, essentially because a larger share of households already had access to water. Still, improving the supply of water to Niamey was by far the topmost priority in each quintile group, indicating the importance of the issue.

Table 6.2 Main priorities of the population by quintile of wealth, Niamey (Niger)

Quintile group	*Improve storm water drainage (%)*	*Improve water supply (%)*	*Improve sanitation (%)*	*Improve disposal of solid waste (%)*	*Improve health system (%)*	*Improve education system (%)*	*Total (%)*
1	8.6	62.9	4.8	2.9	18.1	2.9	100.0
2	8.7	62.5	3.9	3.9	18.3	2.9	100.0
3	10.6	55.8	6.7	4.8	13.5	8.7	100.0
4	14.4	50.0	6.7	5.8	16.4	6.7	100.0
5	14.4	38.5	10.6	4.8	23.1	8.7	100.0
All	11.3	53.9	6.5	4.4	17.9	6.0	100.0

Note: The columns values in each row may sometimes not sum up to a precise 100 due to rounding up of the numbers reported in each column.

Source: Bardasi and Wodon (2008).

While better access could benefit the poor, it hasn't happened in practice so far. One of the objectives of the poverty reduction strategies implemented in many countries was to improve access rates. This is a worthwhile objective, since access to such services is believed to have beneficial impact not only on productivity and growth, but also on a range of social indicators (among others in education and health), which are precisely those that are targeted under many PRSPs and more generally under the MDGs (see chapter 3). In addition, from a pure distributional point of view, it can be shown that in most cases, policies such as connection subsidies that aim to improve access tends to be more pro-poor than policies such as lifeline or means-tested consumption subsidies that aim to improve the affordability of consumption for those who already have access, simply because households that already have access tend to be better off than those without access. Unfortunately, in SSA it is clear that improvements in access, assuming that they are observed, do not benefit the poor, unless special efforts are made in order to reach them. As better-off households tend to benefit first from improvements in access (because they are closer to the existing networks managed by utilities, or because they can more easily afford to pay for the services provided by utilities), improvements will often trickle down to the poorer members of a society only when access rates are already relatively high among the nonpoor. Since access rates remain lower in SSA than in other regions of the world, it is clear that a substantial part of new connections is not likely to benefit the poor without specific interventions to target them.

One way to show statistically how the better off have benefited the most from increases in access so far is to rely on the Gini Income Elasticity (GIE hereafter) as a summary statistic (e.g., Wodon and Yitzhaki 2002; 2003). For ease of interpretation, a GIE of one for access to a service at any point in time implies that access to the service is as unequally distributed as the measure of wealth used to rank households in terms of well-being. A GIE greater than one implies that access to the service is even more unequally distributed than the measure of wealth. This means that the access to the service is even more concentrated among the wealthy than wealth itself. A GIE lesser than one implies that access to the service is less unequally distributed than the measure of wealth. However, this does not mean that the poor benefit more from access than the better off. Indeed, on average, if all households were to benefit equally from access, the GIE would be equal to zero. Any positive value for the GIE suggests that there is a positive (Gini) correlation between access to the service and wealth. For the poorer households

to benefit more from access to the service than the better-off households, the GIE would typically have to be negative, that is, lesser than zero. The same interpretation of the GIE holds for changes in access over time, in which case we will use the expression of marginal GIE or MGIE. For example, an MGIE of greater than one for the distribution of changes in access over time implies that the wealthier still benefit more than the poorer households even at the margin do, in terms of who benefits from an expansion of the network.

GIEs for access and MGIEs for changes in access over time were computed by Diallo and Wodon (2005) for piped water and electricity for a subsample of countries for which two data points in time were available in DHSs. The GIEs and MGIEs for electricity were greater than one for all countries. Thus, not only access, but also increases in access over time tend to be more unequally distributed than wealth itself. Similar results were observed for piped water availability within the dwelling of households, and to a large extent also for tap water in general (within or outside of the home), although for tap water there were some cases in which the GIE or MGIE was lower. Clearly, both access and increases in access remain highly skewed toward the wealthy.

One would expect that increases in access rates would gradually benefit the poor once better access is achieved among better-off households. This would mean that the GIEs and MGIEs would be reduced once access rates are higher. However, for electricity, there was virtually no reduction on average in the value of the GIEs and MGIEs when access rates increased, confirming that both access and increases in access remain highly unequal. For water, the relationship was slightly more favorable, suggesting that when access rates are higher, at the margin, increases in access rates tend to be slightly less unequally distributed, perhaps because it is easier for water sector to set up independent systems in smaller geographic areas populated by poorer households than for electricity, where access is more dependent on the main network line. Still, while over past decades most African countries have made substantial efforts to increase their network coverage in water and electricity, access for the poor has not improved much.

Why Does Access among the Poor Remain So Low?

Lack of Supply

The supply problem is obvious. Many poor households may not have access to the infrastructure services simply because they are too far from the services. This is especially the case for network utility services such

as water and electricity. For many among the poor, even if the services were affordable, they would not be able to benefit because the services are not provided in the areas where the households are located. But there are also problems on the demand side, as the cost of being connected to the network, when the network is available, is often too high for the poor. The affordability problem is indeed particularly acute for the poorest.

The absence of a network is a constraint to the supply of utility services for the poor. But even when a network is available, the capacity of the network seldom adjusts as fast as the rapidly evolving demand would require and older networks end up with a limited ability to provide the required service. Consider the case of Niamey, the capital of Niger. The demand could not be satisfied, in part, because after 1990, few investments in the network were made until studies for new investments were carried out in 2001 (at the time of the privatization of the distribution network), and projects were not started until 2003. At that time 65,000 m^3 per day were produced in Niamey. Investments were underway to increase the quantity produced by 10,000 m^3 per day by the end of 2005, and new investments were to add another 20,000 m^3 per day in the following couple years. But delays continued to take place. To maintain the quality of the service (water pressure and number of hours in a day when water is available), improvements to increase the production of water should probably have been completed before new initiatives to subsidize additional social connections for the poor are undertaken.

Lack of Demand

Consider again the experience of Niger to illustrate how expansion needs are often associated with high connection costs needed to recover the investments made. In Niger, two companies were in charge of the management and provision of water in urban areas. SPEN (Société de Patrimoine de l'eau du Niger) is a public company, whose tasks are the management of the water network as a national resource, the investments in the sector, and the maintenance of the network. SEEN (Société d'Exploitation des Eaux du Niger) is a private company that took over the distribution of piped water in 2001. SEEN realizes the connections to the network, distributes the water, and bills the customers. At the time, the water network covered 52 urban centers and, for historical reasons, a few small rural centers. As of May 2004, there were a total of 88,662 connections (including private connections, public fountains, industry and trade, and administrative connections), of which 74,693

were in working order. Of these, 62,769 were private connections or public fountains. The cost of a connection depended on the distance between the main pipe and the house. The cost of cheapest connection was in principle FCFA 115,000 (US$1 is equivalent to about FCFA 500), which was high for a poor household. In addition, a number of smaller fees were added to the standard cost. When the application was presented to SEEN, the household had to pay FCFA 1,500 as administrative costs. At this point, a SEEN technician provided an estimate of the cost to realize the connection. If the household agreed, it had to pay the cost of the connection and in addition, a deposit whose amount depended on the diameter of the meter. Finally, FCFA 1,500 were required for the installation of the meter and other costs before the private distributor SEEN provided the connection. Without further policy intervention, these costs were bound to generate an affordability problem for the poorest.

Use of Simple Techniques to Assess the Roles of Demand and Supply in Connection Rates

The importance of assessing the role of demand as opposed to supply-side issues was recognized by Foster and Araujo (2004) in their study of the impact of infrastructure reforms on the poor in Guatemala. These authors proposed a simple statistical method for assessing the contribution of pure demand-side problems, pure supply-side problems, and combined demand- and supply-side problems to coverage deficits. If a household living in an area with access to piped water or electricity service was not connected, this was taken as a sign that the service was not affordable for the household (pure demand-side problem). In practice, the authors assessed whether households lived in an area with access simply by checking if any other household living in the same primary sampling unit of the survey had access. Indeed, household survey samples rely on geographically defined primary sampling units, which tend to be well-delimited areas, especially in an urban setting. To the extent that the primary sampling units in urban areas are small (about 15–20 households per primary sampling units in surveys who tend to live in specific neighborhoods), access by one household in the primary sampling unit could be considered as indicating potential access for all the households in that primary sampling unit.

Foster and Araujo then defined the magnitude of supply-side problems as the part of the lack of coverage that was not due to the pure demand-side problem mentioned above. In addition, they decomposed

supply-side problems into two components. The authors noted that even if there were access to the service in neighborhoods currently without access, some households would still not connect to the network. They, therefore, argued that in areas without access, some households had a combined or mixed problem of both demand- and supply-side problems. Next, for those households who would probably connect to the network if there were access in their neighborhood to the service, the authors argued that there was a genuine pure supply-side problem. Overall, the authors thus decomposed the lack of coverage of the network as a pure demand-side problem, a pure supply-side problem, and a combined demand- and supply-side problem. Others, including Angel-Urdinola and Wodon (2007; 2012) and Komives et al. (2005; 2007) have expanded on the work of Foster and Araujo in order to analyze factors determining not only who benefits or not from a connection to the network, but also who benefits (or is likely to benefit) from various connection or consumption subsidies for modern infrastructure services.

However, a weakness with the simple statistical approached used by Foster and Araujo lies in the fact that there are limitations in the surveys used to empirically assess the magnitude of demand- and supply-side problems, and that this may lead to biases in the estimates of demand-side as opposed to supply-side problems. As already mentioned, some households may live in an area where there is access to the service, but may still be located too far from the electric line or water pipe to be able to be connected (or perhaps the capacity of the electric line or water pipe may be designed to support a specific and limited number of households). Under the simple empirical procedure for estimating demand- and supply-side problems proposed by Foster and Araujo, these households would be considered as suffering from a demand-side problem, while the true nature of the issue may be a supply-side constraint. To some extent, this type of bias can be dealt with by using regression techniques following an approach proposed by Wodon et al. (2009), with both techniques giving somewhat different results.

Statistical results suggest that demand-side issues are important. Using the Foster and Araujo statistical approach, the proportions of the deficit in coverage due to demand-side, supply-side, and combined problems were computed for piped water and electricity by Wodon et al. (2009) using DHS data for African countries. This was done in urban areas only (given that in rural areas, supply-side issues clearly dominate). The data suggest that access at the neighborhood level is widespread for both water (73% of households have access, and this increases to 79% when no population weights are used) and electricity (93% of households have

access, and this is slightly reduced to 89% without weights) in African cities. Take-up rates are lower, at 48 percent for piped water (49% without weights) and 75 percent for electricity (61% without weights). This means that the coverage rate for piped water, on average, is 38 percent (41% without weights), and for electricity it is a much higher 71 percent (56% without weights). Conversely, the share of households not currently served is 62 percent for piped water (59% without weights) and 29 percent for electricity (44% without weights).

The proportion of the deficit in coverage attributable to demand-side factors is large under the Foster and Araujo method. For piped water, the estimate of the role of demand-side factors is at 59 percent on average for the region when countries are population weighted, and at 68 percent when we use a straight average for all countries. For electricity, the corresponding figures are 79 percent, both with and without country population weights. The proportion of the deficit in coverage that is attributable only to supply-side factors is much lower, at 15–18 percent for piped water depending on whether country weights are used, and at 12–15 percent for electricity. The combined demand- and supply-side problems account for 18–23 percent of the coverage deficit for piped water, and 6–9 percent for electricity on average for all the countries in the sample. These results would suggest that demand-side problems might be larger than supply-side problems in explaining lack of infrastructure coverage in African cities.

However, econometric results instead suggest that supply-side issues are more prevalent. The findings are reversed versus those obtained with the simple statistical decomposition. The proportion of the deficit in coverage attributable to demand-side factors is now small for piped water, at 19 percent (population-weighted data) to 23 percent (unweighted data). For electricity, the corresponding figures are 39 percent (unweighted data) to 52 percent (population-weighted data). By contrast, the proportion of the deficit in coverage that is attributable only to supply-side factors is now much larger, at 41–42 percent for piped water depending on whether country population weights are used or not, and at 37–39 percent for electricity. The combined demand- and supply-side problems account for 35–39 percent of the coverage deficit for piped water, and 11–21 percent for electricity on average for all the countries in the sample. Given that the combined supply and demand factors reflect first a supply issue (these are urban areas where the network is not available), lack of supply appears to be a larger constraining factor than lack of demand in explaining coverage deficit in urban areas.

Connection subsidies can help in reducing demand-side problems. The above analysis suggests that supply-side issues are most prevalent, but demand-side issues also should not be neglected. Recall Niger's affordability problem associated with new connections. The solution was to introduce some 11,200 social connections, about half of them in the capital city of Niamey. The connections were not totally free—a deposit and a payment for administrative fees were still required. In addition, to be eligible for a social connection a set of conditions concerning the house had to be met. The house had to be built in solid materials, that is, had to be a stable and permanent house, and had to be located within 20 meters from the main pipe. Finally, the household had to be able to pay the water bill each month, in cash and in a single installment.

Household survey data were collected in 2005 among a representative urban sample among others to assess the targeting performance of the social connections program. According to table 6.3, households who benefited from a new connection around 2002–2004 (about two to three years before the survey) tended to be significantly poorer on average (i.e., belonged to poorer quintiles of the population in terms of income or predicted consumption) than households who got connected before or after, suggesting that the social connections were indeed relatively well targeted.

How regulation can help reduce the affordability problem. Tariff and subsidies are however not the only instruments that can be used to improve affordability. The design of the market structure may actually be quite important as well, particularly in countries with widely dispersed populations unlikely to be able to afford large networks interconnecting all the population poles. Mauritania offers an interesting and creative experience in this respect. In a country such as Mauritania where water is scarce and where the nomadic mode of life has decreased considerably while urbanization has made rapid progress, access to piped water is a concern and has been on the government's agenda for a long time. As shown by Collignon and Vezina (2001), access rates in the capital city of Nouakchott were low at the end of the 1990s even by West African standards, at least in comparison to other capitals.

By contrast, access rates in smaller cities in Mauritania improved. A study by Hidroconseil (2001) documents the expansion of the network in Mauritania's small cities and its context. In 1993 water supply management in small urban areas was delegated to external operators. In 2001, those operators, 75 percent of which are private, were providing water in 190 cities among the 270 cities with a water network.

Table 6.3 Since when do you have access to the water network? (Niger)

Time (years)	*Income quintile (%)*					*Predicted consumption quintile (%)*					*All (%)*
	Q1	Q2	Q3	Q4	Q5	Q1	Q2	Q3	Q4	Q5	
< 1	7.4	6.0	1.8	12.1	5.1	7.4	6.3	4.0	7.0	7.6	6.7
1–2	6.4	1.2	3.6	1.9	6.6	5.6	5.0	2.0	7.6	2.4	4.2
2–3	11.7	14.3	14.5	5.1	3.0	16.7	16.3	11.9	5.7	4.0	8.3
3–4	7.4	7.1	3.6	5.1	5.1	7.4	7.5	4.0	5.7	4.8	5.5
> 4	55.3	48.8	51.8	49.7	53.3	50.0	56.3	60.4	47.5	50.2	51.9
Do not know	11.7	22.6	24.5	26.1	26.9	13.0	8.8	17.8	26.6	30.9	23.5
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Note: The row values in each column may sometimes not sum up to a precise 100 due to rounding up of the numbers reported in each row.
Source: Authors.

Because the contract linking the operators with the public provider (Direction de l'Hydraulique) was rather flexible, there was room for initiative. Financed by the households without the support of the banking system, the operators extended the network by 150 percent. In the 33 small towns considered in the study by Hydroconseil, 70 percent of households now have a private connection.

The affordability issue emerges as follows. Since households have to finance their connection to the network themselves, the poorest may be left behind and still have to rely on less-modern and convenient water sources. According to data from a national household survey implemented in 2000, only 13 percent of the poorest (i.e., the population in the first quintile of per capita consumption) had access to piped water against 42 percent in the highest quintile. A larger share of the poor must therefore still purchase their water from private sellers at between 300 and 500 MRO/m^3 while the network price is between 80 and 140 MRO/m^3. In fact, the demand for private connection in small cities was stimulated by the relatively low price of network water. Overall, an analysis of the data suggested that the situation in small cities was better in 2000 than in the main cities serviced by the public provider, even among the poorer quintiles. This result is probably attributable, at least in part, to the role played by private providers in small cities.

The Mauritanian model for the expansion of access in small cities had limits, however. The main limit to network extension was probably the lack of local infrastructure such as underdimensioned solar water pumps or drilling capacities. Similarly, interest for private connections also existed in Nouakchott, but the public provider responsible for the 12 main cities in the country was simply not able to meet the demand. In addition, while the flexibility of the concessionary contract allows private initiatives to flourish in small cities, inefficiencies remain. Once an operator is entitled to serve an area, its flexibility is considerable. While initially the operator's responsibility was supposed to be restricted to the daily management, contracts were flexible enough to allow the operator to initiate long-term investments. This allowed for the considerable network extension mentioned above. But prices were actually too low relative to the cost of water production. Prices were, in principle, the competence of the ministry for water and energy. They were calculated for each network separately and tended not to be revised over time. Yet at 95 MRO/m^3 on average for a private connection and about 110 MRO/m^3 at the public fountain, they were below cost. As a result, operators could not survive without tax evasion or without a lack of investment in maintenance and renewal of the network.

Operators tried to increase net revenues by maximizing the number of private connections in order to share the fixed costs. Still, the financial health of the operators was fragile. Because fixed costs were large, average costs could be declining but marginal cost pricing was not viable in the long term. In addition, the system as it was organized also suffered from a lack of transparency and organization. Rules were unclear and contracts between the operators and the national water provider were incomplete and precarious. Property rights of the connections were not explicit enough and the responsibilities of the Direction de l'Hydraulique, the operators, and the households were not well defined. The network did expand as this corresponded to the interest of the operators and of the clients but there was no guarantee that this would remain the case. Technically, as well, the network extension required more planning. Finally, even though some poor households had benefited from the network expansion, the poorest still lagged behind because they did not have the means to finance their connection to the network themselves. When they had difficulties to pay their water bills, those who had a connection could not rely on any public protection since operators had the right to simply cut the water provision.

Summing Up

The main point of this chapter has been to summarize evidence of the fact that the poor tend to be left out of the efforts aimed at improving access. Even though demand and affordability issues play a role, this is not mainly from a lack of demand. On the contrary, there is indeed quite strong evidence that there is a tremendous demand for access to all public services by the poor.

One of the consequences of the differentiation in the speed with which access rates are increased across income or wealth classes is that changes in access rates have tended to be regressive. This is problematic (if not surprising) in view of the strong commitments made by the international community to place the needs of the poorest at the center of the concern of international aid. It is particularly problematic in view of the very high share of investment in infrastructure that is actually financed from foreign aid.

CHAPTER 7

Are Infrastructure Services Affordable for All Users?

Improving access is a step in the right direction. This step will, however, not achieve much if users cannot afford the services they potentially have access to. Being a subjective concept, affordability is quite difficult to define precisely. There are indeed disparities in views on what affordability means. But there are also few rules of thumb that can be used to assess whether a service imposes a reasonable financial burden or not on the users. These are usually defined as a maximum proportion of income or consumption that households should have to pay to meet the basic needs of a specific public service. Some of these rules of thumb have been suggested in the literature, others are more formal statements by international organizations, and yet others belong to the "tool kits" of field experts with a long oral tradition. We use some of these rules in this chapter to offer a diagnostic of the affordability problem in Africa. We then look into the main factors that drive that diagnostic, including the costs and quality of services.

The Cost of Infrastructure Services Is High for the Poor

Rules of Thumb to Assess Affordability

The most formal rule of thumb is for W&S. The World Health Organization (WHO) has long estimated that 5 percent of income should be the maximum the poor should spend on their W&S need—3.5 percent for water alone. In the case of electricity, there is no such widely accepted "rule of thumb." Komives et al. (2005) suggest that households in Latin America, Eastern Europe, and South Asia spend

around 4 percent of income on electricity (and 1%–2% of income on water supply). In their experience, the percentage of income spent on water supply and electricity decreases across quintiles as average household income rises. For the poorest households, electricity represents 4–6 percent of income, while water supply represents 1–3 percent of income. The most informal rule is the one that suggests that poor households should not have to spend more than 15 percent of their income on infrastructure services.

Evidence for Extent of Infrastructure Services Affordability in African Countries

Using available household income and expenditure surveys, Banerjee et al. (2008) provide evidence on the extent to which Africa fits these various affordability guidelines. They first note that most African households live on a tight budget, with more than half of total expenditures allocated to food. An average African household lives on US$180 per month or less, with its spending ranging from around US$50 per month in the lowest consumption quintile to US$400 per month in the top quintile. By country, the average household monthly budget ranges from US$57 in Ethiopia to US$539 in South Africa (as per 2002 US$).

Given that on an average more than half of a household's budget is allocated to food, budget left for other goods, including basic infrastructure services, is limited. Because data on spending on infrastructure services is often of limited quality in household surveys, Banerjee et al. (2009) report data on spending patterns only for those households that reported access to the four network infrastructure services of water supply, sewerage, electricity, and telephones, as well as separately for transport since most households declare at least some expenditure on transportation. It turns out that infrastructure services' spending absorbs on average 7 percent of the household budget, and it falls within the 5–15 percent range for most countries, although in rare cases spending on infrastructure services exceeds 25 percent of the total budget. The service that accounts for the largest share of total spending (among those using the service) is cellular telephony, but data are available for only a handful of countries and the service remains concentrated among relatively few households. Electricity and transport come next, while other services account for smaller shares of total spending.

The picture that emerges from the data is biased however, because it is estimated only on a small subset of the population that tends to be better off. Another question is whether the population as a whole would

be able to afford services if these services were accessible. The approach used by Banerjee et al. (2009) consists of first defining a minimum bundle of services that would be deemed necessary to meet basic needs, and estimating an approximate cost for those services. Next, data on consumption patterns are used to assess the share of households likely to be able to afford the services, under the assumption that no more than 5 percent of the total consumption of a household should be allocated to any one such service.

For example, the affordability threshold would be US$5 per month for a household with a monthly consumption of US$100. For households belonging to the various quintiles of consumption per capita, the share of the household's budget that would be required to meet basic infrastructure services expense would depend on the price of the service. Many households in the poorest quintile would reach the 5 percent affordability threshold at a level of spending of about US$4 per month per infrastructure service. While this might be enough to pay for piped water and electricity under lower-bound cost and consumption assumptions, it would not be enough under the upper-bound assumptions used by the authors. Thus for the very poor, affordability of even a minimum level of consumption is an issue, while this is not the case for the upper quintiles. More detailed analysis at the country level suggests that cost recovery of basic subsistence consumption levels could lead to affordability problems for 60 percent of households.

Thus, while Africa's population with access to infrastructure services may not spend more than 15 percent of its consumption on those services, poverty is such that affordability is an issue for many without access. Because a large share of the population is very poor in many countries, any increase in spending for any category of consumption must be acquired by cutting spending elsewhere, even though in most areas the poor simply cannot afford what they need. In a way, affordability would need to be measured in terms of what households have to give up for purchasing infrastructure services. In Africa, this means giving up basic food items that are needed for adequate nutrition, or health care. Many of Africa's poor also have difficulties sending their children to school due to both out of pocket expenditures involved and the opportunity cost of schooling in terms of losses in child labor. This also explains why it is often difficult in African countries for firms and governments to raise utility tariffs as well as the price of other infrastructure services. Even small increases may have important negative consequences for a population in which a larger share of households are not able to meet its basic needs in many different areas.

Are Alternative Services Affordable for Those without Network Access?

What Happens to People Who Are Not Connected to Networks?

While there may be affordability issues for customers connected to the water and electricity networks, it is important to remember that only a very small proportion of the bottom 60 percent of the population classified in terms of wealth is actually connected to a network as discussed in chapter 6. So it would be useful to get a sense of how affordable services are for those who are not connected to networks and have to rely on alternative providers instead. Unfortunately, there is not much information available on the affordability of water services for the poor not connected to networks and this represents a very large proportion of the population according to the data presented in chapter 6—again, at least, 60 percent of the population.

A study by Kariuki and Schwartz (2005) provides, however, a useful sense of the differences in water prices charged by a wide range of providers. The authors found a wide variation in prices between different small-scale providers, within each category, for different locations. While prices charged by small piped-network operators are not dissimilar to those charged by the utility, unit prices for nonnetworked services can increase several fold with the highest prices being recorded for mobile distributors (tankers and carters). In Ghana, for example, the price of water increased several fold as it moved along the supply chain (e.g., the water utility sells water to a tanker who sells it to a private individual with storage tank who in turn sells to a carter who delivers water to households in jerricans).

Much Higher Cost of Service for Those without Access to the Network

A case study from Niger shows clearly that the cost of service tends to be much higher for those without access to the network. As explained by Bardasi and Wodon (2008), for those connected to the network, the price of water in Niger is set to cover all costs plus a markup. The private distributor SEEN declares the operating price each year, that is, the average price per cubic meter of water sold at which the company is able to cover its costs as well as earn a margin representing its profit. As shown in table 7.1, the price charged by the operator per cubic meter is lowest for households consuming less and for public fountains. However, while

Table 7.1 Unit prices and average consumption by main source of water, Niamey

Main source of water	*Average price (FCFA/m³)*		*Average household consumption (m³/month)*	*Average per capita consumption (m³/month)*	*Average household consumption (L/day)*
	By source	*By consumer*			
Piped water connection	182	182	30.6	5.2	1006
Private, exclusive, not sold		176	26.9	3.4	883
Private, exclusive, sold		184	32.9	4.3	1082
Private, shared, not sold		186	32.3	8.3	1061
Private, shared, sold		186	33.6	5.3	1106
Fountain	534	545	6.7	1.0	222
Vendors	926	848	6.8	1.1	223
Neighbors	591	496	6.4	0.9	210
Wells/river	250	202	8.9	1.1	292

Source: Bardasi and Wodon (2008).

the price of network water is regulated, the price of water resold at public fountains by the private operators of these fountains is not. This is important because even in the capital of Niger, Niamey, the poor tend not to have access to piped water.

According to data collected in 1998, in the city, more than 55 percent of households did not have access to piped water in their dwelling, 21 percent shared the connection with other households living in the same dwelling, and 24 percent had a private connection of their own. A private connection was strongly correlated with wealth—while none among the poorest 20 percent of households had a private connection, 65 percent of households in the top quintile were connected. Out of the 55 percent of households without connection, only 2.8 percent were in the top quintile, versus 38 percent in the bottom quintile. The main sources of drinking water for the poor were vendors and public fountains. Provision from vendors was especially important for households in the three bottom quintiles. The very poor (those in the bottom quintile) also relied on water from public fountains, while almost no household in the top of the distribution relied on this source. Although water bought from the neighbors did not represent a substantial share of consumption overall, 10 percent of the households in the bottom of the distribution used this source as their main option. Also, more than 10 percent of the very poor (those in the bottom quintile) relied on water from rivers and wells as their main source.

A detailed analysis of the survey data (see table 7.1) showed that piped water provided through the network (at an average of FCFA

182 per m^3) was by far the cheapest source, while water from vendors was the most expensive. Despite the fact that the agent in charge of the water fountain benefited from the social tariff (i.e., the agent paid the same social tariff to the utility as that paid by households who consume less than 15 m^3), the actual price paid by the consumers of fountain water was much higher—about 3 times as high as the average price paid for piped water, not all of which was sold at the social tariff. Even more expensive were the buckets of water bought from vendors (*porteurs d'eau*) at an average of 5 times higher price than the average price of piped water.

As a result, the poor paid the highest price for the water they consumed while having the lowest consumption levels. On average, poorer households—most of whom did not have a connection to the network—consumed much less than 15 m^3/month, which was the threshold of the lifeline in the network, yet they had to pay a much higher price for the water they consumed than they would have if they had been connected. The low level of consumption of these households could be partly attributed to the high price they faced. Furthermore, the better off who were able to pay for a connection to the water network often benefited from a subsidized price (at least for the first 15 m^3 sold at the social tariff), and they could also make a profit by selling part of their water to households who were not connected (about one-third of households with a private connection sold part of their water). In table 7.2, the highest average price paid for a cubic meter of water was paid by households in the bottom quintile (FCFA 645 per m^3) while these households again had the lowest consumption level (6.3 m^3 per month). Price steadily decreased while consumption steadily increased with the level of wealth.

Table 7.2 Unit prices and average water consumption by quintiles of wealth, Niamey

Quintile group	*Average price (FCFA/m^3)*	*Average household consumption (m^3/month)*	*Average per capita consumption (m^3/month)*	*Average household consumption (L/day)*
1	645	6.3	1.1	206
2	541	13.2	2.6	435
3	509	18.7	3.8	614
4	422	20.3	3.2	668
5	249	29.4	3.8	965

Source: Bardasi and Wodon (2008), based on data for 1998.

The Less "Formal" the Access, the Higher the Cost

The evidence from the Niger case study as well as that provided by Kariuki and Schwartz (2005) implies that the less "formal" the system on which a household needs to rely, the more likely it is that the services will become unaffordable and that rationing of consumption of improved water sources will be the norm. The evidence reviewed here confirms that the limitations to access discussed in chapter 5 can have dramatic social consequences for those households who do not have access. At the policy level, as discussed later, this calls for a much more decentralized and detailed monitoring of the behavior of infrastructure suppliers. But since a close monitoring of all microscale providers is unlikely to happen, one of the most effective policy instruments is likely to be the promotion of competition at all levels in the supply chain. The larger the number of small actors, the closer the price charged by the resellers is likely to be to the price these resellers pay their own suppliers.

Summing Up

The message on affordability may seem a bit confusing. Putting the numbers together should make it crisper. Many users who are connected to a network do not have a major affordability problem under traditional measures of affordability based on the share of total expenditure allocated to water or electricity. However, because many households in Africa are so poor, the trade-offs imposed to households in order to meet their basic infrastructure needs remain difficult, and many households not connected would have a hard time meeting the cost of basic infrastructure needs at full-cost-recovery prices.

The users who are not connected often do have a major affordability problem when they rely on alternative service providers due to the high cost of those alternatives. They address those affordability problems by rationing the services they consume. Most of the population is not connected to utility networks and, although this was not discussed here, probably only a third has access to transport services to attend to local needs (e.g., to benefit from education or health services). The households not connected or without access tend to be among the poorest income groups, and the fact that these households lack connections has consequences for a wide range of areas related to the MDGs, as discussed in Part I of the book.

The majority of Africa's population, thus, has an affordability problem for utility services and many also lack affordable transport services. Even if these are very rough orders of magnitude, these figures hint at a major problem with the idea of relying on private operators concerned with full cost recovery without any subsidy component in the region. The usual argument that consumers are already paying unit costs for most of the services does not hold considering that one of the objectives is to remove the very drastic degree of demand rationing that tends to prevail in the sector, in particular, among the poor—that is, an equivalent water bill buys a much lower volume of water when the household is not connected to the network. Very close to the top, if not at the top, of the challenges that the next wave of infrastructure reforms for Africa face is the need to recognize that while the consumption levels Africa can hope for in the next ten years may not be the same as those in other regions even with improved access, the current level of rationing is not sustainable either under a system in which a large share of the population has no access and has to pay high unit costs for the little that they consume.

CHAPTER 8

Are Quality and Production Costs a Problem?

This chapter gives a rough sense of the level of the quality of infrastructure services in Africa. An assessment of quality is indeed an essential complement to the discussion of access provided previously. Access to water or electricity 4 hours a day is very different from access 24 hours a day both for households and for the investment climate that affects firms' decisions. Access to well-maintained roads implies very different transport costs than having to rely on poorly maintained roads. Quality should thus be part of any assessment of the state of infrastructure in Africa. The chapter also looks at the available evidence of the cost efficiency with which services are delivered. If financing needs are to be minimized and tariffs aligned with the ability to pay, cost minimization should be a top concern for policymakers.

The chapter presents information available from comparable sources on the various dimensions of quality for each sector. It starts with snapshots of information and continues with a discussion of the evolution of some of the quality dimensions in the last two decades. The last section summarizes the evidence available on the economic and cost efficiency of the infrastructure sectors. It may be worth pointing out that what this chapter does not show may be as important as what it does show. Indeed, it is unfortunate that very little of the data used in this chapter (except maybe for telecom sector) seems to be reliable simply because quality is not measured properly and if it is, its measurement is not reported, thereby reducing the accountability of providers and regulators. It is quite symptomatic that the data generated by the AICD study mentioned earlier does not really address quality. The conclusions that can be generated from the data available must thus be

taken with a significant degree of caution, except for the fact that poor accountability for (poor) quality seems to be an undeniable trademark of infrastructure sectors.

Is the Nonresidential Demand Being Met?

While in general, the book is concerned with the needs of the household, it is also useful to try to see if nonresidential needs are met or not. This is interesting because data on nonresidential quality levels tend to be easier to find than data on residential quality and in most developing countries, if the nonresidential needs are not met, the odds are that residential needs are not met either. In other words, if we find a nonresidential concern for quality, it is very likely that we have a residential quality problem as well.

The focus is on the information available on the investors' satisfaction with their access to infrastructure. Somewhat unsurprisingly, most of the evidence available comes from assessments of infrastructure as an impediment to foreign investment in the infrastructure sectors. As in the case of the growth literature, there are unfortunately very few published or at least widely disseminated results on the importance of infrastructure for Africa specifically. Two main approaches have been followed to assess the needs of investors: econometric analysis and survey-based analysis. The econometric literature has tended to focus on the lessons from the past. The survey-based analysis has tended to assess the needs with a view to assess the potential for investments looking to the future. Both viewpoints provide useful lessons.

How Much Do Investors Really Care about Infrastructure?

A large share of the literature on Africa has tried to assess why the region has been so much less successful than other regions in attracting private investment. Asiedu (2002) has been one of the most systematic analysts of the topic and has tested most of the plausible assumptions in her research. In an analysis covering the 1988–1997 period, she tests the extent to which infrastructure may matter differently to Africa and other regions; she approximates infrastructure by access to telecom services because there was then little data for Africa on other infrastructure activities to generate the sort of tests applied as a standard practice to assess the importance of an activity for FDI. She finds that while infrastructure development promoted FDI to non-SSA countries, it had no significant impact on FDI flows to SSA—ceteris paribus. Morisset

(2000) and Naudé and Krugell (2003) find a similar result when they account properly for the institutional and geographic characteristics of Africa. Yet none of these authors believes their own results. All agree that the relevance of infrastructure in Africa may come about in ways that do not match the norm observed for other regions. In other words, Africa and the way infrastructure matters to investors in Africa may be different from other regions.

Are Africa and African Infrastructures Different from Other Regions?

The impression of irrelevance of infrastructure sometimes covered in the literature has three explanations. First, the proportion of FDI going to natural resources—mainly extractive industries—is much larger in Africa than in other regions. These investments tend to require fairly specialized transport infrastructure such as pipelines for oil, rail for many minerals, which are not picked up by the proxies used by these authors. Second, many of these investors have long given up on the provision of services by the public network providers and have tended to rely on autonomous infrastructures—own generators, satellites, and so on. Again these are usually not picked up by comparable cross-country statistics and hence not reflected in the cross-country assessments of needs. Third, what investors want is more of an infrastructure platform that bundles together a package of services consistent with the needs of modern production. This is certainly true for investors concerned with exports where the logistic chain includes all components of the platform to ensure quality of services delivered just in time. Focusing only on the telecom sector is bound to be misleading.

In spite of the doubts raised by the lack of precision with which infrastructure has to be modeled, the main policy implication of this research may be that Africa may indeed be different, but so is infrastructure in the region compared to other regions. Indeed, the African infrastructure market structure tends to differ from the one observed in other regions—for example, self-reliance as a way of life to avoid rationing by unreliable public providers; areas too large to serve to hope for dense networks, over 70 percent of rural clients, about 50 percent of poor clients. This complexity may be hiding the existence of an effective but frustrated demand and certainly hides the very high costs to the economy of forcing investors to aim at self-reliance. This rationed demand and the high associated costs are better revealed by the forward-looking surveys of actual and potential investors.

Investor's Demand for an Initial Critical Infrastructure Mass

In a study on the topic, Lumbila (2005) contributes to a settlement of the earlier debates with an improved statistical analysis. He shows that African countries with larger infrastructure stocks—unfortunately still only approximated by telephone connections—see significantly more FDI and domestic investment than countries with low infrastructure stock levels. First, this may imply that infrastructure meets the investors' demand but only after a threshold has been reached. Second, countries with more developed infrastructure also see a greater impact of FDI and domestic investment on growth thanks to the effect of infrastructure. However, countries with lower underdeveloped infrastructure see no statistically significant impact of infrastructure of investment on growth. This suggests that not only can the lack of infrastructure be an impediment to more investment, but it can also be one of the dimensions of the poverty trap argument since it seems that a critical mass of infrastructure is needed to convince investors to make the decisions that lead to growth. In these types of countries—the majority of African countries belong to this group—self-sufficiency seems to be the norm to meet demand.

The investors' demand is strong because the cost of poor infrastructure is high. Escribano et al. (2009) provide a systematic, empirical assessment of the impact of infrastructure quality on the total factor productivity (TFP) of African manufacturing firms. They apply microeconometric techniques to investment climate surveys (ICSs) of 26 African countries carried out in different years during the period 2002–2006. For each country, they assess the impact on ten different productivity measures. Poor-quality electricity provision affects mainly poor countries. Losses from transport interruptions and water outages affect mainly slower growing countries. Overall, they argue that infrastructure problems can be blamed for an average drop of about 40 percent in firm productivity.

Of course, not all investors just sit there and wait! It is quite interesting to see that when investors' needs are not being met, many rely on alternative sources of supply. The best indicator of this issue may be in the power sector when investors are forced to rely on their own sources where networks do not have enough coverage or are not reliable enough. Data from investment climate assessments (ICAs) show the extent of the problem for African countries. First, in general the larger the establishment, the larger the odds that it owns a generator

to offset the risks associated with network provision. Second, with the exception of Senegal, few of the countries in the sample compare favorably with countries such as Morocco or even China. Why are producers so keen on increasing their autonomy? Simply because the costs of having unreliable services can be quite significant. The ICAs data suggest that the costs of power losses are equivalent to losses in sales ranging from about 2 percent of total sales to close to 6 percent (in the case of Kenya).

Do foreign investors care more about infrastructure than domestic ones? Moss, Ramachandran, and Shah (2005) analyze the data collected on three East African countries (Uganda, Tanzania, and Kenya), distinguishing between foreign and domestic investors. They find that foreign investors are systematically more concerned with electricity and transport than domestic investors are. Though this is only anecdotal evidence, it is consistent with the traditional vision built-in in the design of policies aimed at attracting foreign investors.

Summing up, from a strict policy viewpoint, three main lessons for Africa seem to emerge jointly from the econometric and survey evidence: (1) nonresidential demand is not being met and energy seems to be at the top of the list of investors' concerns; (2) there is an infrastructure-stock level threshold required for foreign investors to start investing in activities other than those related to natural resources; (3) while foreign and domestic investors share some concern with respect to infrastructure, their demand can be different and hence designing an infrastructure to cater to the foreign demand may leave some of the domestic demand unmet—in other words, if the policy is to promote domestic investment, that is, promoting small and medium corporations, it may be worth conducting a differentiated assessment of infrastructure needs per investor type to assess the level and sources of differences.

The Dimensions of Quality and Efficiency

Quality Indicators: Technical versus Service Orientation

Quality has several dimensions. The most widely reported measure is technical quality. It includes partial productivity indicators (i.e., output/employees or per connection), water or energy losses or outages or phone faults. This is a fairly objective measure that raises few issues—although their measurement is often quite uncertain. Additional indicators focus on the quality of the administrative and commercial management of

the infrastructure sectors and cover activities such as budget execution or bills collection effectiveness. But there is also another much more subjective measure of quality. It deals with the service orientation of the quality. This can focus on relatively objective information such as number of clients per employee but it is often much more subjective. Service orientation quality is usually generated from perception surveys—for example, the global competitiveness report or the investment climate assessments.

Cost of Quality and Economic Efficiency

While these quality concepts are useful, they do not address the crucial importance of costs minimization in a sector in which cost padding is known to be quite common—and not just in developing countries.[1] Cost padding hurts the poor because it contributes to the mismatch between the ability to pay and the tariff required to recover costs. It usually also hurts the taxpayers because the financing gaps that operators can't recover from users tend to be recovered from taxpayers. This assessment of costs is not independent of the assessment of quality to the extent that quality has a cost and that this implies that quality choices have to be made in ways that internalize the necessity to deliver services that meet the users' ability and willingness to pay. Indeed, quality costs hurt any user when there is an excess supply of quality. Until not too long ago, the Concorde provided much higher transport speed than alternatives, but few were able or even willing to pay for it; as a result, demand never reached the level needed to maintain the airplane's financial viability. Similarly, providing a service quality associated with costs that would result in tariff levels inconsistent with the ability to pay would keep many of the poorest looking for alternative solutions to their infrastructure needs—and in the process hurt the operators. The policy solution to this problem boils down to a match between the technology choices, the users' ability and willingness to pay, and the design of the tariff structure. This goes beyond the discussion covered in this book.[2]

There is a second way in which broadly defined quality can result in excessive costs to the users. This is when the service providers pad costs for a given level of quality by charging tariffs that represent very high profit margins for the service delivery.[3] Such cost padding hurts the poor proportionately more. Controlling the risks of cost of padding and ensuring that quality and overall service delivery are consistent with the users' willingness and ability to pay are the main purposes of the

introduction of economic regulation in environments in which operators enjoy long-term residual monopoly powers. The main instrument available is to measure the extent to which the services are delivered at the lowest possible cost throughout the duration of the contract, for a given quality level—recognizing that technology and know-how can improve to allow a steady flow of cost savings opportunities.[4] This is what cost efficiency estimates show. This chapter provides a brief survey on the evidence on Africa's infrastructure performance in terms of these economic measures of cost efficiency.

A Snapshot on Quality

The latest World Economic Forum's Global Competitiveness Index (2012–2013) confirms that inadequate infrastructure continues to be one of the main reasons why Africa remains the least competitive region globally. Inadequate infrastructure is cited as the third most-serious constraint to doing business in the continent (only behind finance and corruption). But most of this information is subjective as it is based on interviews. The latest, more objective technical information available on the quality of infrastructure services is provided by the AICD study. Foster and Briceno-Garmendia (2010) offer a detailed overview of many background studies. Their conclusions can be synthesized as follows. Mismanagement of infrastructure can be observed in a few key dimensions.

Misallocation of resources: This implies use of scarce public resources to fund activities that could be funded by the private sector; it is costing Africa about 7.3 percent of their current infrastructure spending or roughly 3.5 percent of their needs.

Incomplete execution of budgets: About a third of budgets allocated to infrastructure are lost in institutional and bureaucratic capital budgeting processes. In other words, about 30 percent of the investment needs in some of the infrastructure sectors could be addressed by more effective disbursements policies. Roughly, 2 percent of the needs could be financed by fixing this problem.

Undermaintenance: Besides the tough physical experience of road traveling and the frequency of water or electricity service interruptions, the best evidence of undermaintenance are the high level of expenses needed to rehabilitate. Roughly, 10 percent of the total expenditure needs of the road sector could be saved if road maintenance worked better.

Poor technical and commercial management: Unrecovered utilities bills (10%–30%), undercollection of roads funds contributions, and service interruptions are all facts of life in most countries of the region.

Overstaffing: Infrastructure does not escape the extensive use of the public sector as an employer of last recourse (overemployment varies between 20% and 80% across sectors and countries).

Ignoring underpricing and failures to recover costs, these quality problems in the management and operation of the sector are equivalent to a 20 percent tax on the actual expenditures in infrastructure. This implicit tax is the highest in the power sector where it reaches about 30 percent. The problem with this tax is that it does not do much to finance any public sector expenses. The implicit tax is simply a rent benefiting some operators and some employees.

The emerging overall picture from this diagnostic of quality is summarized in table 8.1. The average cost of quality problems is high but it clearly hurts electricity a lot more than the other sectors. The table also shows that the main drivers of the total additional costs vary significantly across sectors. Capital budget execution problems, for instance, are more important for irrigation and transport than for the other sectors. Operational and commercial inefficiency is about twice as large in electricity as it is in the other sectors, and is its major problem.

The fact that the infrastructure quality continues to be a matter of concern can also be seen in the combined AIDI index produced by the AfDB. It is a useful complement to all of the other studies in that it combines quantity and quality indicators. The AIDI is based on nine performance indicators covering the four key infrastructure sectors. For roads for instance, quality is represented by including both total road network and paved roads. For W&S, it focuses on access to improved

Table 8.1 Cost of quality problems as a share of total actual expenditures

Infrastructure sector	*Operational and commercial efficiency (%)*	*Capital budget execution (%)*	*Cost recovery (%)*	*Total costs (%)*
Electricity	29.3	1.7	19.8	50.9
ICT	13.3	–	–	13.3
Irrigation	–	11.1	–	11.1
Transport	11.7	8.0	3.7	23.5
Water & Sanitation	13.0	2.6	23.4	29
Total across sectors	16.5	4.0	10.4	30.8

Source: Authors' calculation based on AICD data.

sources and facilities. For ICT, it reflects the access to broadband rather than just the Internet, for instance. On a scale of 0–100, the composite indicator is 100 when the performance access to quality infrastructure is ideal.[5] In a snapshot, it allows countries to compare their progress in time and in comparison to other countries. Although most countries have somewhat progressed, rankings have largely remained stable and there is still an obvious significant difference in overall performance between the top three countries (Seychelles, South Africa, and Mauritius) and the other countries. The poorest and the most unstable countries have also suffered from continuous poor performance.

Quality and the Poor

Information on Quality from Household Access Data

Household surveys provide very limited data on quality indicators for access to basic infrastructure services. We do not know, for example, for how many hours per day a service is available, or whether other issues plague the provision of services to the poor (these issues may include long delays for connection, cumbersome procedures and administrative rules to obtain access, poor service quality in general, etc.). Yet some indicators of quality can be obtained from the access data themselves. For example, the share of access to improved water sources that is obtained from piped connection within the dwelling of a household can be estimated. When such indicators are used, the "quality" of access to water is as expected much lower for households in the bottom quintiles of wealth than for better-off households, and there seems to be very little improvement over time in this indicator of quality.

Satisfaction with Infrastructure Services in Household Surveys

In a number of household surveys, we also have information on the satisfaction of households with a range of public services. Typically, satisfaction rates with the quality of public services is low, and especially so among those who are poor (as measured through their consumption level compared to a poverty line) or feel poor (as measured through self-reported measures of subjective poverty). For example, in a 2001 household survey for Senegal, the only public services for which users expressed moderately high levels of satisfaction were drinking water, basic-needs retail stores, primary schools, and televisions centers, but even then, close to half of the users declared not being satisfied by the services

received. Satisfaction rates were below 50 percent with respect to public transportation, secondary schools, health centers, and maternity services. Satisfaction rates among nonpoor households were systematically higher than those among poor households by 5–10 percentage points, and satisfaction rates among households who did not feel poor were also higher than among households who felt poor by 10–20 percentage points. In other words, apart from the fact that overall levels of quality in service provision are low, the quality of services, including infrastructure services, is lower for the poor than for the nonpoor.

Are Cost Levels an Issue?

A common impression not unique to Africa is that in many instances, policymakers with a budget constraint tend to react to that constraint by asking for money. A common response is to improve cost recovery. This is very clearly likely to be a top priority in the reform agenda for most sectors in most countries. Cost recovery achieves not only financing objectives, but also signaling objectives for both users and operators. Operators inform their investment decisions on the information they have on the willingness to pay and on the commercial losses revealed by the total level of cost recovery. Users also adjust their consumption levels and their waste of resources to the cost it represents to them. When access to services is scarce as it is in Africa, demand management is an important policy dimension. However, it is not an easy one as seen for one of the few sectors for which information is available. Based on the information from a sample for 27 water utilities collected by International Benchmarking Network for Water and Sanitation Utilities (IBNET), the average recovery rate for operational expenditures between 1997 and 2002 was around 18.5 percent. The fact that cost recovery is a major issue does not make it the only issue. Indeed, one of the most successful areas of improvement widely recognized—and clearly documented in the 1994 World Bank World Development Report—is the need to look for cost savings to reduce the financing requirements and close the gap between ability to pay and the demands of cost recovery.

While quite intuitive, the search for cost savings seems to be just as difficult to implement as the effort to improve cost recovery, in particular in regulated industries owned by the government. Political pressures and other constraints can make the option just as politically unrealistic in some instances as the quest for improved cost recovery. It is, however, useful to try to get a sense of what these potential savings are. This

quantifies the financial costs associated with political constraints that impede cost minimization or cost recovery. Equivalently, when reforms, which may be designed to improve the cost and the recovery performances, including increased private sector participation, are considered, it provides an estimate of the possible gains from the reforms. Being able to correctly assess the potential for cost savings is, however, not an easy task. Data is once more an issue. Few African countries enjoy a good tradition of public sector accounting or accountability, whether the operator is public or private. This is why approximate solutions need to be relied on. The following is an overview of the rough approximations available on costs padding in infrastructure services in Africa.

How to Roughly Assess If Costs Are Excessive?

There are two major approaches to assess the extent to which costs are excessive. The first is based on detailed project-level information available for each individual project. The second approach to assess the scope for cost savings is based on analytical assessments of performance at the sector level, ideally in terms of costs. This second approach is the one adopted by the AICD study and will not be repeated here. But additional information at the sector level based on the production performance is worth considering to get a sense of excess sector-level costs and will be discussed in this chapter with an overview of studies on economic measures of performance in the sector derived from estimates of economic production and cost functions.

What Project-Level Information Can Teach Us about Costs

Project-level information is not too hard to come by, including for Africa. Aid agencies are indeed a useful source of information of project-level data. The projects they finance tend to be approved by boards, which generate a de facto ex-ante audit of costs. Many of the aid agencies also have evaluation departments, which generate ex-post audits. For any given project, the comparison of the ex-ante and ex-post performances provide information not only on the level of cost overruns but also on cost underruns—which tend to reflect disbursement problems. While a cost overrun may simply reflect changes in the environment in which a project is being implemented, it could also reflect a tendency of operators—sometimes in collusion with governments—to pad costs once they have won the contract. Contract renegotiations that result in higher costs for equivalent commitments appear, indeed, to have become

the norm in transport and W&S sectors around the world—much less so in telecom and electricity sectors though. The detailed study of infrastructure concessions experiences in Latin America by Guasch (2004) shows how common renegotiation in infrastructure can be. For Latin America, 75 percent of the water and transport concession contracts were renegotiated with cost increases as one of the most common outcomes. The worldwide assessment of transport projects conducted by Flyvbjerg and colleagues (Flyvbjerg, Skamris Holm, and Buhl 2002; Flyvbjerg, Skamris Holm, and Buhl 2003; Flyvbjerg, Bruzelius, and Rothengatter 2003) in over 30 countries, including developing countries, provides ample evidence on the linkages between renegotiation and cost levels. Both groups of researchers imply that these renegotiations take place because governments tend to trade-off the contracts rebidding transaction costs versus renegotiating costs in favor of renegotiation.

Project-Level Cost Overruns versus Cost Underruns in Africa at the World Bank

A survey of ex-post audits conducted on World Bank infrastructure projects with significant cost over- or underruns between 2001 and 2004 benchmarked Africa's performance against the performance of the rest of the World Bank's borrowers for every sector. The first observation is that few projects are exactly on target—which is not surprising given the high level of uncertainty that tends to be associated with most infrastructure projects in any country of the world—and that projects without the relevant data are more common in Africa than in other regions. The second observation is that Africa has a larger share of underruns than the rest of the developing countries. The ideal explanation would be that project implementation reveals cost savings. This is not the case unfortunately. The large number of underruns is the result of major disbursement problems in the region. Indeed, many commitments endorsed by the board do not get disbursed—often for very good reasons, but these go beyond our scope here.

Focusing on overruns, the data provides useful insights as well. First, the World Bank experience suggests that Africa is doing, on average, better than other regions. Indeed, its cost overruns were roughly 20 percent versus 22 percent for the rest of the borrowers—again there are some explanations, including the composition of loans, that is, works versus technical assistance. This good news is, however, only relative. It does suggest that when cost overruns exist, they increase costs by about 20 percent. Second, the sector-specific information is to be taken

with significant caution for Africa in view of the small sample sizes. It suggests a wide range of experiences across the sectors, and not only in Africa. For Africa, as in the rest of the world, cost overruns tend to be the highest for transport and lowest in the telecom sector (5%).

World Bank projects tend to have three main components: financing of works, purchases of goods, and purchases of services. The works component tends to be the largest one. While it is not possible to decompose the information for the database used to estimate the 20 percent, a smaller sample size suggests that in Africa the overruns tend to come much more from the purchases of goods and services than from works. In that case, the cost of overrun may not simply be about cost padding. For goods and services, cost overruns may also reflect exchange rate fluctuations since a large share of goods and services used in infrastructure can be imported.[6]

Estimating Potential Cost Savings from Efficiency Studies

The most common alternative approach available to assess the potential for cost savings in a sector is an extrapolation from estimates of the economic efficiency performance of the sector. The concept of economic efficiency is, however, much more popular among economists—in particular modern regulatory economists—than among other sector specialists.[7] Many engineers and financial analysts working on utilities or transport have their preferred set of partial performance indicators—output per worker or per machine, number of employees per type of equipment, output or input losses, clients per employee, and so on. These are useful for day-to-day monitoring but can be misleading to use for many regulated decisions on costs—and hence for tariff design. By focusing on specific inputs only or ignoring the multioutput nature of many businesses, it is difficult to get a good sense of the potential for cost savings that can be achieved from a reform of the sector that deals with multiple inputs and outputs simultaneously. Regulators who need a more balanced view of performance generally rely on a synthetic indicator of efficiency changes over the specific period of observation. This synthetic indicator accounts jointly for all inputs—or as many as data allows—and all outputs into a TFP indicator. This approach is now the most common among modern regulatory agencies. Regulators can also rely on techniques to separate the TFP changes into its sources. This allows an assessment of the extent to which changes in costs are due to changes in scale, technology, or the effectiveness with which the operators run their business.

The measure of economic efficiency and its components has been the subject of many academic publications. Unfortunately, few of those studies generate information on Africa—we identified fewer than 20 over the last 15 years and most had a different focus so that it is impossible to strictly compare across sectors or even over time within sectors. Some of the studies focused on efficiency levels, some on their changes, and others on both. Some of the studies relied on a linear programming technique (Data Envelopment Analysis [DEA]) and some on econometric techniques to assess the minimum cost or maximum production that an operator should be able to reach. The various efficiency measures of interest are derived from a comparison of the actual cost or production performance with the estimated "optimal" performance accounting for all inputs available and the diversity of outputs to deliver. The method matters when very specific assessments are needed but for our purpose here, the diversity in approaches is not a major issue.[8]

What Do Efficiency Studies Say about Potential Cost Savings?

Overall, they suggest that production costs are excessive in almost all sectors (i.e., with averages excesses ranging from 15%–45% according to the sectors), with the exemption maybe of the telecom sector where the technological revolution has guaranteed the right incentives to maintain cost-cutting efforts.[9] These are clearly very rough conclusions but this is because most of these studies were conducted with quite rough data. Despite these limitations, these studies provide some unique insights on the cost savings potential in Africa that no other type of analytical assessment has so far generated. The following is a brief overview of studies conducted on each of the sectors.

For electricity, Estache, Tovar, and Trujillo (2008) focused on generation. They documented economic efficiency levels for a sample of 12 operators providing services in the 12 countries of the Southern Africa Power Pool. They analyzed the changes in TFP of the largest operators in each country between 1998 and 2005—relying on a DEA decomposition to identify the sources of the changes in TFP. The results suggest fairly comparable levels of efficiency in the region as well as performance levels, and evolution quite independently of the degree of vertical integration, the presence of a private actor, or the main sources of energy supply. The analysis suggests that although the companies have not made significant improvements during the period of analysis in using their capital and human assets, they have done much better in

adopting better technologies and better commercial practices. Overall, inefficiencies were in the order of 15 percent. Note that no clear correlation could be associated with the adoption of reforms during the last decade and data limitations impeded a more refined assessment of the impact of reforms on efficiency at this stage. Recently, Jaunky (2013) covered the technical efficiency performance of the electric utilities associated with the South Africa Power Pool from 2003 to 2010. The main result of the study is that the performance of the utilities diverged quite significantly with the poorest performance at less than a third of the best performance, suggesting scope for improvement in the cost performance for some of the utilities. It is useful to point out a study of the Nigerian experience that puts a positive twist on the progress that can be achieved. For Nigeria's power sector, Pestana Barros, Ibiwoye, and Managi (2011) show that there was an average improvement in its efficiency performance from 2004 to 2008 and credit it to the reforms adopted by the country, suggesting that improvement is possible.

For the water sector, there are only three detailed studies available (to our knowledge). Estache-Kouassi (2002) and Kirkpatrick, Parker, and Zhang (2006) looked at the differences in the performance of public and private operators and disagreed on whether there was actually a difference in terms of efficiency. The most recent paper by Perelman, Mbuvi, and Witte (2012) is more complete and relies on a better data set. It covers 21 countries equivalent to 60 percent of all countries who participated in a self-assessment and benchmarking exercise in 2006. They find that on average technical efficiency amounts to 70 percent (when output quality is ignored) and 63 percent when service connectivity is added. A quarter of the utilities in the sample had the possibility to increase technical efficiency by 51 percent. Once more, this shows the scope for cost savings in the sector.

In transport, the study of the railways subsector may be the oldest one. Mbangala worked on assessing the performance of the railways subsector for his PhD thesis and updated his dataset a few years later. This allowed an assessment of the performance of 10 African railways operators over a 21-year period, which was published as Mbangala (2004). It showed that cost reductions were likely to have been very modest given that railways efficiency only improved by 1.1 percent between 1980 and 2001. This poor result was in spite of the fact that he had accounted for both improvements in management and improvements in technology. The average efficiency level for the period analyzed was also relatively low at 77.1 percent. Since this covers a long period, it is actually an overestimate because the average performance has deteriorated over time.

Perelman and Mbangala (1997) had already found an average efficiency level of 86.4 percent for the 1975–1990 period for roughly the same sample of operators and with the same methodology. Ignoring this evolution for now, this efficiency level implies—very roughly—a minimum average excess cost of over 20 percent in the subsector if the subsector has continued to underperform as it had until the early 2000s.

The most recent illustration of the approach to assess the scope for improvement is the paper by Trujillo, González, and Jiménez (2013) on the performance of African ports. Relying on data on 37 ports (including some in North Africa) covering the 1998–2007 period, they find an average technical efficiency of 30 percent with a peak in 2006 at 32 percent. They do point out, however, that the upward trend was started in 2004 and that all ports are slowly improving. As in the case of the other sectors, the approach highlights the extent to which progress has been slow, even if there has been progress. Most importantly, it points to the importance of the scope for improvement and as we'll discuss later, the importance of the right market and organizational structure for the sector. Policy matters, and it shows up in costs, across sectors.

Other Ways of Looking at Costs

Once more, the economic approaches are not the only ones to generate information on potentially excessive costs in infrastructure sectors. Engineering data could also help identify cost-related policy issues. This is the case for the road subsector, for instance. Desmarchelier (2005) looks at the percentage of the road network that carries less traffic than the usual threshold used for each technical type of road. This analysis shows the percentage of the network that could have been "overdesigned." Taking these data with all necessary precautions, they nevertheless identify a potential issue since they suggest that some of the investments in the road subsector may not be the most cost-efficient given Africa's traffic level. This is quite surprising in a situation in which budget constraints are high and investment needs to address a wide variety of demand are limited. Indeed, "overengineering" may have long-term payoffs—which is why they may even be favored or even stimulated by donor policies but this may be done at the expense of the absolute size of the network in the short to medium term when resources are limited. A larger lower-quality network may have a much larger long-term growth payoff than a smaller top-quality network if the larger network gets Africa on a higher or faster growth path.

Summing Up

The main overall lesson for Africa from this overview is that quality and costs continue to be an issue in the region. The correlation between quality and access rates may be the most striking. The top performers in access tend to also be the top performers in quality—although there are exemptions. This suggests that when a country has a sector policy problem, it is likely to be multidimensional rather than simply about access or quality. It also suggests that the ideal indicator for access rates should be a quality adjusted access rate, whatever the sector analyzed.

In most countries the infrastructure's policy problems spill over to costs as well. Africa's infrastructure is much more costly than it needs to be—at least based on the very partial information available. There are, of course, multiple reasons leading to high costs. These range from commercial and political risks to circumstances associated with geological or other natural risks. Technology choices may also be an issue in that the quality supplied may sometimes be inconsistent with the ability of the users to pay for their maintenance. This in turn tends to result in high costs associated with the poor maintenance of the assets.

To a large extent, this conclusion echoes the widely quoted assessment of the scope for improvement in infrastructure at the global level conducted by McKinsey (2013). The consulting firm suggests that just keeping pace with projected global GDP growth will require an estimated US$57 trillion in infrastructure investment between 2013 and 2030 (ignoring maintenance and climate adaptation). That's nearly 60 percent more than the US$36 trillion spent over the past 18 years. The main point, however, is that McKinsey suggests that practical steps could boost productivity in infrastructure by as much as 60 percent, thereby lowering world spending needs by 40 percent for an annual saving of US$1 trillion. Africa is clearly not alone in its search for improved efficiency. But the opportunity cost of not doing it is probably higher than anywhere else. And it is higher for the poor than for any of the other population segments, since financing gaps typically translate into investment delays, and those who need to benefit the most from new investments are the poor.

Main Messages of Part II

Some of the main messages of the Part II can be summarized as follows.

Africa's infrastructure market structure is "different" because there are more poor households to serve and a higher share of the population lives in rural areas; there is therefore a larger spread of population and production hubs. In addition, foreign and domestic investors do not always agree on infrastructure priorities, and the priorities are also likely to be different between investors and households.

Many African countries will need a critical infrastructure supply mass before the investment climate is considered favorable by investors, and progress to date in meeting investors' needs has been slow and unpredictable. Measured in terms of the percentage of establishments for which the following factors are major or very severe obstacles for the operation and growth of their business, the average is 22 percent for telecom sector, 25 percent for transportation, and 48 percent for electricity. To put things in perspective, 40 percent of the establishments surveyed list corruption as a major or very severe obstacle. This is a key reason why costly self-reliance continues to be widespread among commercial and industrial users.

Progress in meeting households' demand has varied across sectors. In telecom, water, and transport sectors, Africa has made limited progress, but in electricity and sanitation sectors, it did worse. In all sectors except telecom, access rates are not doing significantly more than catching up with population growth. Progress has also favored the better off more that the poor and the middle class (access rates to networks attend at most to the 40% wealthiest population).

Affordability is an issue for a large number of the poor—over 50 percent of the population—and may have worsened in some sectors during the 1990s. Small-scale providers are closing the infrastructure gaps for households but often at high production costs and at high

profit margins, collected mostly from poor households who are left out of access to the services provided by larger utilities.

The quality of Africa's infrastructure can only be approximated because the data on quality are exceptionally poor, especially at the household level. Still, based on evidence from ICSs, the technical quality performance varies significantly across sectors. Except in telecom sector, catching up with best practice is very slow. Perceptions of quality are low for water and energy and there is not enough data on transport and telecom sectors to have a full picture for the region. In general, the top performers in terms of quality also tend to be the top performers in terms of access.

The assessment of the performance for a large sample of countries in the last two decades hints at the need to assess production and investment costs data much more carefully. Studies find excess costs ranging from 15 percent in energy sector to as much as 45 percent in water. Overengineering of projects when budget constraints are tight may push Africa into lower or slower growth path. Lower costs would help to reduce the financing requirements of the infrastructure sectors. The focus on the need to minimize cost should, however, not distract from the importance of cost recovery to ensure the long-term viability of the sector in terms of its fiscal costs, efficiency, and equity.

PART III

What Did Past Reforms Achieve and What's Next?

This third and final part of the book focuses on the reforms options that were considered and implemented in the last two decades. We first summarize the evidence on the spread of reforms and their types, with a focus on the issues related to PPI and the setting up of Independent Regulatory Agencies (IRAs). We then look at the central role of prices and subsidies as an outcome of these reforms. Indeed, prices and their structures, including subsidy levels and types are central to the affordability of infrastructure services. We show that many of the existing subsidies that prevent cost recovery are not well targeted to the poor, and suggest ways to improve targeting of performance. The concluding chapter takes a step back from the focus on empirical data in much of the book in order to summarize some the directions that the next wave of reforms should consider if the winners of reforms are to include the poor.

CHAPTER 9

Markets, Institutions, and Reforms

This chapter provides an overview of the evolution in the market structures and institutions of the various sectors. The description is partial because it mostly focuses only on two dimensions of market structures and institutions: (1) the extent to which there is some degree of PPI and (2) the extent to which governments have decided to signal their commitment to transparent and accountable regulation by creating an IRA for the infrastructure sectors.[1] In the mind of many, these two reforms have been the most important topic of discussion in policy circles working on the transformation of the institutions driving decisions and service delivery in infrastructure.

The Relevant Dimensions of Reform

Despite their high profile, these may not be the key performance drivers in infrastructure. Indeed, only a small fraction of Africa's infrastructure investment needs were financed by the private sector and everywhere else, the public sector and small-scale operators took the lead in delivering the services. Many other reform dimensions have influenced the infrastructure markets and their institutions—that is, decentralization, separation of rural and urban agencies, restructuring to promote competition, commercialization and governance of public operators, procurement rules, and so on. Readers interested in a more encompassing discussion of the institutional dimensions of reforms in Africa are referred to the detailed discussion offered by Vagliasindi and Nellis (2009).

Their paper is particularly important because it offers an important discussion of the needs to reform the management and operation of public enterprises. Banerjee and Morella (2011) build on their work to

assess the water sector in more details and point to the widespread effort to corporatize the large utilities public sector operators that were not taken over by private operators. This is also an important dimension of the reform of the sector and the interested reader is referred to this source for more details. In many ways, it is the return of an old demand of the 1970s with the hope that governments and donors have learned enough not to make the same mistakes. Poorly designed corporatization and performance contracts including a lot of wishful thinking were widely blamed for the push for privatization in the region at the end of the 1990s.

An additional essential driver of infrastructure performance that deserves some discussion here is the design of procurement rules. Procurement theory has improved tremendously in the last 15 years or so and there is ample empirical evidence to allow the international community to improve common procurement practice. This evidence shows that poor practice has had dramatic consequences for the unit costs in infrastructure sectors as well as for the development of new local private actors in the delivery of infrastructure services. Estache and Iimi (2011) review the distortions induced by overly conservative procurement rules adopted by most international organizations. These include biases against the development of a local capacity in particular in regions in which the local capacity has little historical record to claim when competing with more experienced actors. It also includes the development of a network of consultants and equivalent actors, which ended up importing approaches rather than developing local solutions better matched to local constraints. Finally, it also introduced a bias against small-scale operators, which was eventually overturned out of pragmatism and necessity in many countries with the help of some bilateral agencies.

Looking ahead, improvement in the management of public enterprises and procurement rules should probably be top priorities for any effort to improve infrastructure service delivery and its costs in the region. They are essential because they deal with the main form of service delivery in the region: delivery by the public sector. However, few of the relevant policies were significantly altered in the last 20 years, which is why they are beyond the scope of this book.

Informal versus Formal Evidence

The informal evidence is, as in earlier chapters, based on a systematic assessment of the correlation between the performance of each sector

and the adoption of either one or both of the two policies of PPI and IRAs. The idea is to simply present the stylized facts without much technical assessment of what explains these facts. This is done in the last section, which provides a brief overview of the econometric evidence available on the impact of these reforms. In that context, there is an explicit discussion of the importance of corruption in infrastructure in Africa since it seems to be one of the emerging issues in policy circles, catalyzed by the Transparency International global corruption reports.

Africa's Experience with PPI and IRAs

How Common Are IRAs in Africa?

As of 2013, most countries in the region have a regulator for their telecom sector and about two-thirds already have electricity sector regulator, and more are planning to have one. Where regulators are not in place yet, the sector is usually regulated by the ministry of the sector; what the reforms have tried to achieve is an increase in transparency and accountability to minimize the risks associated with what boils down to self-regulation. A few countries such as Zambia, Kenya, and Mozambique have a regulator responsible only for the water sector. Ghana, Lesotho, Mali, Mauritania, Niger, Rwanda, Tanzania, and The Gambia have a regulator responsible for both water and electricity sectors.[2]

The main purpose of the creation of these agencies was the creation of an independent capacity to regulate the sector. The independence from political interference in decisions, financing, staffing, and planning was widely seen as an essential dimension of the changes that the sector needed to protect users and investors and reduce the abuses of the past that had been blamed for rationing, underfunding, overstaffing, and poor quality.

With the benefits of over a decade of experiences with regulatory agencies, the extent to which they are independent is debatable and not really easy to document since the innumerable papers and reports on these agencies seem to all have their own specific definition of the concept of independence and few report the relevant information on the analytical tools (e.g., the specific regulatory accounting rules needed to ensure a reasonable monitoring of any cost accounting strategic manipulation by the operators and to assess the efficiency performance of a regulated company, as well as the financial models to be used to assess the financial performance of regulated companies or the extent to

which a cost of capital is assessed independently or "imposed" implicitly or explicitly by the regulated company).

Vagliasindi and Nellis (2009) tried to get more detailed information on the tools of regulation through a questionnaire. Some respondents volunteered this information but it was not sufficient to be able to have wide enough coverage. Although the discussion of IRAs goes beyond the scope of this book, box 9.1 provides a flavor of its relevance in the context of infrastructure services but it is mostly there as a reminder that there may still be too much of an effort to import readymade ideas rather than to adapt good ideas to local circumstances to ensure better matches and ultimately better outcomes, in particular for the poor as seen in the initial restructuring in several West African countries (see, Boccanfuso, Estache, and Savard 2009a; 2009b; 2009c; Gualberti et al. 2009).

Box 9.1 What's the big deal about IRA in Africa?

To appreciate the strong push for the creation of IRAs in Africa, it helps to remember the origins of the debate. Two decades ago, when the privatization and related reforms wave started worldwide, a main concern was to reduce the degree of political capture and/or the control of the sectors by corrupt politicians. Infrastructure sectors were among the favorite sectors to create jobs for friends, family, supporters, and voters. Infrastructure prices charged by public enterprises to recover costs were among the least likely to be increased to adjust to cost increases and the upper- and upper-middle income classes were the main beneficiaries of subsidies in the sectors since the others were not connected and were hence not eligible. The fact that infrastructure quality was a constant source of concern was often mellowed by some high-profile, highly mediatized, new investment that would be used to calm the spirits. This lasted until the fiscal costs of this approach had become unbearable.

The solution to deal with the fiscal cost while improving access rates and quality was then to restructure to increase competition and to open up to the private sector. Conceptually, the sustainability of the new model required a commitment to a strong regulatory regime that would fairly address the concerns of the operators, users, and, government/taxpayers. Because there was then a genuine concern with the risk of capture of weak governments by much

better legally and technically equipped operators, most reformers were advised to develop a regulatory capacity that would enjoy institutional and financial independence from the corresponding sector ministry. This independence was to allow more transparency to allow for better accountability. In turn more accountability would minimize the risk of distorted price, quality, and financing issues that the previous model had allowed. Of course, independence was not a sufficient condition to achieve accountability but it was widely viewed, then, as a necessary condition. Most important was the adoption of instruments that would further guarantee accountability. These included regulatory accounting and performance measurement guidelines to allow the regulators to assess the extent to which costs were minimized and the adoption of economic models that, for instance, would come up with average tariffs to be able to generate a fair return to investors while ensuring tariff structures that would preserve the users' ability and willingness to pay, in particular the poor.

The model was clearly inherited from a new Anglo-Saxon tradition championed by the United Kingdom, Australia, and New Zealand since the early 1980s. In continental Europe, until various collective decisions catalyzed the adoption of this very same model as a requirement in network industries, the preference tended to be for politically controlled regulation. Indeed, until the early 1990s, in most European countries, regulatory issues would be dealt with directly between operators and ministers, largely ignoring the huge empirical literature that had, for years, demonstrated the adverse effects of these opaque regulatory transactions.

While the adoption of independent regulatory agencies only became an issue in Latin America when the public opinion expressed concern with the actual degree of regulators' independence, this model seems to always have been a source of conflict in Africa. The evidence seems to suggest that the two main sectors of interest tend to have adapted differently to the changes. For electricity sector, 36 percent of the African countries have created an IRA while only 28 percent have a private operator in their distribution business. For W&S sector, it's the opposite; more countries (20%) have a private operator involved in its distribution while only 12 percent have created an IRA. Electricity has "gone Anglo-Saxon" while water has adopted the now largely

defunct model from continental Europe in which regulation is a bilateral transaction between the operator and the government, without a role for an independent third party. Note that even where an IRA has been created, it does not mean that it is enthusiastically supported by all the actors. There are several instances in which water operators have entered into unhappy contracts with governments in countries that have chosen to adopt IRAs. It seems that the water operators have entered into very tense relations with the IRAs, much tenser than the relation between operators specialized in electricity distribution and their own regulators.

Two main lines of explanations seem to emerge from the debates on the necessity or not to have IRAs. The first is against the IRAs because (1) water is different from other sectors, in particular if services are delivered under an affermage contract and does not require an agency; (2) the creation of an IRA does not address the governance issues it claims to be addressing. In favor of IRAs there are a couple of facts. First, when operators are monopolies, for as long as analysts have documented their performance, they have tended to abuse their monopoly power when not controlled effectively; since the odds of capture of ministers are high, IRAs can help reduce the risks of monopoly abuses more effectively than the traditional continental regulatory model if the commitment to the IRA model is serious—that is, reliable regulatory instruments are developed to ensure fair, efficient, and accountable decisions. Second, IRAs are part of a wider institutional reform agenda. It is a small realistic step toward improvements in the institutional performance of a sector that is likely to take much longer to change than to build a decent regulatory capacity.

The jury on which one of the two positions will prevail is still out!

How Common Are PPIs in Africa?

Private participation as a vehicle for public policy implementation has probably not been as effective as many had hope in the early days of reforms in the mid-1990s and as many still hope for, as the speeches widely reported across the media seem to suggest. Of course, if infrastructure boiled down to the telecom sector, privatization could be

viewed as a success story. The number and the dynamism of the private actors in the telecom sector have simply been impressive. They have indeed connected Africa. The road ahead is still long before victory can be claimed in terms of access to fast Internet connections but all the evidence points to a success story on that front as well in the foreseeable future, that is, when access to electricity would have improved enough. It is not surprising that most of the PPI commitments have been going to the telecom sector, as discussed earlier. The commitments to the energy sector have been growing in the last few years but its needs are still far from being covered. The only other subsector in which the private sector has been quite active is the port subsector (Trujillo, González, and Jiménez 2013).

In electricity, most countries have enacted laws permitting private sector participation, but progress is mixed, with private concessions in Uganda, Cameroon, Cote d'Ivoire, Mali, and Gabon and management contracts in Namibia, Lesotho, Rwanda, Tanzania, Kenya, and Nigeria. The private success story may be the number of independent power producers (IPPs) in the region with over 50 IPPs across Africa. In the W&S sector, some countries have explicit policies for the delegation of water supply services to private operators, including Benin, Burkina Faso, Mauritania, Mozambique, Niger, Rwanda, Senegal, and Uganda but in most of these countries, the large investments are still financed or cofinanced by the government (i.e., the tax payers).

Overall, excluding the telecom sector, less than a third of the countries have managed to get private money in infrastructure sectors in the last five years. The good news is that a third of countries have been able to do so but the real policy challenge is about what to do with those who were not able to attract private investors. These are among the poorest in the world, not just in the region, their needs are huge, and their access to private money may be shrinking. Indeed, there are a few major instances in which the private sector pulled out of the sector, as in the case of Mali as discussed in Estache and Grifell-Tatjé (2013).

Small-Scale PPI

One of the problems with the debates on the role of the private sector is that most of the datasets available tend to focus on large-scale operators yet there are also many small actors happy to deliver services where the large ones are not interested. The number of African construction companies continues to grow and many are working in several countries and not just their home country. The best illustration may, however, be

provided by the water sector. The most basic fact is that only 20 percent of the countries have any significant private sector participation in the form of major contracts with international operators. The four main international actors in Africa are Veolia, Ondeo, Saur, and RWE. They are present in the 20 percent of African countries with significant PPI. In most of these countries, they also focus mostly on—and dominate—the urban market. This means that 80 percent of the water markets are being catered by other providers. In Africa as in other regions, there is indeed a plethora of small-scale providers, sometimes financed from foreign capital, sometime domestic firms, which are taking over an increasing share of the contracts.[3]

A similar story could be told for the energy sector in complementing large public and private providers. Indeed, there are cases of small-scale providers contributing to rural electrification in almost half of the countries of the region. In the early 2000s, they played a significant role in rural electrification in Kenya, Mali, Somalia, Mozambique, and Ethiopia, and accounted for as much as 21 percent of rural households with access to solar powered electricity in Kenya (entrepreneurs), 20 percent with generator powered electricity in Somalia (entrepreneurs), and 12 percent with generator powered electricity in Mali (community organizations).

The Case for a Refocus of Reform Efforts?

The main lesson from this overview may be that it may be a mistake to continue placing privatization at the center of the infrastructure policy debate in this region. Vagliasindi and Nellis (2009) and some of the authors who have used their data are right in highlighting the many dimensions of the institutional challenges of Africa. Except in the telecom sector, in certain transport infrastructures (ports, rail, and airports) and for large energy projects, the large-scale private sector is not that important at the scale of the continent. It may be important in specific countries but not in all of them. The public sector continues to place a major role and the small-scale operators are taking a slowly increasing, yet generally underestimated role in catering to the needs of the populations not supplied by the actors with higher visibility. This segment of the market supply has its own quality, affordability, and sustainability issues that are too seldom addressed as part of the high-profile policy debate. This is an issue because in many countries, these suppliers cater to the needs of shares of the population at least as large as those being served by public and private utilities.

Opening an IRA does not guarantee PPI in Africa. A simple comparison of the shares for IRA and PPI for each sector provides some insights on the interactions between these two dimensions of reform. From the energy sector experience, it should be clear that the commitment to institutional reform has not yet generated the expected private investment payoffs. More African countries now have an IRA than there are countries with private operators in electricity distribution. The experience of the telecom sector is misleading. There are indeed many more cases of IRAs than cases of private fixed line operators. This is because (1) many African countries have favored corporatization over privatization and (2) the mobile business has been the main entry point for private operators in most countries.

And, PPI does not always require an IRA! The various sectoral experiences, and in particular water, suggest that IRAs are not necessary to attract the private sector in all cases since a larger share of countries enjoy private operators than IRAs. The risks are not the same. The need for regulation is lower for transport activities than for water since intermodal or intramodal competition tends to be important in transport while the residual monopoly power continues to be strong in water, in particular urban areas, where alternatives tend to be much more costly.

In sum, the overview of the institutional incoherence of the reforms should not be a total surprise and is coherent with the evidence available on a broader set of reform experiences. In a recent book, Andrews (2013) provides a useful, very broad coverage of the reasons why efforts to change the rules of the game in developing countries, however crucial these changes are recognized to be, often, fall short of their anticipated outcomes. His point is that reforms are generally enacted as oversimplified and overspecified "signals" and these excessive simplifications and specifications may be what leads to failure because they ignore the context. They try too hard to imitate preestablished forms of best practice, often prepackaged by international consultants happy to sell bright ideas, but with little time to think about the implementation challenges. Ideas end up superimposed on structures that fundamentally do not change. The signals of reform are there to convince the external actors but fail to do much to change the core institutions locally. Spending a lot more time on the adaptation of the good ideas should be the way out. But that requires time and since time is money, the supply of the technical assistance needed to adapt is rationed. The best way to see how important it is to take the time to do the right thing may be seen in the review of the evidence available on the impact of these changes on the key indicators of relevance to the poorest-income classes.

How Do Reforms Correlate with Access, Quality, and Equity?

The next few sections are intended to provide a very broad overview of the evidence available on the impact of reforms on three of the main policy concerns of most policymakers. The idea is to provide a very simple sense of what a basic statistical analysis rather than an assessment trying to establish causality would reveal on the topic. It is important to consider these data since they provide the basis for many of the advocacy debates on the sector and are broadly used to fuel ideological discussions. The next section will discuss more analytical evidence.

Access Rates

With respect to access rates, Estache and Goicoechea (2005) looked at whether reforms until 2004 had been associated with better access rates in Africa. A few findings stood out with longer-term implications. First, in any sector, all the countries that had engaged in both reforms had done better. Second, all of the deteriorating countries were countries that had not adopted any of the reforms. Third, if only one reform had to be chosen, there was no obvious superiority of one over the other and more detailed analysis is required to get a more precise answer. But once again, keep in mind that these conclusions have to be considered as only impressions. Although they do not represent evidence of causality but simply a statistical observation, they match many preconceptions.

Efficiency and Quality

Estache and Goicoechea (2005) also look at the association of reform with the evolution of quality. The main message emerging from the analysis is that trying to match performance with reform is not clear-cut. Indeed, for the two sectors for which quality can be approximated by a reasonable indicator, that is, electricity and telecom, the emerging story is a mixed one.

For electricity, as indicated earlier, the average performance measured in terms of transmission and distribution losses has not improved significantly for many countries, except those that have escaped a conflict situation (as some of the largest Lusophone countries). The most surprising fact, however, is that the countries with a deteriorating performance include not only countries that have not reformed but also countries that have adopted an IRA, PPI, or both. In fact, the improvements in

performance have been higher for ending a conflict than for introducing a reform. Two facts are worth keeping in mind. First, country-level losses tend to be measured poorly in Africa and hence the results presented here need to be considered with a touch of caution. Second, it is not unusual that the introduction of an IRA is associated with a deteriorating performance, simply because performance and in particular faults tend to be measured better by an independent regulator than by government agencies, which tend to regulate themselves.

For telecom sector, the story seems to be even stronger. Indeed, countries in which quality has deteriorated are countries that have adopted at least one of the two reforms. The fact that the worse performing is a country in which the only reform adopted is the creation of the IRA hints again at an issue of data quality. Anecdotal evidence for this sector also suggests that one of the major potential benefits of the introduction of a regulator is that outcomes get measured better. For most sectors, the easiest performance indicator to improve is the one that deals with quality. There are thus two possible interpretations to the few cases in which quality has deteriorated in spite of the adoption of reform in this sector, which has been pulled by an exceptional technological revolution: either reforms hurt or institutions take their monitoring job more seriously!

The proxy used for the water sector is not a great one. In order to be able to track down the evolution of at least some quality dimension, the focus has to be on the share of people with access to water who have no choice but to rely on nonpiped sources. Any increase in that share is considered to be a deterioration of quality. Once more a mixed story emerges. While most of the countries with deteriorating quality have not adopted any reform, one of the deteriorating countries is one that created a regulatory agency. Also, the best performing country in terms of improvement in quality is one that adopted neither of the two most common reforms during the period of assessment. So once more, no clear story emerges on this front for this sector.

Distribution of the Effects across Income Classes

The distributional impact of the reforms is not an easy issue. A precise assessment of the issue requires a lot more data than available. But when using data available from DHSs for services such as electricity, piped water, and improved water sources, as mentioned in chapter 6, there has been an improvement for electricity, but less so for water and toilets.[4] For example, for piped water few gains have been achieved for

the bottom 40 percent of the population. This suggests that the gains in access have not come from utilities in the water sector. For electricity, the story is a much more positive one. Except for the lowest-wealth classes, matters have improved for all income groups, but the largest gains have been achieved by the middle-wealth group.

Reforms to be Credited or Blamed for Changes across Wealth Groups?

There is no recent analysis available but Estache and Goicoechea (2005) provide some preliminary insights for the situation in the mid-2000s. They separated their sample into a series of binary variables according to the following criteria: (1) whether a country has an IRA but not PPI; (2) whether a country has PPI but not IRA; (3) whether a country has both an IRA and PPI; or (4) whether a country has neither IRA nor PPI. The changes in access rates per quintile were then compared for each one of these classifications. The main results of this tabulation can be summarized as follows.

For electricity, IRAs appeared to be associated with improvements for the middle-wealth quintile, even if globally they are associated with lower improvements in performance across wealth groups than for countries who have chosen not to introduce IRAs. In contrast, PPI was associated with increases in access rates for all wealth quintiles while countries without PPI only saw increases in access rates for the wealthiest 60 percent population; the largest increases for both groups of countries tended to favor the middle-wealth groups, although when no PPI was present, the better off saw much higher increases in access rates. Having both PPI and IRA once more tended to favor the middle groups; the poorest and the top quintile were better off in countries in which government adopted only one of the two reforms. Countries that adopted neither of the reforms were associated essentially with no impact at all on the bottom 60 percent of the population, with most of the increases accruing to the wealthiest, top 20 percent of the population.

For water, the introduction of IRAs had clear benefit for the bottom 60 percent of the population. Countries with and without IRAs saw the access rate drop for the wealthiest 40 percent population, but those with an IRA saw the access rates drop faster—that is, investments started to trail population growth. PPI was associated with no obvious impact for the bottom 40 percent of the population and only minimally helped the middle-wealth group. Countries with and without PPI equally suffered a drop in access rate for the top quintile. The

joint introduction of IRAs and PPI had no significant impact for the bottom 60 percent of the population; it was associated with losses for the top 40 percent of the population. Countries that introduced no reform were the worst performers for the top quintile. There was no clear difference without reform or with at least one reform for the other wealth groups.

Analytical Evidence on the Impact of Reforms

While the above analysis provides some idea of the association between reforms and access rates, it does so in a very partial way and it does not account for complex interactions that take place between policy reforms and various country- or time-specific characteristics. More precise cross-country analytical assessments have been a dynamic area of research in the last decade. This research is a useful complement to detailed country-specific studies that need to be conducted to undertake country-specific evaluations. This section provides an overview of what the economic literature offers on the impact of reforms in Africa. The telecom sector has enjoyed the largest number of cross-country studies while the electricity sector has enjoyed the fewest. Most of the studies tend to focus on different outcome variables. Some focus on access or quality, while others focus on the financial or employment performance of the operators. But overall they still provide useful insights on the potential impact of the reforms.

Evidence of the Impact of Reforms in Telecom Sector

Thanks to the International Telecommunication Union (ITU) database, which has good country coverage (and we only focus here on papers that include Africa in their coverage), the performance drivers of the telecom sector are fairly well known. They cover not only the two policy instruments emphasized in this book (regulation and PPI), but also other issues such as the relevance of the degree of urbanization, the importance of political commitment or the impact of corruption.

For Africa, the most relevant research on the impact of the main reforms can be summarized as follows: (1) privatization tends to speed up coverage and cut average prices; (2) the effect of competition is, however, much more important; (3) good regulation matters to affordability; (4) quality problems get better identified after reform; and (5) the introduction of IRA offsets some of the effects of corruption and of investment risks.

More specifically, the following papers are the closest to explicitly deal econometrically with the impact of reforms in the sector in Africa. Ros (1999) analyzes the engines of network deployment and the efficiency of telecom sector for a sample of 110 countries, including African countries. He finds that ownership is an engine of faster deployment; but with the proxy he uses to assess competition, he is unable to demonstrate if competition matters or not for network expansion. Wallsten (2001; 2002; 2003) has generated more quantitative analytical research relevant to Africa than anyone else and also provided the largest number of insights on what matters and what doesn't in Africa. His most interesting point may be his disagreement with Ros on the relative importance of ownership and competition. Relying on better technique to separate the various effects, Wallsten (2001) finds that competition matters a lot more than ownership. He shows that competition speeds up access rate increases and decreases call prices in Africa. On the importance of IRAs, his research shows that countries that established separate regulatory authorities prior to privatization saw increased telecom investments, fixed phone penetration, and cellular penetration than countries that did not. He also finds that investors are willing to pay for more firms in countries that have established an IRA.

Fink, Mattoo, and Rathindram (2002), covering 1985–1999, find that both ownership and competition matter. Hamilton (2001) shows the importance of open markets for a faster increase in access in a study of the African experience. She also shows that a strong institutional framework can enhance investment in basic telecom sector. Hamilton's result on the importance of institutional governance is reinforced in a study of 147 countries during 1960–1994 by Henisz and Zelner (2001). They find that long-term political commitment to accountability, through the development of systems of checks and balance has a strong positive relationship with growth of main lines per habitant. It also appears to be important to promote incentives for the private sector where the fact that competition is often limited through restructuring arrangements offers many opportunities for opportunistic behavior.

Li and Xu (2004), working with a panel of 177 countries for 1990–2001, find that full privatization improved access and network penetration while partial privatization in the sector shows no such impact during that period. They also find that competition reinforces the positive effects of privatization in the sector. Estache, Goiecoechea, and Trujillo (2004), working with 48 African countries for 1990–2002 find that while there is no significant individual impact of a change in ownership or of the creation of an IRA, both of these policies jointly

significantly contributed to increased access rates. They did, however, also increase residential tariffs significantly in the region. Somewhat surprisingly, they find that the number of faults increased with the adoption of an IRA but this may simply reflect the fact that measurements improved. But when combined with PPI, the creation of an IRA does improve quality, however. Corruption and investment risks offset some of the impacts of IRAs and vice versa.

Djiofack-Zebaze and Keck (2009) find for Africa that competition and regulation are associated with lower prices and improved availability of telecom services, albeit not for all indicators and in all segments. Globally, more competition and commitment to a pro-competitive regime are associated with lower prices in both the mobile and fixed-line segments. Africa still suffers from higher prices compared to the world average, although reforms are starting to pay off, most importantly, from increased competition in the mobile segment. They also find that long-established nominally autonomous regulatory agencies seem to matter for the local fixed-line segment as well as for the telecom sector as whole.

Evidence of the Impact of Reform in the Water Sector

The econometric literature is much less generous in its coverage of the water sector in Africa. Its main messages are that (1) there is no clear indication that ownership matters to costs—estimates suggest that costs may in fact be higher under private operations; (2) institutional variables such as political instability or corruption are significant cost drivers; (3) the creation of a regulatory agency does not guarantee performance improvements significantly different from those that could be achieved by a well-run public operator; and (4) fiscal considerations should be part of the decision making process when designing public-private partnerships.

The specific contributions of each paper can be summarized as follows. Estache and Kouassi (2002) use a database of 21 African water utilities covering the period 1995–1997. They find that the 3 private operators of that sample have higher production efficiency than the 18 public operators. They also find that corruption and the quality of institutions were far more powerful at explaining differences in efficiency levels and water costs. A more surprising result is that constant returns to scale prevail in the sample, which means that there should not be efficiency costs to the community-driven development approach. There is some concern that their results are biased by the sample size and composition.

Kirkpatrick, Parker, and Zhang (2006) show that indeed the earlier research may have been influenced by the timing and the small size of the sample. They rely on a data set of 76 water utilities—of which 10 were private—covering the period 1998–2001. They use various statistical and econometric treatments of the data to assess the cost drivers in that sample and fail to find evidence of a better operative efficiency performance in private utilities compared to state-owned utilities. They also find that regulation has no statistically significant effect. They did, however, find that privatization combined with other institutional reforms such as competition or regulation has the desired effects—in terms of penetration, capacity expansion, and labor efficiency. Privatization is effectively supported by regulation, provided the regulatory regime supports investors' confidence. Privatization with or without regulation has no statistically significant impact on prices.

Estache and Rossi (2005) rely on the same data set as Kirkpatrick, Parker, and Zhang (2004) to analyze first the labor requirements of the sector as a proxy for efficiency. Their main findings are that private and public firms are not significantly different in terms of labor productivity. They also find increasing returns to scale in the African water industry although very modest ones. Finally, they find that the quality of political institutions of the country in which the firm operates appear to be significant driving factors of firms' performance. For every point of increase in the political risk index, the number of employees decreases on average by 5.1 percent. They complement their assessment of the labor productivity case by an analysis of costs. Surprisingly, however, the cost of producing a given bundle of output is now higher for private firms, and the institutions of the country in which the firm operates are not as significant driving factors of firms' performance as in the labor productivity case.

Auriol and Blanc (2009), relying on a theoretical model built around stylized African observations, offer a match of supplier types with client types. They find that the participation of private unregulated firms in the supply of services for the middle class and poor people is fairly common in SSA. By contrast, services for better-off households are provided by public utilities. They also find that piped water (and electricity) are subsidized, pointing to a problem of capture by the ruling elite. This problem in turn leads them to question the perverse incentives in the role of the ruling elites in the design privatization programs. Finally, they show that because of the fiscal loss it represents, privatizing profit centers of public firms entails large social costs in very poor countries.

Perelman, Mbuvi, and De Witte (2012) cannot find robust evidence that independent regulation is positively correlated with efficiency. It is only statistically significant when service connectivity variables are considered. In addition, they test and fail to find a positive effect for the existence of a performance contract. The main determinant of differences in efficiency across countries according to their work is the level of GDP, which can also be considered a proxy for the level of institutional development in the country.

Evidence of the Impact of Reform in the Electricity Sector

Somewhat surprisingly, the power sector is the least covered network of the three utilities for Africa. Most of the published papers focus on case studies and rely on correlation rather than formal efforts to establish causality between reforms and outcomes. Relying on a panel of 51 countries from 1985 to 2000, Zhang and Kirkpatrick (2008) show that competition increases service coverage, capacity expansion, and labor productivity. However, the effect of privatization alone is not statistically significant—except for capacity utilization. Estache, Speciale, and Veredas (2005) complement the earlier results focusing on their database of 48 countries during the 1990–2000 period. They find that the adoption of an IRA significantly improved the quality of service in Africa—that is, electricity transmission and distribution losses dropped—but it did not have a statistically significant impact on access rates by itself. However, when considered jointly, PPI and IRA significantly improved access rates. Corruption did, however, reduce the effectiveness of the IRA in improving quality. Moreover, corruption on its own reduced access rates in electricity—independent of the existence of an IRA or PPI. Ultimately, the main message of this research is that (1) competition helps, (2) regulation helps, and (3) privatization alone does not go very far.

Reconciling the Assessment of the Stylized Facts with the Econometric Evidence

Table 9.1 summarizes the information presented in the chapter. Its main purpose is to draw from the lessons on Africa's experience in terms of the benefits from PPI and IRAs as provided by the two sources of information discussed. The first is an assessment of basic correlations between the existence of reforms in countries and the performance of these countries. The second is the econometric analysis provided by more detailed

Table 9.1 Role of PPI and IRAs in Infrastructure Performance Indicators

Sector	*Analytical method*	*Investments or access rates*	*Quality*	*Average costs or inefficiency*	*Average prices*	*Comments*
Electricity	Statistical correlation	++	++	NA	+	- IRA and PPI work better jointly
	Econometric analysis	++	++	None	None	- IRA and PPI work only jointly - Risks matter
Water	Statistical correlation	?	+	NA	NA	- IRA by itself works - PPI by itself does not work - Overall picture much more complex than in other sectors
	Econometric analysis	?	+	0/–	NA	- Corruption and institutions matter
Sanitation	Statistical correlation	++		NA	NA	
Telecom	Statistical correlation	+	+	NA	–	- IRA matters more than PPI
	Econometric analysis	++	?	–	–	- IRA and PPI work better jointly - Competition is what matters - Politics matter
Roads	Statistical correlation	+	+	NA	NA	- Impact on road density positive only for Anglophone countries and for landlocked countries; negative in other instances

Note: "++": very positive; "+": positive/increase; "–": negative/decline; "?": unclear; "NA": no good information available.

Source: Compiled by the authors.

research. The table considers the implied impact of reforms on investment, quality, costs, and prices. When reading the table, it is essential to remember that there are limits to the way in which performance indicators are measured. In some instances they may focus on capacity, in others on access, and in yet others on some indicator of density.

From the viewpoint of the poor, the main focus of this book, the main interest is to look at the extent to which the changes are of some interest to them. In principle, the increases in coverage should be seen as a positive outcome except that for most sectors, the initial coverage rates were so low that any failure to achieve at least some improvement on that front would have certainly been catastrophic—which seems to be the case for the water sector. Quality has tended to increase as well. This may not actually be a desirable outcome in case the increase in quality is matched by an increase in costs that need to be passed on to tariffs. If these tariffs increase too much, the services become unaffordable. Unfortunately, the information on the impact on tariffs is generally very uncertain and no conclusion can be drawn from the broad messages emerging from table 9.1.

Summing Up

The main lessons from this overview of the statistical and econometric evidence are quite simple and generally predictable as follows:

1. In all sectors, these reforms tend to have a stronger impact when implemented jointly; regulation or competition tends to be much more important than ownership.
2. In all sectors but water, on average, PPI and IRAs have been associated with increases in investments or access rates and quality.
3. In all sectors for which some measure is available, these reforms have also been associated with improvements in quality.
4. The impact on average tariffs has generally not been statistically significant in energy but has been associated with a decline in telecom sector.
5. Very little is known about the impact of these reforms on costs, except in water where PPI has been associated with either no impact or with an increase in costs.

CHAPTER 10

Reforming Prices and Subsidies in the Interest of the Poor

Ultimately, if Africa's poor are to have an effective access to infrastructure services, it will be driven by prices and more precisely by the tariff structure that allocates the recovery of recurrent and capital expenditures not only across users but also between users and taxpayers. Indeed, in many instances, taxpayers will be called on simply because subsidies are unavoidable in many of the countries and for many of the services. Average tariffs need to ensure that all costs are recovered by the provider and when they do not, subsidies will have to close the gap between average costs and average tariffs. The main issue then becomes how to make sure that the subsidies are well targeted and do not send the wrong economic signal, that is, do not lead to over- or underconsumption of a service. These concerns are at the center of this chapter, which looks at both the extent to which the current tariff designs are consistent with the services affordability for the poor as well as the need for cost recovery for the operators. We then look at how subsidies and in particular their design could achieve much more than they do.

What's the Problem with Infrastructure Prices?

There is plenty of evidence that costs are not covered by tariffs. This means that if the users don't pay the full cost of the services received and if the gap is financed directly or indirectly by governments, taxpayers, whether today or tomorrow, will have to pay the difference. It also means that the odds of getting the private sector involved in investing

any of their resources are very low since private operators would never recover their investments with tariffs below costs (on tariffs, see among others Ying et al. 2010; Ajodhia, Mulder, and Slot 2012; Arze del Granado, Coady, and Gillingham 2012; Alleyne 2013). On average in African countries, the underpricing of water adds up to 0.3 percent of GDP but can reach up to 0.9 percent as in the case of Senegal, where it represents about 40 percent of revenues, and has even larger subsidies for electricity.

How bad is the cost-recovery problem? The AICD study suggested that the problem is really serious for Africa. According to its estimates of the potential source of Africa's huge investment needs financing, improved cost recovery was found to have been able to cover close to 25 percent of expenditure needs for W&S and about 20 percent for electricity. Their assessment is quite robust as it is based on a survey conducted in 23 African countries for 45 water utilities.

Komives et al. (2005) provide their own evidence with similar conclusions. The cost-recovery levels are low across regions. They are, however, particularly low in SSA, in part because the tariffs are set at especially low levels in that region and the costs seem to be quite high. For example, for electricity, 29 percent of electric utilities do not have tariff levels that would permit to pay for some operation and maintenance costs for their network, and 71 percent have tariff levels that would enable partial funding for these costs. Overall, in low-income countries, and especially in SSA, there is a clear long-term sustainability issue for the existing networks because of a level of tariffs that is too low in order to cover costs.

What Would Be the Impact of Higher Tariffs on Poverty?

How much would higher tariffs contribute to solving or worsening poverty? Given that the cost recovery for infrastructure services is only partial for many utilities and cross-subsidies are widespread, it is legitimate to ask what the impact on poverty would be if there were an increase in tariffs for residential customers. This impact was simulated for electricity and water tariffs using household survey data from 13 countries: Cameroon, Cape Verde, Cote d'Ivoire, Ghana, Guinea, Kenya, Malawi, Mozambique, Niger, Sao Tome and Principe, Senegal, Uganda, and Zambia. In order to facilitate the poverty comparisons, a relative poverty line was set at 50 percent of each country's mean per capita consumption. Then, the impact on poverty of proportional price increases for piped water and electricity (assuming no change in consumption

patterns) of 50 percent or 100 percent for every household consuming the good was estimated. The impact of these price increases on poverty was computed for the headcount index of poverty, the poverty gap, and the squared poverty gap. As is well known, the poverty headcount provides the share of the population in poverty. The poverty gap takes into account the distance separating the poor from the poverty line, and the squared poverty gap takes into account the inequality among the poor thereby placing a higher weight on the poorest of the poor.

It turns out that the poor on average would not be hurt that much by higher tariffs since they are not connected. The impact on national poverty measures is small, essentially because those who are connected to the water and electricity networks tend to be relatively well off, and spending on water and electricity is limited as a share of total per capita consumption. As expected, the impact is somewhat higher when considering only households who have access to water, electricity, or both. In some countries with better access rates, such as Cape Verde, a higher proportion of the population with access is poor (because the analysis relies on a relative poverty measurement approach), so that the impact is actually substantial. But in many other countries, even if increases are important, it is important that many of the countries start from a low-coverage basis. However, as mentioned earlier, even small impacts may be important when the populations are very poor in absolute terms. In addition, the estimates do not take into account the possibility of ripple effects from the prices paid by households connected to the network to the price paid by households who use other services. As shown below, the prices paid by households not connected to the network tend to be much higher. Because these households often do get their water in part from connected households or public fountains, an increase in prices for water obtained through the network may lead to higher prices all along the supply chain used by the not connected households.

The Case for Residential Subsidies in Africa's Infrastructure

The main lesson so far is that a change in average tariffs would not affect the poor that much since most are not connected. Still, the challenge is to find a way of setting prices in such a way that those among the poor who are connected do not suffer too much, while also ensuring that the poor who could connect in the future can indeed afford being connected. This is why subsidies and their targeting are so central to the debate on service access in Africa.

Part of the rationale for subsidies stems indeed from the fact that households in Africa have limited means to pay for the full cost of service, and the provision of service is known to bring a wide range of benefits (as discussed in chapter 3). Subsidies for residential customers have often been made possible by cross-subsidization between industrial and residential customers, as well as by direct support from governments. In some cases, the subsidies are also maintained at the cost of a proper maintenance of production, transmission, and distribution installations, which then limits opportunities for future extensions of the network. The magnitude of the implicit or explicit subsidies in place tends to be largest for water, but it can also be substantial for electricity.

While prevalent, cross-subsidies are, however, not what they used to be. Historically, one of the most common ways of financing both the expansion of the electricity network and affordability of service for residential customers was to have cross-subsidies from industrial users to the residential users. This has clear perverse incentive effects, which have been widely criticized for quite a while. The ideal solution would be to have targeted subsidies financed from tax revenue. Unfortunately, as discussed in chapter 2, since Africa's tax systems tend to be highly distorted, in many instances it may be preferable to give up a little bit of efficiency to achieve equity objectives by relying on cross-subsidies to keep tariffs affordable. Not all regulators or policymakers chose the same side of this efficiency-equity trade-off. In many countries the costs of serving a residential user is roughly 20 to 50 percent higher than the cost of serving a nonresidential user. If the ratio of the tariff for a residential user as compared to a nonresidential user is in that range, not much can be said of the extent to which there are cross-subsidies between the two types of users. However, if this tariff ratio is higher than 1.5, there is clearly no cross-subsidy since the tariff ratio is higher than the cost ratio. Countries in that group have chosen efficiency over equity. If it is below 1.5, it is very likely that there is a cross-subsidy from nonresidential to residential users, since the ratio is lower than the ratio of the costs needed to serve the two types of clients. Since the ability of residential users to pay is usually lower than that of nonresidential users, countries in that group can be said to have chosen equity over efficiency. This is particularly the case when the tariff for nonresidential users is designed to protect artisans and other small-scale businesses and ensures that larger commercial and industrial users bear the bulk of the cross-subsidy.

Because costs are also driven by the source of energy, that is, hydropower versus others, such an analysis must also account for the share

of hydropower in the energy sources, simply to check if there is some pattern in the behavior toward the efficiency-equity trade-off based on the cost driver. Accounting both for the design of the tariff structure and the technology of production that drives costs, preliminary analysis for a few countries suggests that South Africa and Namibia may have chosen efficiency over equity. This may reflect the ability of the tax system to redistribute resources, if needed. Zambia, Tanzania, and Zimbabwe have tended to favor equity. The choice is unclear for other countries with the required data because not enough information is available on the cost structures. There is no clear pattern on the impact of the sources of energy on the choice in the trade-off between efficiency and equity.

It is also important to realize that cross-subsidies have limits when they are implemented. In many poor African countries, there are relatively few commercial and industrial customers from whom additional revenues can be obtained in order to subsidize poor residential customers. This implies that balancing various interests in tariff design and using cross-subsidization to the benefit of the poor may be difficult. Excessive cross-subsidization and/or lack of proper targeting of poor households when cross-subsidies are implemented can lead to a situation in which a small share of industrial users subsidizes a large number of residential customers. In Côte d'Ivoire, for example, the provision of free connections for water for residential customers during the 1980s was funded through charges imposed on a limited base of industrial customers, leading industrial customers to ultimately exit from the public network (Lauria and Hopkins 2004).

Targeting Performance of Existing Subsidies for Residential Customers

The targeting performance of residential subsidies depends on both connection rates to the network and the design of tariffs and subsidies. Subsidies for infrastructure services are prevalent in Africa as well as elsewhere. These subsidies are, in theory, designed to provide access and consumption at affordable prices for the poor. Yet the analysis to be presented in this section demonstrates that existing residential subsidies for electricity and piped water are very badly targeted to the poor. This is due to both low connection rates among the poor and tariff design issues.

Connection rates are a key factor in explaining poor targeting performance, since subsidies embedded in the tariff structure are accessible only to households who are already connected to the network.

Connection itself depends on access availability in the urban neighborhood or rural village where a household lives, and the decision by the household to connect to the network. Tariff design is the other parameter affecting the targeting performance of consumption subsidies. Under inverted block tariff structures (IBTs), all households connected to the network benefit from a lower price for the lower blocks of consumptions. The share of households receiving at least some subsidy is then equal to the share of households connected to the network. By contrast, under volume differentiated tariffs (VDTs), only the customers consuming below a certain threshold are subsidized through the price at that level. Thus, instead of providing all customers with a subsidized first block of consumption, as is the case in IBTs, VDTs provide a subsistence level of consumption at a lower price, but this lower price is accessible only to those who do not consume more than the subsistence level.

Existing electricity and piped water subsidies are poorly targeted. In order to analyze the extent to which subsidies contribute to making infrastructure services affordable for the poor, and whether they indeed reach the poor in priority, a simple measure of the benefit incidence of the subsidy can be used. This targeting performance indicator, denoted by Ω, is simply the share of the subsidies received by the poor divided by the proportion of the population in poverty. In other words, a value of one for Ω implies that the share of the subsidies received by the poor is proportional to their share in the overall population. If the poor account for 30 percent of the population, then a neutral targeting mechanism would allocate 30 percent of the subsidy to the poor. A value greater than one for Ω implies that the subsidy distribution is progressive, since the share of benefits allocated to the poor is larger than their share in the total population while a lower value of Ω implies a subsidy distribution is regressive. For instance, in a case where 30 percent of the population is poor but obtains 60 percent of the subsidy benefits, Ω would equal to two, meaning that on average the poor are receiving twice as much subsidies as the population.

To estimate the value of Ω, the working assumption is that the price per kWh in the highest bracket of consumption in the tariff schedule can be used as a rough approximation of the cost of providing the service (estimates of targeting performance are actually not very sensitive to that assumption). Based on this assumption, Tsimpo and Wodon (2009a; 2009b) analyze the targeting performance of electricity and water subsidies in about 20 African countries for which data are available. The summary results for the region as a whole in terms of the

Table 10.1 Average targeting performance of different types of subsidies

Sector	*Existing subsidies through IBTs (Ω)*	*Simulated subsidies through VDTs (Ω)*	*Simulated connection subsidies*		
			Option 3 (Ω)	*Option 2 (Ω)*	*Option 1 (Ω)*
Electricity	0.329	0.423	1.180	0.947	0.375
Piped water	0.307	0.384	1.120	0.736	0.349

Source: Adapted from Tsimpo and Wodon (2009a and b). See text for the definition of the three options for consumption subsidies.

targeting performance of existing subsidies through IBTs are provided in table 10.1. Clearly, existing subsidies are very poorly targeted, with the estimates of Ω being not only below one in all countries for both electricity and water, but also often very low.

Beyond estimating the value of Ω it is also feasible to assess the key determinants of its value using a framework proposed by Angel-Urdinola and Wodon (2007). The value of Ω is a function of following five terms, which must be estimated separately for both the population as a whole and for the poor: (1) the access of households to the network (with access measured through the presence of the network in the area where a household lives); (2) the usage rate or uptake of the service among those who have access in their neighborhoods; (3) the targeting incidence of the subsidy or share of households who benefit from the subsidy mechanism among users; (4) the subsidy rate among those who benefit from the subsidy; and (5) the total quantity of the good (water or electricity) consumed by those who benefit from the subsidy. The value of Ω is equal to the product of the ratios of each of those five terms for the poor and for the population as a whole. It turns out that, as expected, the first two factors—the access of households to the network in their area and the usage rate or uptake of the service among those who have access in their neighborhoods are the main factors driving the low values of Ω in the various countries, but tariff and subsidy design also play a role.

Clear messages emerge from this analysis. Consumption subsidies for electricity and water are very poorly targeted in African countries. Several reasons explain this poor targeting performance. First, access factors are important in determining the potential beneficiaries of consumption subsidies. As poor households tend to live in areas without electricity and piped water service, it is impossible for them to benefit from the subsidies. Second, even when there is potential access to the network where the poor live, many among the poor remain unconnected

to the networks, either because they live too far from the electric lines or water pipes, or because the cost of connecting to the network and purchasing the equipment required to use electricity and water is too high. In order to compensate for the negative impact of access factors on targeting performance, good subsidy design mechanisms are required.

Unfortunately, the traditional IBTs that prevail in many countries tend to be poorly targeted. First, these tariff structures spread subsidies among all households connected to the network, since even those that consume high amounts of electricity benefit from a subsidy for the part of their consumption that belongs to the lower-level blocks of the tariff structure. Second, the lower blocks often tend often to be too high in terms of consumption levels to target the poor well. And finally, the differences in unit prices between the various blocks may not be large enough (although this is not the case in all countries).

What Can Be Done to Improve Subsidy Design?

Using VDTs instead of IBTs

Experience shows that reducing the levels of consumption (or "lifeline") that benefits from a subsidy in IBTs often does not lead to much higher targeting performance for the subsidies. One alternative is to instead implement low-volume discounts, as defined earlier. VDTs typically improve targeting performance, as shown in table 10.1, but still not by very much as the values of Ω remain well below one. In other words, there is clearly some improvement, but except in cases such as that of Cape Verde for electricity where access rates are higher, in many cases the improvement is limited, essentially because the neighborhood access and the usage/uptake factors mentioned earlier continue to contribute to weak targeting performance, and moving from IBTs to VDTs does not solve that problem since such a move does not directly affect access and uptake rates.

Proxy Means-Testing and/or Geographic Targeting

Instead of trying to better target subsidies by changing the rules related to the consumption levels that can benefit from subsidies, one could use proxy means-testing or geographic targeting to better identify the poor and allocate the subsidies to them. Under proxy means-testing, a number of characteristics of the households correlated with its level of income, consumption, or wealth (such as the material used in their

dwelling for walls, roofs, floors, and their other assets, as well as other observable characteristics) are used to determine whether the household should be eligible or not for the subsidies. Under geographic targeting, only households living in poor areas would receive the subsidy (geographic location can also be used as one of the parameters in the proxy means-testing system). Many African countries typically have limited capacity to implement sophisticated proxy means-testing or geographic targeting schemes, but some do. In Cape Verde, simulations were prepared to help design a better targeting system that could be used not only for utility subsidies but also for other programs.

Results from this analysis are presented in table 10.2. The first column in table 10.2 provides the share of the population considered eligible for the subsidy. This eligibility rate is essentially a political decision, which can, however, be informed by the measurement of poverty in any given country. In Cape Verde, about 37 percent of the population was considered poor at the time the simulations were done; hence, 40 percent could very well be a reasonable eligibility rate for any specific

Table 10.2 Errors of inclusion and exclusion in alternative targeting systems in Cape Verde

	Geographic targeting using census-based poverty map		*Proxy means-testing using household surveys*	
Share of sample considered eligible (%)	*Error of inclusion (%)*	*Error of exclusion (%)*	*Error of inclusion (%)*	*Error of exclusion (%)*
National				
20	28.63	27.38	19.92	25.86
30	33.08	23.06	24.32	20.01
40	37.35	18.65	28.99	13.84
50	42.00	14.48	35.84	9.27
Urban areas				
20	55.33	12.60	24.07	12.26
30	61.30	10.60	35.11	7.92
40	65.39	8.65	44.41	4.58
50	50.00	6.80	51.94	1.92
Rural areas				
20	22.61	50.68	16.58	43.00
30	25.69	48.23	18.37	37.98
40	28.33	45.64	23.33	34.01
50	30.75	42.87	25.93	28.15

Source: Angel-Urdinola and Wodon (2006). The actual "poor" are defined as those households having per capita consumption below CVE 43,249.80 per capita per year (the official poverty line), which is the case for 37 percent of the population.

subsidy program if its intent were to help the poor. The fourth and fifth columns provide the errors of inclusion (providing subsidies to those who should not get them) and exclusion (not providing subsidies to those eligible) in the population as a whole (rather than only those with access to utility services) under a proxy means-testing system for various shares of the population deemed eligible for subsidies. The second and third columns provide similar results using geographic targeting on the basis of poverty maps constructed using both household survey and census data. While both means-testing and geographic targeting involve errors of inclusion and exclusion, it can be shown that the performance of these targeting mechanisms is in fact superior to that of consumption-based utility subsidies. This is especially the case for proxy means-testing in urban areas where access and usage rates are higher for utility services.

Connection Subsidies as an Alternative to Consumption Subsidies

Connection instead of Consumption Subsidies

Traditional tariff structures assign at least some consumption subsidies through social tariffs or lifelines to a majority or even all residential customers irrespective of their level of well-being. Moving from IBTs to VDTs has the potential to improve overall targeting performance, but not necessarily to satisfactory levels. This is because the subsidies provided under these tariff structures do not solve the underlying issue of a lack of access and take-up rates among the poor. One alternative would be to provide connection instead of consumption subsidies. Assuming that newly connected households are poorer than households already benefiting from connections are, this could lead to potentially high values for Ω (see again Angel-Urdinola and Wodon [2007] for a detailed discussion), especially if the connection subsidies are targeted using proxy means-testing or geographic targeting (or any other way of identifying the poor).

Table 10.1 above provides the potential targeting performance of connection subsidies under three scenarios. First, we assume that connection subsidies will be distributed in the same way as existing connections. This first option (option 1) is a pessimistic assumption from a distributional point of view since it tends to favor better-off households, but it could be realistic if access rates to the network are low. As a second option (option 2), we assume that new connections could be

distributed randomly among households that are currently not connected, but live in a neighborhood where connections are available. As a third option (option 3), we assume that new connection subsidies could be randomly distributed among all households that do not currently have access. This is a very optimistic assumption given that many of these households do not live in neighborhoods where access is available. As shown in table 10.1, and as expected, the value of Ω is largest under the assumption that new connections benefit households that are selected randomly from the population without access (option 3). In all countries, for both water and electricity, Ω is larger than one under this assumption. Under option 2, the values of Ω, while often lower than one, are still much better than those for consumption subsidies. In option 1, targeting performance remains poor. Thus, if connection subsidies could be designed in order to reach the majority of households not connected to the service networks but living in areas where service is provided, the targeting performance of those subsidies would be much better than that of consumption subsidies.

Connection Subsidies Improve Affordability

Importantly connection subsidies have the virtue of reducing the cost of service for households, thereby improving affordability. This was already discussed in chapter 6. In Niger, for example, connections to piped water could enable the poor in the capital city of Niamey to save about FCFA 400–500 per m^3 of consumption, since the cost of water when a household is connected to the service network is much lower than when a household is not connected. Over time, these savings would easily outweigh the subsidy received from the connection itself, which is about FCFA 120,000 for a household located 20 m away from an existing pipe.

Furthermore, as shown in chapter 3, utility connections may improve the household's ability to generate income by reducing time spent (essentially by women) on household chores, and access to utility services is also beneficial to improve a range of social indicators, especially in health. All these factors combined make it likely that at least in Africa where access and take-up rates are low, the benefits to be obtained from connection subsidies will be higher than those observed for consumption subsidies. This does not mean that consumption subsidies should be completely eliminated—rather, one possibility in many countries would be to define lifeline thresholds and tariff structures so as to better target the poor and reduce total outlays for consumption subsidies, and to use

the savings for improving access and take-up rates through connection subsidies, which could themselves be targeted through proxy means-testing or the choice of appropriate geographic locations.

Connection Subsidies Design

While connection subsidies have potential, they need to be implemented well to ensure good targeting and limit costs. In their study on social water connections in Abidjan and Dakar, Lauria and Hopkins (2004) explain how social connections were financed through a Water Development Fund paid for through a surcharge on water tariffs. Unfortunately, poor targeting resulted in 90 percent of residential connections in Abidjan being eligible for the subsidy. In fact, some of the connected households paying the surcharge were found to be poorer than many of the households receiving new social connections. The program suffered from distorted incentives as flat fees paid for each social connection to private operators were an incentive for them to maximize the number of subsidized connections, while at the same time seeking for these social connections better-off households that were likely to consume more water (so that the utilities would reap higher revenues) and were located closer to the pipes (to minimize the cost of connecting). According to the authors, for the poorest households who lived in informal settlements, these distortions may in fact have led to reduced connection rates or at least increase in the time needed for getting connected to the service network. The fact that the social connections required households to own the land on which their dwelling was located also probably undermined the targeting performance of the program. This example makes it clear that for connection as well as for consumption subsidies, good design of the subsidy mechanism is required for the subsidy to actually reach the poor.

Summing Up

Most subsidies provided in SSA for utilities such as electricity and water are consumption subsidies for those already connected to the networks. The subsidies are typically provided through IBTs, so that even well-off households tend to benefit from at least some level of subsidization. The analysis presented in this chapter demonstrates that these subsidies tend to be very badly targeted to the poor, in part because the poor simply are often not connected to the networks, but also because among those connected, a larger share of the subsidies goes to better-off households.

These poorly targeted subsidies have high costs, which often end up being borne by governments in one way or the other. Furthermore, the fact that tariffs do not ensure that all costs are recovered represents a disincentive for utilities to expand their networks. The main issue then becomes how to make sure that the subsidies are better targeted, do not send the wrong economic signal, that is, do not lead to over- or under-consumption of a service, and facilitate network extensions.

Several alternatives could be considered to improve the targeting performance of electricity and water subsidies. One alternative is to reduce the level of the subsidies for consumption, whether this is done by raising tariffs or changing their design, such as shifting from IBTs to VDTs. Because many of the poor are not connected to the networks, and because such reforms need not imply an increase in tariffs for those who consume the least, they would probably have only a very limited negative impact on poverty. Another alternative is to find ways to use proxy means-testing or other mechanisms to better target subsidies, instead of relying on the consumption patterns of households. Still another alternative is to shift from consumption subsidies to connection subsidies, using the savings realized from a reduction in consumption subsidies. Connection subsidies tend to reach the poor much better and also provide higher long-term benefits for beneficiaries than current consumption subsidies for those with access. Overall, while the solutions are likely to be country specific, it is clear that significant reforms are needed.

CHAPTER 11

Toward an African Infrastructure Strategy to Meet the Needs of the Poor

This last chapter draws some lessons from the issues raised in the previous chapters that should be relevant to the design of an infrastructure policy that would include a focus on the poor directly (through prices, subsidies, and technological choices) or indirectly (through an organization of the sector that ensures that services are delivered at the lowest possible costs). The idea is to contribute to the public debate as the international community designs the next wave of reforms for Africa's infrastructure sectors, given that the reforms of the last two decades have not delivered a big enough bang for the buck and certainly not for the large number of poor in Africa. The poor have not seen their fair share of many of the improvements when such improvements have been observed. The only sector that can be labeled a reasonable success story is telecom but this success can largely be credited to a technological revolution rather than to major institutional reforms in the region.

Apart from tariff and subsidy reforms, as discussed in the previous chapter, and initiatives to improve access, as discussed earlier, there is a clear need for a different and better organization of the various sectors. Institutional changes are in fact already taking place to address the needs of the urban and rural poor (see, Vagliasindi and Nellis 2009). But these institutional reforms need to go beyond the simple decision to introduce large-scale PPI and IRAs and many are still in their infancy. Many are also difficult to implement because they require strong coordination with other countries (e.g., supranational power pools, transport

projects, or river management) and cannot be done nationally. Cross-country coordination of reforms aimed at improving infrastructure synergies across borders are indeed emerging as a crucial item in the reform agenda for the region. Overall, this chapter only provides a glimpse of the essential policy issues that should be part of any reform agenda aimed at ensuring that African states improve their ability to respond to the demand of their populations. These reforms will have to deliver a new service delivery model that will more rapidly cater to the needs of all users fairly and cost effectively for both users and taxpayers in Africa. The real challenge, however, will be to implement many of the ideas discussed here at the country level.

Promoting Access While Maintaining Affordability

Less Consumption Subsidies, More Resources for Access

More and better services are needed in most infrastructure sectors, but the ability of utilities to provide more and better services is limited. One of the issues, discussed in the previous chapter, is that the existing consumption subsidies provided in SSA through generous IBTs tend to benefit mostly well-off households. These poorly targeted consumption subsidies have high costs, often borne by governments, and they reduce the incentives for utilities to expand their networks. Tariff reforms should aim to reduce the overall levels of subsidies for consumption by raising tariffs or changing their design while limiting the impact of such changes on the poor. It is also important to shift from consumption to connection subsidies that better reach the poor and also provide higher long-term benefits in areas such as education, health, and productivity through a reduction in the time spent by households in fetching water and wood, among others. Solutions are likely to be country specific, but the direction for reforms is clear.

The Rural Initiatives

The evidence presented in this book shows that a key concern in the design of infrastructure policies aimed at dealing with the poor should be the persistent low access to electricity, water, telecom, or transport in rural SSA, and corresponding low consumption levels in rural areas. In these areas, access rates to networks are at most in single-digit figures. The exclusion of rural areas from the service obligations imposed on utilities have stimulated the creativity of suppliers and generated alternative

businesses that provide some access to the poor. The solutions adopted vary across the continent. However, they all include a significant effort to promote the role of alternative small-scale local suppliers, particularly documented in East Africa (Kariuki and Schwartz 2005). They also include the establishment of a regulatory framework encouraging private entry into the sectors based on competitive tendering for rural licenses by independent suppliers. In other cases, explicit supply (least cost) subsidies for nonprofitable extensions have also sometimes been agreed upon between operators and the government, when these governments were viewed as credible debitors in the sector.

These solutions have allowed some progress in increasing access rates and often quality of service but they have raised their share of issues. Indeed, the fiscal costs of these solutions are often not minor. First, rural infrastructure development often requires expensive investment in network extension simply because the population is so scattered. Second, small-scale providers reduce costs but still represent significant demands on the public sector balance sheets at all government levels given rural population's limited capability to pay. Indeed, the financial viability of infrastructure supply in rural areas is hard to guarantee, at least in the short to medium term, and some way to subsidize the new customers, at least for the initial connection cost, will be necessary in order to achieve higher access rates to modern and reliable sources of supply.[1] Only when these assessments have been made will it be possible to assess the extent to which a major scaling up of the current small-scale reforms will be viable alternatives to reforms that try to make the most of an expansion of the large-scale utility model.

The Identified but Unmet Peri-urban Challenge

In view of the rapid urbanization of Africa, the issue of an exploding number of urban poor with no or very limited access to essential infrastructure services belongs, without question, to some of the most pressing aspects any development policy needs to tackle. The problem of increased access rates for the urban poor appears smaller than the rural poverty issue because potential solutions include the possibility of relying on the existing infrastructure and thus expansion at lower costs.[2] In most cases, the main concern of the reforms is not the cost; it is, instead, the need to generate the resources necessary to subsidize poor urban dwellers because of their insufficient ability to pay. The scale of the subsidy is, however, arguably less per new connection than in the rural case. Another serious problem to tackle is the semilegal

or illegal condition of many dwellings in urban and peri-urban areas, which often precludes dwellers from getting connected to utility networks. While there is a significant amount of talk about these issues, very little concrete assessments of current experiences, in particular assessments comparing the cost effectiveness of rural versus peri-urban interventions, exist. The AICD study provides an excellent first cut at thinking through how these issues need to be tackled.

Dimensions of a More Efficient (and Hence More Affordable) Infrastructure

All the comparative data presented in the earlier chapters show that service delivery in infrastructure sectors is not just insufficient in terms of quantity and quality, but also that it is too expensive. Excessive costs can usually be attributed to the wrong incentives to the providers of the services. Since most infrastructure services are subject to some form of institutional and regulatory control, this suggests that bringing down costs to international standards will require some major technological revolution as in the case of the telecom sector. Alternatively, it may require some major institutional and operational changes in the infrastructure sectors. Figuring out which changes are needed will require honest answers to a large number of questions not only in the African context but also in each African country. The rest of this section offers a brief discussion of these questions.

What Kind of Market Structure Is Required for Africa's Infrastructure?

While the international community has generally been quite focused on the potential role of large international OECD-based operators in financing the sector, the evidence seems to suggest that the scope for such a large role is modest, at best. This opens two main roads to adjust the current model. The first adjustment is to look for non-OECD operators and the second is to look for different types of collaboration with these operators. Under the first proposed adjustment, there are again two options. The first option is to try to promote local operators and in general this will consist of small-scale operators. The fast-growing adoption of this solution and the initial evidence of its effectiveness in East Africa points to the scope of this direction. The alternative is to try to promote South-South FDI. The growing presence of South African, Chinese, and Malaysian operators everywhere in Africa suggests that there is scope for

this kind of approach as well. Most of the evidence available for these new forms of PPI is, however, anecdotal, and very little is known on their effectiveness in delivering service levels consistent with Africa's needs.

What Kind of Economic Regulation and Regulatory Institutions Are Required for Africa's Infrastructure?

The experience of the last two decades has also revealed a surprisingly wide range of views on what constitutes good economic regulation. The same diversity characterizes the views on the necessity and on the ideal design of a regulatory institution. Experts and others have provided a plethora of ideas to governments, sometimes contradictory, on both of these themes. It is thus essential to try to improve the coordination of policy advice given to Africa and to do so to generate evidence that allows government to distinguish between dogma and substance. This will not only show that one size does not fit all, but it will also identify a minimum set of principles common to all reforms that are more consistent with the region's needs and constraints. This set of principles will have to be matched by the identification of a common set of instruments that will allow and ensure their implementation.

Some of the basic questions that need to be addressed were discussed in previous chapters but a more systematic assessment is needed to ensure that the mistakes of the past are not repeated. Quality, costs, fiscal efficiency, and equity concerns will only be addressed if a regulator, independent or not, is given the mandate and the power to do so and if the operators who enjoy a monopoly over service and information are mandated to contribute enough information to ensure that the government's objectives are met. Similarly, once governments have made transparent commitments to operators, it is essential to ensure that the country has a regulator capable of enforcing these commitments and that this regulator can be made accountable for his or her decisions. All these concerns imply a commitment not only to set up that regulatory capacity, but also to support it as needed until the capacity has actually been built, trained, and coached appropriately.

What Kind of Pricing and Subsidies Are Required for Africa's Infrastructure?

The standard message to reformers will continue to emphasize the need to improve the recovery of the costs incurred in delivering the services—assuming that these costs have been minimized. The social situation in

most of Africa, however, is such that cost recovery for operators is often likely to imply direct subsidies or cross-subsidies. It is quite essential for the international community and for Africa to not only recognize this basic fact but also start generating the information that will allow a quantification of what these direct and indirect subsidies will cost. We know little about costs, so that even if we know more about tariffs, we still can't measure the level of subsidies including cross-subsidies well. For cross-subsidies and built-in common tariff design options, it is essential to document their design because they can induce dramatic distortions in efficiency and are not always as progressive as expected. For countries that favor efficiency and want to avoid cross-subsidies or complex tariff structures, the decision to go down the subsidy road adds the need to assess the fiscal costs of the subsidies. A more transparent and less distorting approach may in fact end up being a preferred model for donors interested in providing grants to support effort to improve cost recovery.

What Kind of Contracts Are Required for Africa's Private Sector Collaboration in Infrastructure?

One of the emerging debates is the apparent incompatibility of certain contract types with the historical heritage of some countries. Concession contracts have a clear Anglo-Saxon twist while affermage contracts have a clear Francophile flavor. The domination of concession contracts throughout Africa where PPI has been implemented is a possible explanation for the apparent higher effectiveness of PPI- and IRA-oriented reforms in Anglophone Africa in comparison to non-Anglophone Africa. The sample sizes available to assess the equivalent impact of the adoption of affermage contracts are, however, very small. But there is a clear need to revisit this issue as part of the design of the next wave of reforms. Not all legal frameworks are comparable and these will not be changed by infrastructure reforms. The challenge is to figure out how infrastructure contracts can be designed to fit the legal frameworks while still improving the performance of the sectors along a wide array of criteria. A lot more work is also needed in this area.

What Kind of Public Enterprises Are Required for Africa's Infrastructure?

The limited role of large-scale actors for the foreseeable future in the financing of the sector demands a second look at the reforms needed

in the management of public enterprises. As suggested by Vagliasindi and Nellis (2009), the details of governance matter a lot more than was recognized in the public enterprise reforms implemented in the last 30 years or so. Staffing matters from the lowest-skilled workers to all the levels of management. Transparency in recruitment, promotion criteria, identification of possible conflicts of interests, financial management, and criteria used to allocate resources between maintenance, operation, and expansions are needed to ensure accountability. Accountability is needed to ensure the cost-effective delivery of service. Cost effectiveness is needed to ensure the affordability of services for users and how public enterprises are run matters to the impact infrastructure can have on the poor.

As argued convincingly by Vagliasindi and Nellis (2009), the key is in the incentives to deliver a clearly specified performance in a sustainable way. But these incentives will not only come from contracts such as performance or management contracts. They will also come from the combination of these types of contracts with the design and implementation of an effective regulation. This effective regulation will have to be clear about the efficiency-equity trade-offs, and in the evolving African context it will have to often favor short-term equity concerns to ensure the political viability of measures needed to improve efficiency and ensure the sustainability of efficiency gains. Too many well-intended contracts have been canceled or renegotiated because they were not politically viable in a very transparent way.

What Kind of Procurement Rules Are Required for Africa's Infrastructure?

In a continent in which infrastructure continues to be provided by the public sector, public procurement in bound to be a key driver of the extent to which costs are kept as low as possible to minimize the burden on users or taxpayers when services are subsidized. A challenge in public infrastructure procurement is that there are various unavoidable trade-offs in practice, such as price versus quality, large- versus small-lot packages, local versus international preferences, and experience versus new entry. Some of these trade-offs are crucial for the design of infrastructure policies in the region. For instance, because many of the activities associated with the maintenance of the sector rely on nontradable services, they also offer opportunities to develop local business capacity. It is inappropriate that up to 90 percent of the infrastructure business may be driven by procurement rules that do not give opportunities to

the development of a local capacity. Little is being done by the international community to see how the rules that drive procurement could be reformed to cut costs, change quality options, and develop local capacity and local businesses, including businesses that could be operated by low-skilled workers such as basic maintenance activities.

Local employment and business development are often among the most important policy objectives of policymakers in the region (as in other developing countries), but no one is really monitoring how much of an impact the large number of procurement contracts have on those objectives. Clearly, local enterprises are still developing and are resource-constrained financially, technically, and experientially (Estache and Iimi 2008). This could limit their participation in large-volume contracts. In Ghana, for instance, a public expenditure management, while recognizing the importance of institutional reforms in the public procurement systems, casts light on the limited capacity of the private sector, especially small and medium enterprises (SMEs), to participate in the procurement market, resulting in limited competition for large-volume public contracts (Estache and Iimi (2011). But not all contracts are big and not all of them have to be big. How these markets are designed limits the scope for impact (Estache and Iimi 2009). Linking public procurement to local business development is consistent with a long-term strategy for sustainable and shared growth and this should be considered more seriously in policy debates.

This is not just about jobs for the less skilled and others locally. By limiting competition, these markets are prone to closeness, collusion, corruption, and inefficiency. In some African countries more than 1 percent of GDP may be lost per year because of widespread corruption mostly through public procurement. Alexeeva, Padam, and Queiroz (2008) show that the average time required to award a road contract after bid opening is estimated to range between 3 and 10 months in road projects—over 6 months in over 50 percent of the countries in their sample, which is much too long.

What Kind of ODA Is Required for Africa's Infrastructure?

Finally, given its tremendous role in the financing of infrastructure in Africa, it is important to conclude the list of areas of research of direct relevance to the future of Africa's infrastructure with a discussion of the characteristics of ODA and some of its idiosyncrasies. ODA has its own biases that affect the performance of Africa's infrastructure. The main lessons on this front can be summarized

as follows. The large-scale suppliers have tended to get a large share of the attention of the international community and of the donors even if they cater to only a small share of the population, and most typically the better off. More recently, alternative technologies have started to become the focus of many agencies, shifting resources away from more traditional businesses with a view to help the rural poor. There is, however, some concern with the fact that, however important these technologies may be, they may not be the solution that will cater to the majority of today's and tomorrow's poor (the rural and the urban poor). In some instance, the resource allocation and the focus of the advice of bilateral donors has also continued to be associated with activities that support the interest of their national companies. This is rational and consistent with any definition of sovereignty in the allocation of national resources but it can make and has occasionally made aid coordination difficult. In other instances, agencies have both a private sector development branch and policy branches, which in principle function with Chinese walls to avoid conflicts of interests.

These walls do not, however, function as effectively as generally hoped, creating difficulties in relations between governments and beneficiaries of aid. Finally, there is often a diversity of views across donors and sometimes within governments or within donor agencies, which tend to increase the difficulty of building institutions. Different units in government talk to different units in donor agencies or to different donors working on similar projects, so that the consensus is sometimes difficult to reach. The OECD-POVNET (Poverty Network) effort on infrastructure represents a significant first political step toward better coordination, but it is not sufficient. Additional effort is needed to document the sources of differences (often legitimate) across donors and within donors; more transparency is needed if inconsistent messages are to be avoided and the interests of Africa are to be at the top of donor priorities in infrastructure.

What Kind of Sector Creativity Is Required for Africa's Infrastructure?

One of the major lessons of the theoretical research on regulation is that one size reform does not fit all (Estache and Wren-Lewis 2009). There is scope for creativity within infrastructure. This is well illustrated in the African transport context. The transport sector has been working quite intensively at reforms designed to ensure the long-term

sustainability of any progress achieved. An interesting illustration is the Road Management Initiative (RMI). The RMI is a component of the Sub-Saharan Africa Transport Policy Program (SSATP) that aims at promoting an appropriate road management institutional framework in the SSATP member countries. Beyond the design of a sectorwide strategy/policy, now almost universally used in SSA, the first step is the implementation of second-generation road funds, aimed at channeling funds directly from road users to road maintenance (i.e., shortcutting the government budget) under the management of a board in which users are heavily represented. Road funds have now been established in 86 percent of those countries. Yet, their second-generation features (direct channeling of funds and board with private majority) are not widespread. This is, nevertheless, necessary if the road funds are to deliver what is expected from them and most importantly, if the gains from reforms in their management are to be sustained. Ultimately, the ability of the sector to get access to finance will drive its ability to cater to the needs of the poor as well.

Africa's Other Ongoing Reforms Relevant to Infrastructure

While it is impossible to do justice to the full spectrum of reforms that will impact infrastructure within the scope of this book, it may be useful to highlight two: decentralization and supranational cooperation. Both take away some power from the national governments of countries, but both are expected to have an impact on how effectively infrastructure could meet the needs of the poor.

Decentralization

During the 1990s decentralization spread throughout Africa, but it happened so slowly. Moreover, it happened at different speeds in different regions—for example, Francophone countries have decentralized less than the others have. In that context, many countries are now moving to decentralize the responsibility for local infrastructure and services. In most cases, the policies are aimed at decentralizing financing, planning, and implementation to make policymakers more accountable and policies more transparent.[3] While most local authorities still face capacity constraints, the perception is that the potential for sustainable local operations is significant.

Not everyone feels that decentralization has been a success in the region. There are indeed some concerns associated with the effectiveness

of increased decentralization. Karekezi, Kimani, and Wangeci (2001), for instance, note that increased local participation has often also involved the politically connected rent-seeking classes, which contributed to the failure of the previous model of service delivery to begin with. The specific impact of decentralization on the effectiveness of the sector is, however, largely underanalyzed (one exception is Winter [2003]). Most of the information available tends to be anecdotal and documents as many success stories as failures.

A common message that emerges from the analysis of the decentralization experiences, however, is that capacity building matters and that a lot of learning by doing is taking place. This observation has already been made in diagnostics of the design of regulation of infrastructure services (Brown, Stern, and Tenenbaum 2006; Berg 2009). Presumably, adding the number of regulators needed through decentralization should not ease the management of the capacity constraint on regulatory and management skills in the sector. This concern is seldom addressed simply because it is not measured. Under today's state of knowledge, it is hard to get a rational quantitative sense of any short-term mismatch between the assignment of provision and regulation responsibilities for infrastructure expenditure. There is clearly a lack of information on the extent to which any such mismatch could lead to long-term fiscal, service-level, and quality problems.

Supranational Initiatives

At the opposite end of the spectrum of the assignment of sovereignty over infrastructure decisions across government levels is the increasing importance given to supranational projects. The report by the Economic Commission for Africa (2005) is one of the most thorough documents discussing the specific demands of regional integration in Africa. It identifies infrastructure as a key component of this integration effort. It implies that economies of scale and externalities will be assessed collectively for some key infrastructures. It endorses the NEPAD short-term action plan and various commitments made since 2002 by transport ministers. It endorses the West Africa power pool, the Zambia-Tanzania-Kenya power interconnector, the West Africa gas pipeline, as well as the Kenya-Uganda oil pipeline. It also endorses a much more coordinated management of river basins with clear implications for water uses. And it promotes the harmonization of standards in the various sectors where differences have proven to be costly in terms of growth as in the case of railways or maritime transport.

Table 11.1 Costs, benefits, and challenges of supranational infrastructure projects

Sectors	*Actions*	*Costs*	*Benefits*	*Challenges*
ICT	- Underwater cables around Africa - Fiber optic network connecting capitals and underwater cables	- US$1.8 billion - US$0.3 billion	- Better connectivity - Potential cut of 50% in prices	- Regulation of access to underwater cables
Energy	- Install 22,000 MW of interconnectors needed for free flow of power across national borders	- US$0.5 billion per year for 10 years	- Cut of up to US$0.01/kWh in marginal cost of generation (adds up to US$2 billion/year savings or 5% of total power system costs) - Savings in costs of power trade (US$0.01–US$0.08) - Cut in carbon emissions of up to 12% of anticipated emissions	- Regulation of supranational transmission - Coordination of national regulatory regimes for transmission and distribution
Transport	- Upgrade corridors to the sea	- US$1.5 billion in investment - US$1 billion/year in maintenance	- Cut delays at border crossing and ports by 10–30 hours. - Cut tariff and hence profit margins for freight and passenger transport	- Cutting regulatory and administrative burden associated with freight movement
	- Upgrade road network to support intraregional trade (about 50,000 extra km of roads)	- US$20 billion in investment - Up to US$20 billion in rehabilitation - US$1 billion/year in maintenance	- Up to triple intraregional trade	- Coordination of national regulatory regimes

Sources: Based on Economic Commission for Africa (2005) and information collected from the various AICD background papers on the infrastructure sectors.

A lot is expected from this initiative, but many challenges still need to be addressed. It takes time to implement supranational policies as years of efforts to come up with regulatory designs for the West Africa power pool agreeable to all parties suggests. Once more at the core of the self-assessed requirements for success is the need to generate comparable information across countries to ensure accountability for commitments made to the common good of Africa. Table 11.1 summarizes the major financial costs and economic benefits of the main initiatives in each sector, as well as the main associated policy challenges. The potential is clearly great. But if populations are going to get benefits from the cost cuts, serious regulatory challenges will have to be overcome. This may imply significant coordination costs.

Summing Up

The challenges are clearly not small but they are not insurmountable. Africa has demonstrated an impressive creativity in the face of adversity in general and in infrastructure in particular. A lot can be learned from this creativity just as a lot can be learned from the mistakes of the past. The real challenge is the willingness to take the necessary steps to learn and to do so collectively. This will require patience. It will also require humility since so many of today's actors are part of the mistakes of the past. This humility is essential because all these actors of the past are likely to be the actors of the future as well.

Africa's leaders and Africa's people have to be central to the solution. This solution will, however, demand an increased accountability of Africa's leaders for the effectiveness with which reforms are implemented. It will also require an increased role for the users. Users should have a stronger voice in the assessment of service delivery but they should also have a stronger obligation to contribute to the financing and the other costs of ensuring the long-term sustainability of reforms—recognizing that not everyone has the same ability to contribute.

The donors will also have to be part of the solution. This is first because the odds of Africa's achieving service levels equivalent to those achieved by higher-income countries from African funding alone are limited for most countries. Africa needs ODA to catch up—even if in the long term, Africa should aim at increasing the financial independence of its infrastructures. Second, the donors, including the NGOs, also often have the ability to share the lessons of cross-regional experiences faster than Africa could do on its own for most countries.

Finally, the private sector will continue to be part of the solution. Under the right policy environment—and the identification of this environment may be the biggest challenge—in most sectors both the foreign and the local private sector have already demonstrated their ability to contribute to Africa's effort to meet its needs. The private sector often brings a know-how that the public sector may not have in some countries. The private sector can also bring resources that reduce the need to rely on distortionary taxes, unfortunately still a major issue in Africa. Making the most of these opportunities has been and will continue to be key to Africa's infrastructure prospects.

Main Messages of Part III

Some of the main messages of Part III can be summarized as follows.

The analytical evidence suggests that in general, the joint introduction of PPI and IRAs has helped improve investment and quality of service—and sometimes access rates at the country level—but there are significant differences across sectors and the total absolute effect has generally been modest. The adoption of both types of reforms helped in electricity, telecom, and sanitation sectors; but the adoption of both types of reforms may not have made a significant difference in the water sector. Note that, as expected, impacts at the project level are often clearer and more positive than at the country level. Also, the introduction of IRAs often helps to offset the negative effects of potential corruption.

The reforms were probably not neutral with respect to income classes or wealth groups. The winners of the introduction of PPI and IRA in electricity have tended to be the middle-wealth groups. For example, the introduction of PPI and IRA in the piped water sector hardly had any impact on the 60 percent poorest members of the population. The access rates to improved water sources of the lower- and middle-income or wealth groups increased but the gains in access have not come from standard network utilities.

Geography and legal tradition matters. Anglophone countries have generally done better in electricity, roads, and water while non-Anglophone countries have done relatively better in telecom and sanitation sectors. Anglophone countries have generally benefited more from PPI and IRA in all sectors except water in which no country group has done better and in which there is not significant difference between the countries with and without reforms. While these preliminary results are interesting and important, they reflect recent reforms and hence not enough time may have elapsed to be able to draw a definitive conclusion on the impact of the reforms.

The subsidy mechanisms that exist in many countries and prevent cost recovery tend not to be well targeted to the poor. In many countries, the average subsidy received by a poor person is only a third (or less) of the average subsidy in the population as a whole. There are, however, ways to improve targeting performance and thereby affordability for the poor while avoiding large losses for utilities. This can be done through better tariff structure (lower lifeline levels in IBTs and move from these tariff structures to VDTs), as well as through a move from consumption to connection subsidies. In some countries that have higher standards of living, it may also be feasible to target subsidies through geographic targeting or proxy means-testing.

There is more to reform than PPI and IRA, and reforms of one size do not fit all sectors or all countries. The solution to Africa's infrastructure challenges must recognize that ODA is unavoidable. The private sector is unavoidable. Improved cost recovery is unavoidable. Domestic capital needs to be tapped. Differences in legal and cultural traditions need to be addressed in the design of future institutional and contractual arrangements. Incentives of all actors to deliver on commitments need to be improved. And governance and accountability needs to be improved to allow incentive to work. Institutional designs and basic accounting practices are at the core of the required improvements especially when dealing with regulated monopolies and the decentralization of responsibilities for service delivery. Users are also crucial actors to improved accountability.

Notes

Prelims

1. For politicians, a rent is an additional (formal or informal) benefit. This benefit can be a personal income, a contribution to the financing of its political party or added simply an opportunity to achieved political recognition associated with the way he or she interacts with the firms winning the contracts to deliver or maintain infrastructure.

1 Introduction

1. The book only marginally deals with the needs of the investors and producers. This does not mean that these needs are not important. It simply reflects the fact that there is a lot of new work currently being undertaken in the region on the drivers of investment climate but this work is only in its preliminary state and the direct linkages with poverty concerns are still very limited.
2. We leave out urban transport, irrigation, and dams, not because they are less important but simply because they require addressing much more specific issues than those we are trying to address here.
3. As pointed out by Brunel (2004), Africa's colonization dramatically modified the use of space in the region, shifting growth and urbanization from inland to the littoral. Most African capitals are ports built at the end of railways designed to carry flows of raw materials and people from the inland. She also points out that transport networks inherited from that growth was located perpendicularly to the seashores rather than a network designed to occupy space widely. This is one of the reasons why the economic capitals of Africa are often so peripheral and why increasingly political capitals have moved to more central locations.
4. There is no country in Africa who is not a member of at least one of the ten regional economic groupings!
5. The urban population now represents 40 percent of the total, versus 30 percent 25 years ago. This is more than 300 million people.

6. Sachs and his colleagues talk about average annual infrastructure expenditure needs equivalent to 13 percent of GDP, in their United Nations paper. See, Millennium Development Project (2005).
7. The heated debates of governments—and often the World Bank sector staff—with the International Monetary Fund (IMF) on road funds serve as a witness to the divergence of views on this topic. The debates are, however, on very solid concerns. According to Desmarchelier (2005), the ratio of actual to required maintenance in roads for a sample averaged 42.4 percent and varied from 0.28 percent in the Democratic Republic of Congo (in 2003) to 89.3 percent in Burkina Faso (in 2001). It was below 50 percent for 6 of the countries.
8. As Europe has been slower than many had hoped for to pull out of the Great Depression, emerging markets have been attracting a lot of interest. In particular, Africa's infrastructure is a recurring theme in investors' conference and in the financial media. The IMF and the African Development Bank (AfDB) are pushing for African infrastructure bonds and many key private players have been launching their own efforts, as discussed later.
9. The overview report (Foster and Briceno-Garmendia 2010) and many of the datasets and studies conducted in that context started to be released in 2010.
10. For a complete presentation of this new database, see African Development Bank (2013) and Africa Infrastructure Knowledge Program (2011).

2 Infrastructure, Growth, and Country Strategies

1. A PRSP is an official document issued by government in low-income countries to describe the macroeconomic, structural, and social policies and programs that a country will try to implement over a specific time span to promote growth and reduce poverty. It is prepared in consultation with key domestic and foreign actors. It includes an identification of the financing needs associated with the strategy and a discussion of the essential external financing sources, often at the project or program level. The International Monetary Fund (IMF) and the World Bank played an active role in helping countries prepare these PRSPs.
2. The reader is referred to a later section for a discussion of more robust econometric evidence on the relative importance of the various sectors, in particular Calderon and Serven (2008).
3. For almost 20 years now, there have been debates on the drivers of growth in Africa; see Ndulu and O'Connell (2005), Ndulu (2004), and a new wave of research anchored in debates on the quality of statistics that could lead us to over- or underestimated growth and improvements in consumption in Africa. These have involved, among others, Miguel (2009), Young (2012), Devarajan (2013), and Harttgen, Klasen, and Vollmer (2013), and

provide some additional insights on infrastructure but only marginal ones so we will not address them here. To our knowledge, the only papers covering infrastructure quantitatively are Easterly and Levine (1997), Esfahani and Ramírez (2003), Calderon and Serven (2004), and Estache, Speciale, and Veredas (2005), Calderon (2009), and Jerome (2011). Many other papers mention infrastructure as an important variable but don't model it. Occasional country-specific studies deal with it, see for instance, Fedderke and Bogetic (2009).

4. Estache, Speciale, and Veredas (2005).
5. See Estache, Speciale, and Veredas (2005), who compare the relevance of infrastructure stocks in an augmented Solow model with and without human capital variables. There are also a few studies looking at the importance of being landlocked for a country. They are reviewed in Ndulu (2004).
6. See Ndulu (2004).
7. Estache, Speciale, and Veredas (2005).
8. Abdulai, Diao, and Johnson (2005).
9. See Stern and Holder (1999) and Ros (1999).
10. Wallsten (2001).
11. For more details, see Briceno, Estache, and Shafik (2004).
12. Because of the way they are computed, these rates of return are closer to financial rates of return and tend to underestimate the social rates of return. The underestimation is likely to be quite significant. For Uganda, for instance, Fan et al. (2004) estimate that the marginal returns to government intervention for feeder roads in rural areas is equivalent to a benefit-cost ratio of over seven.
13. These findings underscore the need to decarbonize the fuel mix for centralized power generation as it expands in Africa.
14. Leonard (2005) offers a useful survey of the literature on infrastructure and PRSPs; Ellis and Freeman (2004) illustrate some of the limitations of PRSPs including those for decisions regarding infrastructure in very specific contexts for four countries.
15. For detailed overviews, see Nankani and Allen (2004), Craig and Porter (2003), and Oxfam (2004), for instance.
16. In his review of infrastructure presence in PRSPs, Murooka (2004) provides detailed information on 17 SSA countries. Ghana, Mali, and Senegal stand out in the clear priority assignment to infrastructure.
17. See, for instance, UNDP, AfDB, and UNECA (2013).
18. Note that this correlation measure can reflect not only direct or indirect causation but also a simple statistical oddity. In this context, however, the correlation is taken to be an initial indication of a link between education and infrastructure that deserves better scrutiny.
19. See Ndulu (2004) for a survey.
20. Sachs and Warner (1997) were among the most vocal to argue the relevance of this variable initially. See Ndulu (2004) for a survey; one exception not

covered by Ndulu's survey is Naudé and Krugell (2003) who find no evidence for the role of geography once institutions are taken into account.

21. For details, see, http://www.3ieimpact.org/evidence/impact-evaluations/.

3 Infrastructure and the MDGs

1. See, http://www.un.org/millenniumgoals/environ.shtml.
2. See, for example, Besley and Burgess (2003).
3. This derivation is possible because we rely on a semilog regression setting. In this setting, the impact of access to basic services will be proportional to the expected rent computed using all housing characteristics except the services.

4 Africa's Infrastructure Investment Needs

1. Foster and Briceno-Garmendia (2010).
2. This section is largely based on the background studies conducted for the AICD study. For details, please refer to Foster and Briceno-Garmendia (2010). It also relies on updated information from the PPI database of the World Bank on foreign private investment in infrastructure.
3. To be precise, the estimates based on a sample of 28 countries for which the required data on poverty is available suggests that a population-weighted average growth per capita needed to achieve the MDGs is 5.2 percent. More than half of the countries in the sample need per capita growth rates of over 6 percent.
4. The main investments include about 7,000 megawatts a year of new power generation capacity, 22,000 megawatts of cross-border transmission, an acceleration of the residential electrification rates, an expansion of the intraregional fiber-optic backbone network and of the continental submarine cable hoop, a major improvement and development of the road network and of interconnections within that network, a globalization of mobile systems, 100 percent public access to broadband, a doubling of irrigated areas, and the delivery of the commitments made to reach the W&S MDGs.
5. Note that this discussion ignores the restrictions associated with the limited absorptive capacity of many countries. This discussion has many dimensions and goes beyond what can be addressed in this book.
6. See, for instance, Schiere and Rugamba (2011) for a discussion of the potential role of China in infrastructure.
7. This information is not all that inconsistent with an estimate that would derive investment rates from a comparison of the changes in the value of infrastructure capital stocks assessed at constant price. From 1970 to mid-1980s, this exercise yields total expenditure levels of around 9 percent of GDP.
8. The section draws on some of the calculations prepared by Warlters (2005).

9. There are, of course, specific projects and specific activities for which the private sector will be an ideal partner, but this statement must also be weighed against the possibility that these private projects are associated with cream-skimming problems in which a profit center is amputated from a public sector business at a higher net fiscal cost. There is significant evidence of this in Latin America (see, e.g., Campos et al. 2003).
10. See Briceno, Estache, and Shafik (2004).
11. This is from the OECD database, which only provides data on commitments and moreover has some problems in the classification of infrastructure expenditures because donors do not classify strictly similarly. The "big picture" of what this data means for infrastructure is however fairly reliable.
12. Direct comparison between MCF and WACC rates of return is only possible if infrastructure projects yield no externalities, whereas in general we would expect the social benefit of infrastructure to exceed the private returns to the investor.
13. Although it did not occur in any of these seven countries, it could also occur that within a single country public financing is cheaper than private financing in some sectors but not in others. And if a different measure of the MCF were used (i.e., the MCF of a particular tax), different comparative results would result.
14. See, among others, Adelegan and Radzewicz-Bak (2009), Mbeng Mezui (2012), and Mu, Phelps, and Stotsky (2013) for discussions of the scope for capital market development in the region directly relevant to the scope for innovative financing options in infrastructure. See also Mben Mezui and Duru (2013) on additional options to finance infrastructure through the use of reserves.
15. For a very useful overview, see Bevan (2005).
16. Note in addition that the debate on grant versus loan financing of this scaling up effort is actually irrelevant to the assessment of the fiscal absorptive capacity since it turns out that conventional fiscal accounting generally does not distinguish between borrowing and external grant financing. This means that the bias against accessing grant finance further hurts infrastructure asset accumulation, growth, and long-term solvency.
17. Even after accounting for the common real exchange-rate appreciation that tends to be associated with export booms, the Dutch disease problem resulting from the distribution of gains from infrastructure investments between tradables and nontradables need not appear as indicated by Adam and Bevan (2004).

8 Are Quality and Production Costs a Problem?

1. See Flyvbjerg, Skamris Holm, and Buhl (2003).
2. A longer discussion of this issue is available in Estache, Foster, and Wodon (2002).

3. Although it could be argued that in developing countries, cost padding enables operators to collect a risk premium that needs to be paid to attract private capital, there is ample evidence in both developed and developing countries suggesting that there are governance issues associated with this practice. Poor transparency in costs not only leads to inequity and short-run inefficiency, but it also tends to reduce competition when it allows for opaque cross-subsidies or when unscheduled cost hikes appear shortly after contracts have been awarded, raising concerns that bids are strategic rather than revealers of fair commitments by bidders. Linking tariffs to the cost of capital revised recurrently in a transparent way tends to generate fairer and more efficient outcomes for all parties involved. But as in many matters relating to regulation, unwritten debates point to disagreements on the extent to which this conceptually more desirable approach can actually be implemented when institutions are weak.
4. One of the main purposes of tariff revisions in regulated industries is to ensure that these cost savings are eventually shared with the users in such a way that they do not simply become a pure monopoly profit for operators, while recognizing that the sharing mechanism must maintain some degree of incentives for the operator to continue searching for cost savings opportunities.
5. For more specific details, see African Development Bank (2013).
6. Additional information on the extent of misestimations and how these are related to procurement practices is discussed and documented in Estache and Iimi (2011).
7. For an introduction of the key concepts and their application to infrastructure see Coelli et al. (2003).
8. For more details, see Coelli et al. (2003)
9. This extrapolation from partial data on production and on inputs is a very far stretch conceptually since it uses information on efficiency levels in production to imply cost efficiency levels. It is only done to provide a very rough order of magnitude, not a precise measurement.

9 Markets, Institutions, and Reforms

1. There is quite a widespread interest in assessing reforms but most rely on country-specific case studies or on small samples of countries. See, for instance, Eberhard and colleagues (Eberhard and Tenenbaum 2005; Eberhard and Shkaratan 2012) and Gualberti et al. (2009) for electricity sector; Karekezi and MacKenzie (2002) and Perelman, Mbuvi, De Witte (2012) for water sector; and Trujillo, González, and Jiménez (2013) for ports subsector. See also Parker, Kirkpatrick, and Figueira-Theodorakopoulou (2008) for a survey.
2. Additional information on the changes in governance can be found in Banerjee and Morella (2011) for the water sector and Eberhard and Shkaratan (2012) for the energy sector.

3. This point is very well documented in Kariuki and Schwartz (2005)
4. These countries where DHSs were held are Benin, Burkina Faso, Cameroon, Cote d'Ivoire, Ghana, Madagascar, Malawi, Mali, Namibia, Niger, Nigeria, Rwanda, Senegal, Tanzania, Uganda, Zambia, and Zimbabwe.

11 Toward an African Infrastructure Strategy to Meet the Needs of the Poor

1. It can be argued that technological progress, notably in generation technology, has made it possible for small independent supply networks to achieve cost recovery. However, the issue of mismatched timing between initial capital expenses and insufficient demand development remains and implies that subsidies appear unavoidable, at least in the initial period where up-front investments are needed.
2. The concept of low-cost expansion of network can be easily challenged if it requires major works in dense peri-urban locations.
3. Fishbein (2001) gives a good sense of what and how local governments can take charge of their infrastructure needs in Africa.

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