

A NEW YORK TIMES BESTSELLER

**JEFFREY D. SACHS**

# The End of Poverty

*Economic Possibilities for Our Time*

**FOREWORD BY BONO**

*"Book and man are brilliant, passionate, optimistic and impatient... Outstanding."*

—THE ECONOMIST



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### *A c k n o w l e d g m e n t s*

These acknowledgments must perform double duty. In writing this book, I have depended upon countless acts of support, generosity, and guidance. But perhaps more important, in engaging with the challenges of our global society and deeply divided world, I have depended upon steadfast colleagues, teachers, and leaders. This is an important opportunity for me to thank them for a lifetime of collegiality and support.

I naturally begin with my family, wife Sonia, daughters Lisa and Hannah, and son Adam. This has been a family effort, through two decades of redefining "vacation" as listening to Dad give another lecture in a sweltering room in a village in East Africa. Sonia has been my guide, inspiration, teacher of differential diagnosis, and partner and coauthor in development studies. My kids, I'm proud to say, have seen all corners of the developing world and have taken up the challenge of global development themselves. Their wonderment at what we see together is my inspiration to fight for the future for them. In all of this family effort, the wisdom of my father-in-law, Walter Ehrlich, the good sense of my mother, Joan Sachs, and the avid interest of my sister Andrea Sachs, all played a tremendous role in keeping us on the right track. So too has the enduring moral compass of my late father, Theodore Sachs, who devoted his great lawyerly gifts and energies to the struggle for social justice.

For twenty years I have been blessed to be welcome in all parts of the world and to have colleagues who joined me in understanding the local conditions and challenges and in fitting those challenges into the broader global canvas. My earliest colleagues in Bolivia were Daniel Cohen and Felipe Larrain, lifelong companions in intellectual forays. David Lipton left the IMF to join me in work in Latin America and Eastern Europe and then went on to a scintillating role in international political economy during the Clinton administration. Wing Woo has tutored me on Asia for a quarter century and has been my guide, coauthor, and coadviser in many valuable efforts. Nirupam Bajpai has been

steadfast and accurate as a keen observer, scholar, coauthor, and adviser on all aspects of India's remarkable reforms during the past decade.

The best way to become a successful economic adviser is to advise successful governments. I've been extremely fortunate to do that. My earliest adventure was in Bolivia, under the remarkable leadership of the late President Victor Paz Estenssoro and his top economic aide and later president, Gonzalo Sánchez de Lozada. Both taught me about the practical politics of successful economic reforms and the value of honesty and love of country in achieving broader political successes. In Poland, Larry Lindenberg played the pivotal role in introducing me to Solidarity's remarkable leaders, including Adam Michnik, Jacek Kuron, Bronislaw Geremek, and of course Lech Wałęsa. Leszek Balcerowicz, the brave and brilliant leader of Poland's reforms, made us all look good. I admire Poland's long-serving president, Alexander Kwasniewski, and remain in his debt for the honor he bestowed upon Lipiton and me in awarding us one of Poland's highest civilian awards, the Commanders Cross of the Order of Merit. President Janez Drnovsek of Slovenia not only taught me about the tangled politics of the Balkans during the past two decades, but also inspired me with his leadership and honored me with the chance to contribute to Slovenia's birth as an independent country. In Russia, I want to thank my advisory partner Anders Aslund and pay special tribute to three reformers who struggled bravely against the odds: Yegor Gaidar, Boris Fedorov, and Grigory Yavlinsky.

My work in Africa has been blessed by help and guidance from a large number of colleagues and African leaders. I am especially grateful to Calestous Juma, Dyma Athin-Tenkorang, Wen Kilama, Charles Mann, and Anne Conroy. My ardent hopes for Africa are fueled by the powerful and visionary leadership that I have seen in abundance throughout the continent, in contrast to the typical uninformed American view about Africa's governance. In particular I would like to thank Africa's new generation of democratic leaders who are pointing the way, including former President Alberto Chissano of Mozambique, President Mwai Kibaki of Kenya, President John Agyekum Kufuor of Ghana, President Olusegun Obasanjo of Nigeria, former Vice President Justin Malwezi of Malawi, President Festus Mogae of Botswana, President Abdoulaye Wade of Senegal, and Prime Minister Meles Zenawi of Ethiopia.

The world is held together, however precariously, by the vision, leadership, and struggle of its leaders who are committed to a world of justice, equality, and rule of law. The greatest of these is UN Secretary-

General Kofi Annan, whose quiet resolve has helped to keep the world from falling over the precipice in recent years. Another great leader is Gro Harlem Brundtland, who gave me the honor to serve the World Health Organization during her tenure as WHO director general. The WHO Commission on Macroeconomics and Health helped to show the way toward scaling up basic investments for the poor. My fellow commissioners are incomparable leaders in their respective fields, including Manmohan Singh, India's current prime minister; Richard Feachem, director of the Global Fund to Fight AIDS, TB, and Malaria; Supachai Panitchakdi, the director general of the World Trade Organization; and Harold Varmus, director of Memorial Sloan-Kettering Cancer Center.

The UN agencies are filled with talented and dedicated leaders, and I have been honored to work closely with them in recent years. Mark Malloch Brown, administrator of UNDP, who has championed the UN Millennium Project from the start; Joseph Chamie, director of the UN Population Division; Zephirin Diabre, deputy administrator of UNDP and my guide to the economics of the African Sahel; former IMF managing director and current president of Germany, Horst Kohler, who during his stint at the IMF pressed the case for more global justice in resource allocation; Anna Tibajuka, the remarkable Tanzanian-born leader of UN Habitat; Klaus Topfer, the relentlessly talented head of the UN Environmental Program; and Jim Wolfensohn, the brave and energetic leader of the World Bank. I am also grateful for the marvelous collegiality of World Bank Chief Economist Nick Stern and François Bourguignon, and IMF Chief Economist Raghuram Rajan.

Many of the specific ideas on how to end global poverty have emerged from the work of the UN Millennium Project, which I am honored to direct and from which I have drawn amply in this book. This project would have slid off the rails from the start without the unerring, beyond-the-calls-of-duty leadership of John McArthur, my day-to-day colleague in the effort. John and I, in turn, have depended upon a spectacular secretariat, including Chandrika Bahadur, Stan Bernstein, Yassine Fall, Eric Kashambuzi, Margaret Kruk, Guido Schmidt-Traub, Erin Trowbridge, and round-the-clock assistants Alberto Cho, Michael Faye, Michael Krouse, Luis Javier Montero, Rohit Manchoo, and Alice Wiemers.

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reduction and long-term development. Happily, many of these marvelous world-class scientists are my colleagues at the Earth Institute at Columbia University. I am happy to give special thanks to Columbia colleagues Deborah Balk, Wallace Broecker, Bob Chen, Lynn Freedman, James Hansen, Klaus Lackner, Upmannu Lall, Roberto Lenon, Marj Lew, Don Meinick, Vijay Modi, John Mutter, Cheryl Palm, Allan Rosenfield, Josh Ruxin, Pedro Sanchez, Peter Schlosser, Joseph Stiglitz, Awash Teklehaimonot, Ron Waldman, Paul Wilson, and Stephen Zebiak, who have played such a key role in expanding my understanding of the challenges of sustainable development. Columbia University's inspiring president, Lee Bollinger, has strongly backed the Earth Institute in this and its other endeavors, and for that I am grateful. I also thank all of the task force coordinators and task force members for making the UN Millennium Project the extraordinary effort that it has been.

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It is a cliché to say that this book would not have been possible but for . . . and sometimes such clichés are all too true. Margarethe Laurenzi, skilled writer and editorial assistant from the very start of this project, provided incomparable support, expert suggestions, and editorial feedback that kept us on track and on time. Gordon McCord is an invaluable special assistant regarding all aspects of my work at the Earth Institute and the UN Millennium Project, including detailed work on all parts of this book. Gordon is also without doubt an upcoming global leader of his generation in the challenges of sustainable development. Winthrop Ruml joined the team from Harvard in mid-2004 and has been a key member of the project since arriving at the Earth Institute. Martha Symott managed my office during the two decades of the events described in this book, until 2003. Ji Mi Choi offered invaluable

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Andrew Wylie, literary agent nonpareil, helped me to conceive of this book—its structure and logic as a way to broaden the world's understanding of our generation's opportunity to end extreme poverty. Scott Moyers, my editor at The Penguin Press, provided the steady, clear, professional guidance and support to see the project through to fruition, including the enormous skilled teamwork at Penguin Press to make such a masterful production effort. I'm grateful to both.

## FOREWORD

Two men asleep beside each other on a long journey into Africa, literally and thankfully above the thunderclouds. One is fairly clean shaven, papers strewn around him. Matte black suit, eyes slightly hollowed from no sleep, thoughts too big even for his big head. The other is a more bohemian mess. Unshaven, unkempt, he can't just have been up for days, his boyish face says years. An advertisement for why air miles can be bad for your health. When he wakes, an air hostess asks for his autograph. Confused and amused, he points to the geek in the black suit lying among the papers. That's me. Let me introduce myself. My name is Bono and I am the rock star student. The man with me is Jeffrey D. Sachs, the great economist, and for a few years now my professor. In time, his autograph will be worth a lot more than mine.

Let me tell you how we started this journey. It goes back to before Jeff Sachs had become director of the Earth Institute at Columbia University. Before he moved to New York to become UN Secretary-General Kofi Annan's special adviser. It goes back to when Jeff gave me the third degree from the Kennedy School of International Development at Harvard University in Cambridge, Massachusetts. My great friend Bobby Shriver had advised me to meet him in order to know what I was talking about before I went up to Capitol Hill to lobby on behalf of Jubilee 2000 for the cancellation of the LDC's (least developed countries') debt to the rich countries of the OECD (Organization for Economic Cooperation and Development) as part of the millennium celebrations. I would enter the world of acronyms with a man who can make alphabet soup out of them. Soup you'd want to eat. Soup that would, if ingested properly, enable a lot more soup to be eaten by a lot more people.

Hunger disease, the waste of lives that is extreme poverty are an affront to all of us. To Jeff it's a difficult but solvable equation. An equation that crosses human with financial capital, the strategic goals of the rich world with a new kind of planning in the poor world.

I'm a singer with an ear for a melody. Great ideas have a lot in common with a great melody. A certain clarity, inevitability, memorability. . . . you can't get them out of your head, they nag at you. . . . The ideas in this book are not exactly sing-a-long but they have a hook you won't forget the end of poverty. It's a challenge that's hard to ignore.

Jeff is hard to ignore. At speaking events I've had to walk on after this man (it's like the Monkees going on after the Beatles). His voice is louder than any electric guitar, heavier than heavy metal. His passion is operatic, he's physically very present, animated. There is wildness to the rhetoric but a rigor to the logic. God may have given him a voice with an amplifier built in, but it's the argument that carries the day.

He's not just animated, he's angry. Because he knows that a lot of the crisis in the developing world can be avoided. Staring at people queuing up to die three to a bed, two on top and one underneath, in a hospital just outside of Lilongwe, Malawi, and knowing this doesn't have to be so is too much for most of us. I am crushed. He is creative. He's an economist who can bring to life statistics that were, after all, lives in the first place. He can look up from the numbers and see faces through the spreadsheets, families like his own that stick together on treks to the far ends of the world. He helps us make sense of what senseless really means: fifteen thousand Africans dying each and every day of preventable, treatable diseases—AIDS, malaria, TB—for lack of drugs that we take for granted.

This statistic alone makes a fool of the idea many of us hold on to very tightly: the idea of equality. What is happening in Africa mocks our pieties, doubts our concern, and questions our commitment to that whole concept. Because if we're honest, there's no way we could conclude that such mass death day after day would ever be allowed to happen anywhere else. Certainly not in North America, or Europe, or Japan. An entire continent bursting into flames? Deep down, if we really accept that their lives—African lives—are equal to ours, we would all be doing more to put the fire out. It's an uncomfortable truth.

This book is about the alternative—taking the next step in the journey of equality. Equality is a very big idea, connected to freedom, but an idea that doesn't come for free. If we're serious, we have to be prepared to pay the price. Some people will say we can't afford to do it. . . . I disagree. I think we can't afford *not* to do it. In a world where distance no longer determines who your neighbor is, paying the price for equality is

not just heart, it's smart. The destinies of the "haves" are intrinsically linked to the fates of the "have-nothing-at-alls." If we didn't know this already, it became too clear on September 11, 2001. The perpetrators of 9/11 might have been wealthy Saudis, but it was in the collapsed, poverty-stricken state of Afghanistan that they found succor and sanctuary. Africa is not the front line in the war against terror, but it soon could be.

"The war against terror is bound up in the war against poverty." Who said that? Not me. Not some beatnik peace group. Secretary of State Colin Powell. And when a military man starts talking like that perhaps we should listen. In tense, nervous times isn't it cheaper—and smarter—to make friends out of potential enemies than to defend yourself against them?

We wish things were different. But wishful thinking is not just unhelpful here; it's dangerous. The plan Jeff lays out is not only his idea of a critical path to accomplish the 2015 Millennium Development Goal of cutting poverty by half—a goal signed up to by all the world's governments. It's a handbook on how we could finish out the job. On how we could be the first generation to outlaw the kind of extreme, stupid poverty that sees a child die of hunger in a world of plenty, or of a disease preventable by a twenty-cent inoculation. We are the first generation that can afford it. The first generation that can unknot the whole tangle of bad trade, bad debt, and bad luck. The first generation that can end a corrupt relationship between the powerful and the weaker parts of the world which has been so wrong for so long.

In Jeff's hands, the millstone of opportunity around our necks becomes an adventure, something doable and achievable. His argument is clear. We converge from our different starting points . . . he from markets, I from placards. Luckily we agree you need both. However, for all of the book's cogency, you won't find an answer to the most important question of all. It falls outside regressions, theorems, field work and lands fairly, squarely on our shoulders. We *can* be the generation that no longer accepts that an accident of latitude determines whether a child lives or dies—but *will* we be that generation? Will we in the West realize our potential or will we sleep in the comfort of our affluence with apathy and indifference murmuring softly in our ears? Fifteen thousand people dying needlessly every day from AIDS, TB, and malaria. Mothers, fathers, teachers, farmers, nurses, mechanics, children. This is Africa's crisis. That it's not on the nightly news, that we do not treat this as an emergency—that's *our* crisis.

Future generations flipping through these pages will know whether we answered the key question. The evidence will be the world around them. History will be our judge, but what's written is up to us. Who we are, who we've been, what we want to be remembered for. We can't say our generation didn't know how to do it. We can't say our generation couldn't afford to do it. And we can't say our generation didn't have reason to do it. It's up to us. We can choose to shift the responsibility, or as the professor proposes here, we can choose to shift the paradigm.

BONO, 2004

year taught us never to sit back and rely on such commitments. Our politicians, in the final analysis, will follow our lead, not vice versa.

When the end of poverty arrives, as it can and should in our own generation, it will be citizens in a million communities in rich and poor countries alike, rather than a handful of political leaders, who will have turned the tide. The fight for the end of poverty is a fight that all of us must join in our own way. This book, I hope, as it now appears in paperback, may play some role in our shared quest. We have exciting times ahead, and no time to lose.

*Jeffrey D. Sachs*  
*New York City*  
*October 2005*

## *Introduction*

This book is about ending poverty in our time. It is not a forecast. I am not predicting what will happen, only explaining what can happen. Currently, more than eight million people around the world die each year because they are too poor to stay alive. Our generation can choose to end that extreme poverty by the year 2025.

Every morning our newspapers could report, "More than 20,000 people perished yesterday of extreme poverty." The stories would put the stark numbers in context—up to 8,000 children dead of malaria, 5,000 mothers and fathers dead of tuberculosis, 7,500 young adults dead of AIDS, and thousands more dead of diarrhea, respiratory infection, and other killer diseases that prey on bodies weakened by chronic hunger. The poor die in hospital wards that lack drugs, in villages that lack antimalarial bed nets, in houses that lack safe drinking water. They die namelessly, without public comment. Sadly, such stories rarely get written. Most people are unaware of the daily struggles for survival, and of the vast numbers of impoverished people around the world who lose that struggle.

Since September 11, 2001, the United States has launched a war on terror, but it has neglected the deeper causes of global instability. The \$450 billion that the United States will spend this year on the military will never buy peace if it continues to spend around one thirtieth of that, just \$15 billion, to address the plight of the world's poorest of the poor, whose societies are destabilized by extreme poverty and thereby become havens of unrest, violence, and even global terrorism.

That \$15 billion represents a tiny percentage of U.S. income, just 15 cents on every \$100 of U.S. gross national product, or GNP. The share of U.S. GNP devoted to helping the poor has declined for decades, and is a tiny fraction of what the United States has repeatedly promised, and failed, to give. It is also much less than the United States should give, both to solve the crisis of extreme poverty and thereby to provide for U.S. national security. This book, then, is about making the right



choices—choices that can lead to a much safer world based on a true reverence and respect for human life.

I have spent the past twenty years working with heads of state, finance and health ministers, and villagers in dozens of countries in all parts of the world. I have visited and worked in more than a hundred countries with around 90 percent of the world's population. The cumulative experience of seeing the world from many vantage points has helped me to appreciate the real circumstances on our planet—the causes of poverty, the role of rich-country policies, and the possibilities for the future. Gaining a proper perspective on these issues has been my struggle and challenge for two decades. Nothing else in my intellectual life and political engagement has been as rewarding.

I have been fortunate to have observed, and contributed to, some real successes—the end of hyperinflation, the introduction of new stable national currencies, the cancellation of unpayable debts, the conversion of moribund communist economies to dynamic market-based economies, the start-up of the Global Fund to Fight AIDS, TB, and Malaria, and modern drug treatment for impoverished HIV-infected people. I have increasingly understood the yawning gap between what the rich world claims to be doing to help the poor and what it is actually doing. I have also gradually come to understand through my scientific research and on-the-ground advisory work the awesome power in our generation's hands to end the massive suffering of the extreme poor, and thereby to make our lives safer in the process.

In the following pages, I will explain what I have witnessed and learned in societies as varied as Bolivia, Poland, Russia, China, India, and Kenya. You will see that all parts of the world have the chance to join an age of unprecedented prosperity building on global science, technology, and markets. But you will also see that certain parts of the world are caught in a downward spiral of impoverishment, hunger, and disease. It is no good to lecture the dying that they should have done better with their lot in life. Rather, it is our task to help them onto the ladder of development, at least to gain a foothold on the bottom rung, from which they can then proceed to climb on their own.

Am I an optimist? Optimism and pessimism are beside the point. The key is not to predict what will happen, but to help shape the future. This task is a collective one—for you as well as for me. Although introductory economics textbooks preach individualism and decentralized

markets, our safety and prosperity depend at least as much on collective decisions to fight disease, promote good science and widespread education, provide critical infrastructure, and act in unison to help the poorest of the poor. When the preconditions of basic infrastructure (roads, power, and ports) and human capital (health and education) are in place, markets are powerful engines of development. Without those preconditions, markets can cruelly bypass large parts of the world, leaving them impoverished and suffering without respite. Collective action, through effective government provision of health, education, infrastructure, as well as foreign assistance when needed, underpins economic success.

Eighty-five years ago the great British economist John Maynard Keynes pondered the dire circumstances of the Great Depression. From the depths of despair around him, he wrote in 1930 of the *Economic Possibilities for Our Grandchildren*. At a time of duress and suffering, he envisioned the end of poverty in Great Britain and other industrial countries in his grandchild's day, toward the end of the twentieth century. Keynes emphasized the dramatic march of science and technology and the ability of advances in technology to underpin continued economic growth at compound interest, enough growth indeed to end the age-old "economic problem" of having enough to eat and enough income to meet other basic needs. Keynes got it just right, of course: extreme poverty no longer exists in today's rich countries, and is disappearing in most of the world's middle-income countries.

Today we can invoke the same logic to declare that extreme poverty can be ended not in the time of our grandchildren, but in *our* time. The wealth of the rich world, the power of today's vast storehouses of knowledge, and the declining fraction of the world that needs help to escape from poverty all make the end of poverty a realistic possibility by the year 2025. Keynes wondered how the society of his grandchildren would use its wealth and its unprecedented freedom from the age-old struggle for daily survival. This very question has become our own. Will we have the good judgment to use our wealth wisely, to heal a divided planet, to end the suffering of those still trapped by poverty, and to forge a common bond of humanity, security, and shared purpose across cultures and regions?

This book will not answer this question. Instead, it will help to show the way toward the path of peace and prosperity, based on a detailed un-

derstanding of how the world economy has gotten to where it is today, and how our generation could mobilize our capacities in the coming twenty years to eliminate the extreme poverty that remains I hope that by showing the contours of that promising path, we will be more likely to choose it. For now, I am grateful for the chance to share what I have seen of the world and of the economic possibilities for our time.

*One*

## A GLOBAL FAMILY PORTRAIT

### MALAWI: THE PERFECT STORM

**I**t is still midmorning in Malawi when we arrive at a small village, Nhandire, about an hour outside of Lilongwe, the capital. We have come over dirt roads, passing women and children walking barefoot with water jugs, fuel wood, and other bundles. The midmorning temperature is sweltering. In this subsistence maize-growing region of an impoverished landlocked country in southern Africa, households eke out survival from an unforgiving terrain. This year has been a lot more difficult than usual because the rains have failed, probably the result of an El Niño cycle. Whatever the cause, the crops are withering in the fields that we pass.

If the village were filled with able-bodied men who could have built small-scale water harvesting units on rooftops and in the fields to collect what little rain had fallen in the preceding months, the situation would not be as dire as it is this morning. But as we arrive in the village, we see no able-bodied young men at all. In fact, older women and dozens of children greet us, but there is not a young man or woman of working age in sight. Where, we ask, are the workers? Out in the fields? The aid worker who has led us to the village shakes his head sadly and says no. They are nearly all dead. The village has been devastated by AIDS, which has ravaged this part of Malawi for several years now. There are

*Twelve*

## ON-THE-GROUND SOLUTIONS FOR ENDING POVERTY

The end of poverty will require a global network of cooperation among people who have never met and who do not necessarily trust each other. One part of the puzzle is relatively easy. Most people in the world, with a little bit of prodding, would accept the fact that schools, clinics, roads, electricity, ports, soil nutrients, clean drinking water, and the like are the basic necessities not only for a life of dignity and health, but also for economic productivity. They would also accept the fact that the poor may need help to meet their basic needs, but they might be skeptical that the world could pull off any effective way to give that help.

If the poor are poor because they are lazy or their governments are corrupt, how could global cooperation help? Fortunately, these common beliefs are misconceptions, only a small part of the explanation, if at all, of why the poor are poor. I have noted repeatedly that in all corners of the world, the poor face structural challenges that keep them from getting even their first foot on the ladder of development. Most societies with good harbors, close contacts with the rich world, favorable climates, adequate energy sources, and freedom from epidemic disease have escaped from poverty. The world's remaining challenge is not mainly to overcome laziness and corruption, but rather to take on geographic isolation, disease, vulnerability to climate shocks, and so on, with new systems of political responsibility that can get the job done.

In the next chapters, I lay out a strategy for ending extreme poverty by 2025. The strategy focuses on the key investments—in people and in infrastructure—that can give impoverished communities around the world, both rural and urban, the tools for sustainable development. We need plans, systems, mutual accountability, and financing mechanisms. But even before we have all of that apparatus—or economic plumbing—in place, we must first understand more concretely what such a strategy means to the one billion-plus people who can be helped. It is the bravery, fortitude, realism, and sense of responsibility of the impoverished and disempowered, for themselves and especially for their children, that give us hope, and spur us on to end extreme poverty in our time.

### MEETING WITH THE RURAL POOR: SAURI, KENYA

Together with colleagues from the UN Millennium Project and the Earth Institute, I spent several days in July 2004 in a group of eight Kenyan villages known as the Sauri sublocation in the Siaya district of Nyanza Province, about forty-four kilometers from Kisumu, in western Kenya. We visited farms, clinics, a subdistrict and district hospital, and schools in Sauri and the environs. We met with international organizations working in the region, including ICRAF (the World Agroforestry Center), the UN Development Program, and the U.S. Centers for Disease Control and Prevention. The visit made vivid both why extreme poverty persists in rural areas and how it can be ended.

We found a region beset by hunger, AIDS, and malaria. The situation is far more grim than is described in official documents. The situation is also salvageable, but the international community requires a much better understanding of its severity, dynamics, and solutions if the crisis in Sauri and the rest of rural Africa is to be solved.

The situation is best understood through the voices of Sauri's struggling residents. In response to an invitation from our group, more than two hundred members of the community came to meet with us one afternoon (see photograph 2). Hungry, thin, and ill, they stayed for three and a half hours, speaking with dignity, eloquence, and clarity about their predicament. They are impoverished, but they are capable and resourceful. Though struggling to survive at present, they are not dispir-

ied but determined to improve their situation. They know well how they could get back to high ground.

The meeting took place on the grounds of a school called the Bar Sauri Primary School, under the auspices of a remarkable school headmistress, Ms. Anne Marcelline Omolo, who shepherds hundreds of hungry and impoverished schoolchildren, many of them orphans, through primary education and the travails of daily life. Despite disease, orphanhood, and hunger, all thirty-three of last year's eighth-grade class passed the Kenyan national secondary school exams. On a Sunday in July, we saw why. On their "day off" from school, this year's class of eighth graders sat at their desks from 6:30 A.M. until 6:00 P.M. preparing months in advance for this year's national examinations in November. Unfortunately, many who will pass the exams will be unable to take a position in a secondary school because of lack of funds for tuition, uniforms, and supplies. Nonetheless, to boost the fortitude of the eighth graders during the critical examination year, the community provides them with a cooked midday meal, with the fuel wood and water brought from home by the students (shown in photographs 3 and 4). Alas, the community is currently unable to provide midday meals for the younger children, who must fend for themselves. Many go hungry the entire school day.

The village meeting got underway on a Monday afternoon, with the villagers arriving on foot from several kilometers away. I introduced my colleagues and told the community of the Millennium Project's assignment from UN Secretary-General Kofi Annan to understand the situation of communities like Sauri, and to work with villagers to identify ways to help such communities to achieve the worldwide Millennium Development Goals of reducing extreme poverty, hunger, disease, and lack of access to safe water and sanitation. I also announced that thanks to a remarkable grant from the Lentfest Foundation in the United States, the Earth Institute at Columbia University would be able to put some of the ideas to work in Sauri and help the international community learn from the experience in Sauri for the benefit of villages in other parts of Africa and beyond. Several hours later, around 5:30 P.M., we all rose from a discussion that was distressing, uplifting, and profoundly challenging—challenging, most of all, for the rich world.

Whatever the official data may show about "stagnant" rural incomes in places like Sauri, stagnation is a euphemism for decline and early death. Food output per person is falling; malaria is pervasive and in-

creasing. AIDS stalks the community and the region, with adult prevalence on the order of 30 percent, if not higher. Rudimentary springs for collecting water for household use are often dirty, especially later in the day after extensive morning use. An NGO from the UK helped install a few protected water points, but they are too few in number, far from many homesteads, and heavily congested, sometimes yielding little more than a trickle and therefore requiring several minutes to fill a jug. Rapid population growth in the past has made farm sizes small. Fertility rates are around six children per woman, and the villagers have no access whatsoever to family planning and reproductive health services or to modern contraceptives.

I canvassed the group on the material conditions of the community, and received very perceptive accounts of the grim situation. Only two of the two hundred or so farmers at the meeting reported using fertilizer at present. Around 25 percent are using improved fallows with nitrogen-fixing trees, a scientific farming approach developed and introduced into Sauri by ICRRAF. With this novel technique, villagers grow trees that naturally fix nitrogen, meaning that the trees convert atmospheric nitrogen, which most food crops cannot use directly, into a nitrogen compound that food crops can use as a nutrient. The leguminous (nitrogen-fixing) trees can be planted alongside maize or other food crops. By choosing the right timing for planting and the right combination of trees and crops, the farmer gets a natural substitute for chemical nitrogen fertilizer.

So far, just one fourth of Sauri farmers use the new method. It costs money to introduce the technique and one planting season is lost. Farmers may also need to add some nonnitrogen fertilizers, especially potassium, which is also costly, too costly for the impoverished farmers. All of these additional complications could easily be addressed, and the ICRRAF technique could be scaled up throughout the village, if only there were additional financial resources available to ICRRAF and the village to jump-start the process.

The rest of the community is farming on tiny plots, often no more than 0.1 hectares, with soils that are utterly exhausted of nutrients, and therefore biologically unable to produce an adequate crop. The soils are so depleted of nutrients and organic matter that even if the rains are good, with yields of around one ton of maize per hectare, the households still go hungry. If the rains fail, the households face the risk of

death from immunosuppression because of severe undernutrition. Stunting, meaning low height for one's age, is widespread, a sign of the pervasive and chronic undernutrition of the children.

The real shocker came with my follow-up question. How many farmers had used fertilizers in the past? Every hand in the room went up. Farmer after farmer described how the price of fertilizer was now out of reach, and how their current impoverishment left them unable to purchase what they had used in the past. A fifty-kilo bag of diammonium phosphate (DAP) fertilizer sells for around 2,000 Ksh (Kenyan shillings) (US\$25). At \$500 a ton, that is at least twice the world market price. A proper application might require two to four bags per hectare, or \$50 to \$100 per hectare, a cost vastly beyond what the household can afford. Credits to buy fertilizer are neither available nor prudent for these farmers: a single failed crop season, an untimely episode of malaria, or some other calamity can push a household that has taken on debt into a spiral of unending indebtedness and destitution.

In my mind I started the calculations as the conversation progressed. Scaling up an appropriate combination of agroforestry and chemical fertilizer inputs would cost some tens of thousands of dollars. Yes, the amount was out of reach of the villagers themselves, but would represent a low cost per person in villages like Sauri if donors would rise to the occasion. Fortunately, on this occasion, the Earth Institute was able to respond.

As the afternoon discussion unfolded, the gravity of the community's predicament became more and more apparent. AIDS is ravaging the village, and nobody has yet had access to antiretroviral therapy. I asked how many households were home to one or more orphaned children left behind by the pandemic. Virtually every hand in the room shot up. I asked how many households were receiving remittances from family members living in Nairobi and other cities. The response was that the only things coming back from the cities were coffins and orphans, not remittances.

I asked how many households had somebody currently suffering from malaria. Around three fourths of the hands shot up. How many used antimalarial bed nets? Two out of two hundred hands went up. How many knew about bed nets? All hands. And how many would like to use bed nets? All hands remained up. The problem, many of the women explained, is that they cannot afford the bed nets, which sell for a few dollars per net, and are too expensive even when partially subsidized

(socially marketed) by international donor agencies. How many in the community were using medicine to treat a bout of malaria? A few hands went up, but the vast majority remained down. A woman launched into an explanation that the medicines sell at prices well beyond what the villagers can afford.

A year or so ago, Sauri had a small clinic, as seen in photograph 5. The doctor has since left and the clinic is now padlocked. The villagers explained that they could not afford to pay the doctor and buy the medicines, so the doctor departed. Now they fend for themselves without health care or medicines. When malaria gets bad, and their children fall into anemia-induced tachycardia (rapid heartbeat), gasping for breath in small, ravaged bodies deprived of oxygen-carrying hemoglobin, they rush the child to the subdistrict hospital in nearby Yala. The mothers may carry the children on their backs or push them in wheelbarrows for several kilometers over dirt paths. Yet when we visited the Yala subdistrict hospital on our way from the village, we found a hospital with patients lying on cots in the halls—without running water, an in-house doctor (one visits only two afternoons per week), or even one complete surgical kit.

A few years back, Sauri's residents cooked with locally collected fuel wood, but the decline in the number of trees has left the sublocation bereft of sufficient fuel wood. The quarter or so households who are using the ICRAF system of improved fallows, based on leguminous trees, have a dedicated supply of fuel wood. Other farmer households do not. Villagers said that they now buy pieces of fuel wood in Yala or Muhanda (both a few kilometers away), a bundle of seven sticks costing around twenty-five shillings (thirty cents). These seven sticks are barely sufficient for cooking one meal. In our meeting with the villagers, I conveyed astonishment at the price, thirty cents per meal, for a community that earns almost no money at all. A woman responded that many villagers had in fact reverted to cooking with cow dung or to eating uncooked meals.

As this village dies of hunger, AIDS, and malaria, its isolation is stunning. There are no cars or trucks owned or even used within Sauri, and only a handful of villagers said they had ridden in any kind of motorized transport during the past year. Only three or four of the two hundred or so said that they get to the regional city of Kisumu each month, and about the same number said that they had been to Nairobi, Kenya's commercial and political capital, four hundred kilometers away, once

during the past year. There are virtually no remittances reaching the village. Indeed, there is virtually no cash income of any kind reaching the village. Given the farmers' meager production, farm output must be used almost entirely for the household's own consumption, rather than for sales in the market. The community has no money for fertilizers, medicines, school fees, or other basic needs that must be purchased from outside of the villages. Around half of the individuals at the meeting said that they had never made a phone call in their entire lives. (Ironically and promisingly, our own mobile phones worked fine in the village, relying on a cell tower in Yala. Extending low-cost telephony to the village, for example based on a mobile phone shared by the community, would therefore pose no infrastructure problems.)

This year the rains are falling again, another disaster in an increasingly erratic climate, quite possibly a climate showing the increasing effects of long-term man-made climate change emanating from the rich world. The two roof-water harvesting cisterns at the school are now empty, and the farmers fear disaster in the harvest next month. The Kenyan government has already put out a worldwide appeal for emergency aid to fight imminent starvation in several provinces, including Nyanza.

This village could be rescued, and could achieve the Millennium Development Goals, but not by itself. Survival depends on addressing a series of specific challenges: nutrient-depleted soils, erratic rainfall, holoendemic malaria, pandemic HIV/AIDS, lack of adequate education opportunities, lack of access to safe drinking water and latrines, and the unmet need for basic transport, electricity, cooking fuels, and communications. All of these challenges can be met, with *known, proven, reliable, and appropriate* technologies and interventions.

The crux of the matter for Sauri sublocation can be stated simply and directly:

Sauri's villages, and impoverished villages like them all over the world, can be saved and set on a path of development at a cost that is tiny for the world but too high for the villages themselves and for the Kenyan government on its own.

African safari guides speak of the Big Five animals to watch for on the savannah. The international development community should speak of the Big Five development interventions that would spell the difference between hunger, disease, and death and health and economic development. Sauri's Big Five, identified by the villages as well as by the UN Millennium Project, are

- **Agricultural inputs.** With fertilizers, improved fallows (with ICRAF's proven technologies), green manures and cover crops, water harvesting and small-scale irrigation, and improved seeds, Sauri's farmers could triple the food yields per hectare and quickly end chronic hunger. In addition, storage facilities would allow the village to sell the grain over the course of months, rather than all at once, thereby getting more favorable prices. Grain could be protected in locally made storage bins using leaves from the improved fallow species tephrosia, which has insecticide properties. These improvements would be of particular advantage for the women, who do the lion's share of African farm and household work.
- **Investments in basic health.** A village clinic with one doctor and nurse for the five thousand residents would provide free antimalarial bed nets, effective antimalarial medicines, treatments for HIV/AIDS opportunistic infections (including highly effective and low-cost Bac-trim); antiretroviral therapy for late-stage AIDS; and a range of other essential health services, including skilled birth attendants and sexual and reproductive health services.
- **Investments in education.** Meals for all the children at the primary school could improve the health of the schoolchildren, the quality of education, and the attendance at school. Expanded vocational training for the students could teach them the skills of modern farming (for example, using improved fallows and fertilizer), computer literacy, basic infrastructure maintenance (electrical wiring, use and maintenance of a diesel generator, water harvesting, borewell construction and maintenance), carpentry, and the like. With a mere thousand households in Sauri, village-wide classes once a month could train adults in hygiene, HIV/AIDS, malaria control, computer and mobile phone use, and a myriad of other technical and enormously pressing topics. Without doubt, the village is ready and eager to be empowered by increased information and technical knowledge.
- **Power, transport, and communications services.** Electricity could be made available to the villages either via a power line (from Yala or Nyanminia) or an off-grid diesel generator. The electricity would power lights and perhaps a computer for the school; pumps for safe well water; power for milling grain and other food processing; refrigeration; carpentry; charges for household batteries (which could be used for

household illumination); and other needs. The villagers emphasized that the students would like to study after sunset but cannot do so without electric lighting. A village truck could bring in fertilizers, other farm inputs, and modern cooking fuels (for example, canisters of liquid petroleum gas [LPG], familiar from American backyard barbecues), and take out harvests to the market, transport perishable goods and milk for sale in Kisumu, and increase opportunities for off-farm employment for youth. The truck could rush women with childbirth complications and children with acute complications of anemia to the hospital. One or more shared mobile phones for the village could be used for emergencies, market information, and generally to connect Sauri with the outside world.

- **Safe drinking water and sanitation.** With enough water points and latrines for the safety and convenience of the entire village, women and children of the village would save countless hours of toil each day fetching water. The water could be provided through a combination of protected springs, borewells, rainwater harvesting, and other basic technologies. There is even the possibility of establishing links with an existing large-scale storage tank and pumping station a few kilometers away.

The irony is that the costs of these services for Sauri's five thousand residents would be very low. Here are some quick guesses, which colleagues at the Earth Institute are refining:

Fertilizers and improved fallows for the five hundred or so arable hectares would be roughly \$100 per hectare per year, or \$50,000 per year for the community.

A clinic, staffed by a doctor and nurse, providing free malaria prevention and care and additional free basic services other than antiretrovirals, would cost around \$50,000 per year. (Antiretrovirals would be provided by the Global Fund to Fight AIDS, TB, and Malaria, the U.S. Emergency Plan, and other programs.) School meals could be paid for communally out of just a small part of the incremental grain yields achieved through the application of fertilizers.

A village truck would be an annual inclusive running cost of perhaps \$15,000 per year if amortized over several years (or leased from a manufacturer). Modern cooking fuel for the primary and secondary school students (numbering about a thousand) in the entire subloca-

tion would cost an additional \$5,000 per year. A few village cell phones and a grain storage facility would add perhaps \$5,000 per year, for a total of \$25,000 per year.

A combination of protected springs (with improved access), borewells (with pumps), and community taps connected to the large-scale storage system would provide access to water at ten convenient locations and cost around \$25,000 dollars.

Electricity could be provided to the school, the nearby clinic, and five water points by a dedicated off-grid generator or by a power line from Yala or Nyamima for an initial cost of about \$35,000. For another \$40,000 in initial costs and recurring costs of \$10,000, every household could be provided with a battery/bulb assembly to light a small bulb for a few hours every night with the battery charging station connected to the village generator. The annualized costs would be \$25,000 per year.

Additional expenses would include scaling up educational activities, various costs of local management, technical advice from agricultural extension officers, and other related delivery services.

My Earth Institute colleagues and I estimated that the combined costs of these improvements would total around \$350,000 per year, or roughly \$70 per person per year in Sauri, for at least the next few years. The benefits would be astounding: decisive malaria control (with transmission reduced by perhaps 90 percent, judging from recent CDC bednet trials in a neighboring area), a doubling or tripling of food yields per hectare with a drastic reduction of chronic hunger and undernutrition, improved school attendance, a reduction of water-borne disease, a rise in incomes through the sale of surplus grains and cash crops, the growth of cash incomes via food processing, carpentry, small-scale clothing manufacturing, horticulture, aquaculture, animal husbandry, and a myriad of other benefits. With anti-AIDS drugs added to the clinic's services, the mass deaths from AIDS, as well as the deluge of newly orphaned children, could also be stanch.

Sooner rather than later, these investments would repay themselves not only in lives saved, children educated, and communities preserved, but also in direct commercial returns. Consider the case of fertilizers, which are currently unused, since households lack access to storage, transport, credit, and a financial cushion against the risk of crop failures even if credit is made available. A fertilizer application of \$100 per hectare (such as two hundred kilos of DAP), combined with or substituted by improved fallows (as appropriate), could raise crop yields in a

normal season from one ton per hectare to three tons per hectare, with a marketable value of the increment of roughly \$200 to \$400 dollars per hectare, assuming that transport is available and there is a stable price for the maize crop. In a drought year, fertilizer and/or improved fallows would mean the difference between harvesting one ton and a failed crop (with attendant acute hunger, if not starvation). In the first few years, *fertilizers and improved fallows should be given largely for free to the villagers to boost their own nutrition and health, and to build a small financial cushion*. Later on it will be possible to share the costs with the community and, eventually, perhaps in a decade, to provide the fertilizer and improved fallows on a full commercial basis.

#### INTERNATIONAL DONORS AND VILLAGES LIKE SAURI

The international donor community should be thinking round the clock about one question: *how can the Big Five interventions be scaled up in rural areas like Sauri?* With a population of some thirty-three million people, of whom two thirds are in rural areas, Kenya would require annual investments on the order of \$.15 billion per year for its Sauris, with donors filling most of that financing gap, since the national government is already stretched beyond its means. (More precise estimates of cost would have to be worked out in the context of detailed development plans as described in chapter 14.) Instead, donor support to Kenya is around \$100 million, or a mere one fifteenth of what is needed. Kenya's debt servicing to the rich world is around \$600 million per year, so its budget is still being drained by the international community, not bolstered by it.

This is all the more remarkable since Kenya is a new and fragile democracy that should be receiving considerable help from its development partners. Kenya, ironically, is also a victim of global terrorism, caught in a war not of its own making. U.S. and Israeli targets on Kenyan soil have been hit in recent years, sending Kenya's tourist industry into a downward spiral and causing hundreds of deaths of Kenyans and massive property damage.

The UN Millennium Project is working with the government of Kenya to ensure that its poverty reduction efforts are bold enough to

achieve the Millennium Development Goals. This strategy will require much greater development assistance and deeper debt cancellation from the rich world to enable Kenya to invest in the Big Five—agriculture, health and education, electricity, transport and communications, and safe drinking water—not only in Sauri villages, but across impoverished rural Kenya. Yet when the Kenyan government recently proposed a national social health insurance fund, the very thing needed to scale up access to basic health care, donors quickly objected rather than jumped at the opportunity to examine how it could actually be accomplished.

The issue of corruption overshadows donor relations with the Kenyan government. Much of the corruption reflects holdouts from the earlier regime of more than two decades, corrupt officials who have not yet been weeded out. Part of the corruption is new and completely avoidable, but only if donors help Kenya to improve the functioning of the public administration, not by moralizing and finger pointing but by the installation of computer systems, published accounts, job training and upgrading, higher pay for senior managers so that they do not have to live off bribes and side payments, continued support for the government's already major efforts to improve the judicial system, empowerment of local villages to oversee the provision of public services, and some humility on the part of donors. Most donor governments have corruption inside their own governments and even in the provision of foreign aid (which is often linked to powerful political interests within the donor countries). The affliction is widespread, and needs to be attacked systematically and cleverly, but without useless and false moralizing.

Donors should sit down with the government leadership and say, "We'd like to help you scale up the Big Five in Kenya's villages to enable you to ensure that all of Kenya's rural poor have access to agricultural inputs, health, education, electricity, communications and transport, and safe water and sanitation. Together, let's design a budgetary and management system that will reach the villages and ensure a monitorable, governable, and scalable set of interventions across the country. We're prepared to pay if you are prepared to ensure good governance on such a historic project." Private international consulting firms could be brought in to help design these systems and to lend credibility to their implementation and performance.

With a little more forethought, donors and governments could take advantage of the crucial fact that villages like Sauri have a group moni-



toring and enforcement mechanism automatically built into village life that can help to ensure that aid to the village is well used. Just as experience with group lending in microfinance has been highly successful, projects that empower village-based community organizations to oversee village services have also been highly successful. Recent experiences with village governance in India, based on the *panchayats* (local councils), are but one notable example. In Sauri, the villagers jumped with eagerness at the invitation to form various committees (schooling, clinics, transport and electricity, farming) to help prepare for the actual investments and to ensure proper governance as they are put into place. Headmistress Omolo, who oversaw the formation of the committees, also ensured that the village women, with their special needs and burdens and even legal obstacles, would be well represented in each of the committees.

If donor officials would join the government of Kenya in meeting with the villagers and brainstorming with government officials, they could come up with dozens of fruitful approaches to ensure that aid actually reaches the villages. We need to be more creative in order to save the lives of millions of people now struggling to survive—and often failing—in the impoverished villages around the world. The donors and the government of Kenya can and should agree on a suitable and bold strategy: Kenya's new democracy, from the national government down to the villages, is prepared to govern the use of international help with transparency, efficiency, and equity if we can get the delivery mechanisms right and invest in the supporting information and reporting technologies.

#### MEETING WITH THE URBAN POOR: MUMBAI, INDIA

Several thousand miles from Sauri, Kenya, an impoverished community in Mumbai, India, struggles with the urban face of extreme poverty. A group that I met in June 2004 comes from a community that lives near the railway tracks. By near, I do not mean within range of the railway whistle as the train rolls through the city; I mean a community that lives within ten feet of the tracks. It may seem impossible, but the shacks of poster board, corrugated sheet metal, thatch, and whatever else is at hand are pushed right against the tracks, as seen in photograph 6. Chil-

dren and the old routinely walk along the tracks, often within a foot or two of passing trains. They defecate on the tracks, for lack of alternative sanitation. And they are routinely maimed and killed by the trains.

An energetic and charismatic social worker, Sheela Patel, who left academic research years earlier to work with communities like this one, has brought me to meet the group. She has pioneered the cause of community organization within the very poorest slums, such as those shown in photographs 7 and 8. The NGO that she founded, the Society for the Promotion of Area Resource Centres (SPARC), is our host today. The fifty or so people assembled around the room are mostly women in their thirties and forties, but they look much older after decades of hard physical work and exposure to the elements. They have come to meet with me, and also a group of visitors from Durban, South Africa, who are there to learn about community organization for slum dwellers and squatters.

The overarching theme of our discussion is not latrines, running water, and safety from the trains, but empowerment: specifically, the group is discussing how slum dwellers who own virtually nothing have found a voice, a strategy for negotiating with the city government. In the past few years, this particular group, with SPARC's support, has been negotiating arrangements to relocate away from the tracks to safer ground, in settlements with basic amenities like running water, latrines, gutters, even roads. Thousands have already been relocated, though thousands more wait to find new living quarters.

The notion of large communities of people living within a few feet of the train tracks is startling enough for me this morning. It is, to be sure, a measure of the desperation of the poorest of the poor who arrive in cities to escape rural impoverishment, even famine, and then struggle to establish survivable conditions for themselves and for their children. But I'm even more startled to learn that there is actually a Railway Slum Dwellers Federation (RSDF), which has been organized by the community members, with the aid of SPARC, to negotiate with the municipality and the Indian Railways concerning their needs and interests. In addition to SPARC and the RSDF, a third NGO is represented at the meeting, Mahila Milan (Women Together), which focuses specifically on the needs of women slum dwellers.

As the women begin to talk, the realities of extreme urban poverty and the range of solutions come vividly to the fore. Each woman begins with a kind of testimonial to the power of group action. This testimony

might have seemed staged but for the genuine smiles, calm demeanor, and straightforward, matter-of-fact approach of the group. They explain how they have had no schooling—perhaps two or three years of fiftieth-grade attendance several decades ago. They cannot read or write, but they know full well that their children need and deserve better. Before they came together in the joint initiative of SPARC, the RSDI, and Mahila Milan, they were resigned to their dreadful circumstances, living in constant danger, noise, disruption, and squalor.

But group action has taught them that in fact they have legal rights within the city and even the possibility of access to public services if they act together. The city government and Indian Railways, for their part, have been only too happy to try to relocate the group away from the railway tracks, since the presence of the slum right up against the track leads to frequent accidents and forces the trains to slow down markedly, raising costs and limiting service. The city and the railway company have learned the hard way that any forcible actions to relocate individual families can trigger an uproar, as occurred in February 2001 when two thousand huts were demolished along the Harbour railway line and the federation mobilized its members to shut down the city's railways.

As in the villages of Sauri, what this community needs are investments in individuals and basic infrastructure that can empower people to be healthier, better educated, and more productive in the workforce. These impoverished families want basic amenities—to live away from the railway tracks, with access to water, sanitation, roads, and even electricity. They will need to have new ration cards for the government-supplied subsidized food and cooking oil in the new neighborhoods where they will live. Their children will need access to a school and clinic. They would like to be able to reach their jobs on public transport or by foot if they are close enough. All are hard workers, earning their meager incomes as maids, cooks, sweepers, guards, launderers, or in other low-skilled, labor-intensive services. The younger and more literate members of the group have actually begun to gain, or regain, basic literacy, empowered and motivated by their political activism. Those who become literate have a chance to find work at two or three times their current salaries, perhaps in the garment factories.

One recent report from the slums of Mumbai and Pune, India, speaks plainly to how the lack of basic infrastructure, in this case safe drinking water, has devastating consequences on the dignity and physical well-being of women:

It is typically women who collect water from public standpipes, often queuing for long periods in the process and having to get up very early or go late at night to get the water. It is typically women who have to carry heavy water containers over long distances and on slippery slopes. It is typically women who have to make do with the often inadequate water supplies to clean the home, prepare the food, wash the utensils, do the laundry and bathe the children. It is also women who have to scrounge, buy or beg for water, particularly when their usual sources run dry. It is important not to underestimate this side of the water burden. There are no compelling international statistics, comparable to health statistics, documenting the labour burdens related to inadequate water provision. It is difficult for those who have never had to rely on public or other peoples' taps to appreciate how humiliating, tiring, stressful and inconvenient this can be. Not having toilets, or having to wait in long queues to use filthy toilets, carries health risks and is also a source of anxiety.

In many ways, the logistical and investment needs of the squatters will be easier to address than the comparable needs of the villagers in Sauri. Water taps can be provided from the main city pipes. Electricity can be tapped into from the power grid rather than supplied by a stand-alone generator. In densely populated urban areas, access to schools and clinics can also be easier to arrange. Doctors and nurses abound in Mumbai in comparison with the scarcity of trained medical personnel in rural Kenya. The problems in urban areas revolve around empowerment and finance. How can an impoverished squatter community, without its own land, find a collective voice and the security to raise that voice, and how can the financial burdens be shared among the city government and the slum dwellers in a realistic manner?

With SPARC's initiative, the new Slum Rehabilitation Act has given added power to the communities: slum-dweller organizations are now legally empowered to act as land developers if they can demonstrate that they have agreements to represent at least 70 percent of the eligible slum dwellers in a particular location. As land developers, the slum-dweller organizations can tap into special municipal programs to gain access to real estate for community resettlement or for commercial development that can finance resettlement elsewhere. SPARC is also negotiating with the Kolkata Municipal Authority to help set up lavatories in Kolkata's slums, under an arrangement in which the costs of construc-

tion would be borne jointly by the municipality and the slum dwellers, and maintenance would be the responsibility of the slum dwellers' organization.

As Sheela Patel explains, adding an organized slum dwellers' voice at the table will make possible future solutions that were undreamed of in the past. Recently the World Bank has creatively joined the mix, helping to finance some of the upgrading of Mumbai's urban transport based on a major role for the NGOs in the design and implementation of the resettlement programs. The NGOs, for their part, have made important advances in organizing and documenting the community members to facilitate the process. Sheela Patel and her colleagues have said that these programs are "steps on the journey towards citizenship for the urban poor, where rights are translated into reality because of the favorable confluence of a supportive policy environment and grassroots democracy in action."

#### THE PROBLEM OF SCALE

The end of poverty must start in the villages of Sauri and the slums of Mumbai, and millions of places like them. The key to ending poverty is to create a global network of connections that reach from impoverished communities to the very centers of world power and wealth and back again. Looking at the conditions in Sauri, we can see how far \$70 per person can go in changing lives—not as a welfare handout, but as an investment in sustained economic growth. Looking at the conditions in Mumbai, we can see how a stable and safe physical environment for a community can enable its households to get a foothold in the urban economy, one that is already linked to global markets. For a sum similar to that in Sauri, it will be possible to establish that foothold.

The starting points of that chain are the poor themselves. They are ready to act, both individually and collectively. They are already hard working, prepared to struggle to stay afloat and to get ahead. They have a very realistic idea about their conditions and how to improve them, not a mystical acceptance of their fate. They are also ready to govern themselves responsibly, ensuring that any help that they receive is used for the benefits of the group rather than pocketed by powerful individuals. But they are too poor to solve their problems on their own. So, too, are their own governments. The rich world, which could readily provide

the missing finances, wonders how to ensure that money made available would actually reach the poor and be an investment in ending poverty rather than an endless provision of emergency rations. This question can be answered by showing how networks of mutual accountability can run alongside the networks of financing.

In short, we need a strategy for scaling up the investments that will end poverty, including a system of governance that empowers the poor while holding them accountable. In each low-income country, it is time to design a poverty reduction strategy that can meet this challenge.

*Thirteen*

## MAKING THE INVESTMENTS NEEDED TO END POVERTY

At the most basic level, the key to ending extreme poverty is to enable the poorest of the poor to get their foot on the ladder of development. The development ladder hovers overhead, and the poorest of the poor are stuck beneath it. They lack the minimum amount of capital necessary to get a foothold, and therefore need a boost up to the first rung. The extreme poor lack six major kinds of capital:

- Human capital: health, nutrition, and skills needed for each person to be economically productive
- Business capital: the machinery, facilities, motorized transport used in agriculture, industry, and services
- Infrastructure: roads, power, water and sanitation, airports and seaports, and telecommunications systems, that are critical inputs into business productivity
- Natural capital: arable land, healthy soils, biodiversity, and well-functioning ecosystems that provide the environmental services needed by human society
- Public institutional capital: the commercial law, judicial systems, government services and policing that underpin the peaceful and prosperous division of labor

- Knowledge capital: the scientific and technological know-how that raises productivity in business output and the promotion of physical and natural capital

How to overcome a poverty trap? The poor start with a very low level of capital per person, and then find themselves trapped in poverty because the ratio of capital per person actually falls from generation to generation. The amount of capital per person declines when the population is growing faster than capital is being accumulated. Capital is accumulated, in turn, in a balance of two forces, one positive and one negative. On the positive side is the capital accumulated when households save a part of their current income, or have a part of their income taxed to finance investments by the government. Household savings are either lent to businesses (often through financial intermediaries such as banks) or invested directly in family businesses or equities traded in the market. Capital is diminished, or depreciated, as the result of the passage of time, or wear and tear, or the death of skilled workers, for example, because of AIDS. If savings exceed depreciation, there is positive net capital accumulation. If savings are less than depreciation, the capital stock declines. Even if there is positive net capital accumulation, the question for growth in per capita income is whether the net capital accumulation is large enough to keep up with population growth.

### HOW THE POVERTY TRAP WORKS AND HOW FOREIGN AID HELPS OVERCOME IT

Figure 1 shows the basic mechanics of saving, capital accumulation, and growth, and figure 2 shows how a poverty trap works. In figure 1, we start on the left-hand side with a typical household. The household divides its income into consumption, taxation, and household savings. The government, in turn, divides its tax revenues into current spending and government investment. The economy's capital stock is raised by both household savings and by government investment. A higher capital stock leads to economic growth, which in turn raises household income through the feedback arrow from growth to income. We show in the figure that population growth and depreciation also negatively affect the accumulation of capital. In a "normal" economy, things proceed smoothly toward rising incomes, as household savings and govern-

ment investments are able to keep ahead of depreciation and population growth.

In figure 2, the process breaks down into a poverty trap. We start again on the left-hand side, but now with a household that is impoverished. All of its income goes to consumption, just to stay alive. There are no taxes and no personal savings. Nonetheless, depreciation and population growth continue relentlessly. The result is a fall in capital per person and a negative growth rate of per capita income. That leads to still further impoverishment of the household in the future. The figure depicts a vicious circle of falling incomes, zero savings and public investment and falling capital per person as a result.

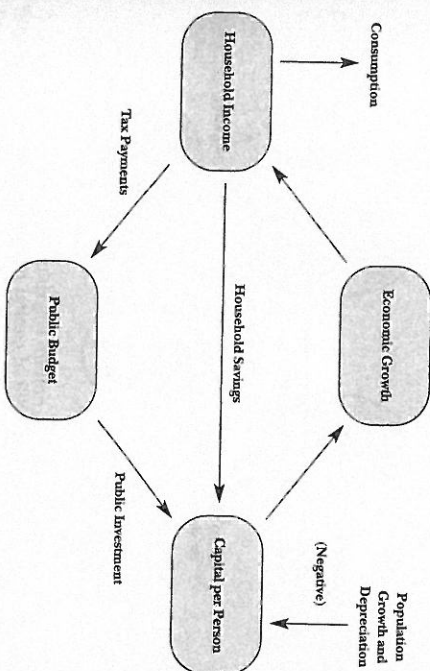
The solution is shown in figure 3, where foreign help, in the form of official development assistance (ODA), helps to jump-start the process of capital accumulation, economic growth, and rising household incomes. The foreign aid feeds into three channels. A little bit goes directly to households, mainly for humanitarian emergencies such as food aid in the midst of a drought. Much more goes directly to the budget to finance public investments, and some is also directed toward private businesses (for example, farmers) through microfinance programs and other schemes in which external assistance directly finances private small businesses and farm improvements. If the foreign assistance is substantial enough, and lasts long enough, the capital stock rises sufficiently to lift households above subsistence. At that point, the poverty trap is broken, and figure 1 comes into its own. Growth becomes self-sustaining through household savings and public investments supported by taxation of households. In this sense, foreign assistance is not a welfare handout, but is actually an investment that breaks the poverty trap once and for all.

#### A Numerical Illustration

Economists like to use numerical models because it helps them to calculate more specifically how much it will cost to accomplish a particular goal, in this case the goal of breaking a poverty trap. Here's a numerical illustration of how the poverty trap works, and through a bit tedious, it shows how financial planning can be used to identify the overall magnitude of official development assistance that will be needed to end poverty. To keep things simple, I use an illustration based entirely on

household savings and investment, without worrying about taxation and public investment.

Figure 1: The Basic Mechanics of Capital Accumulation



Suppose that an economy requires \$3 of capital for every \$1 of annual production. Suppose also that the capital stock depreciates at a rate of 2 percent per year. For each \$1 million of capital this year, about \$835,000 will remain at the end of a decade, after ten years of depreciation. We'll suppose that the economy currently has 1 million poor people, each with capital of \$900. This results in annual income of \$300 per person (\$900 capital divided by three). The total GDP is therefore \$300 million (\$300 per person times 1 million people). The population is growing at 2 percent per year, so at the end of the decade there will be about 1.2 million people.

Suppose now that the society is too poor to save. Each year the population lives hand to mouth, consuming whatever meager amount is produced. The starting income of \$300 is just barely enough to meet basic needs. At the end of a decade, the capital stock will have partly worn out. Instead of \$900 million in capital, there will be only \$750 million in capital. In the meantime, the population will have grown from 1 million

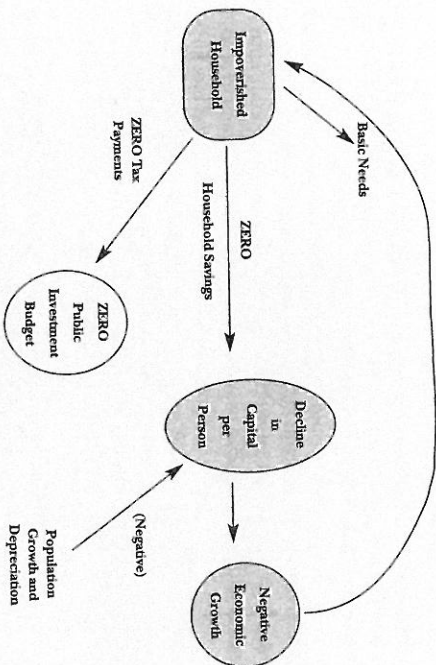


Figure 2: The Poverty Trap

to 1.2 million. Instead of \$900 of capital per person, there is now only \$628 of capital per person (\$750 million in capital divided by 1.2 million population). Instead of each person being able to produce \$300, each person will now produce only \$209 (\$628 of capital divided by three). Households will be sinking into extreme poverty, without the income to meet basic needs.

In another illustration, suppose now that for whatever reason, the economy begins with the same population, but with a capital stock that is twice as large, equal to \$1.8 billion. Per capita income is also twice as large, \$600 per capita. As before, households need \$300 per person per year to meet their basic needs, and do not save anything out of incomes of \$300 or below. On all income *above* \$300 per person, they save 30 percent. Thus a household earning \$600 per capita saves 30 percent of \$300 (\$600 income minus \$300 basic needs), or \$90 in annual saving. Economywide saving is therefore \$90 million.

This year, the capital stock is \$1.8 billion, or \$1,800 per capita. What about next year? I have assumed that 2 percent of this year's capital stock, or \$36 million, will depreciate by next year. But there is also new savings of \$90 million. The net change of the capital stock is a rise of \$54 million (\$90 million minus \$36 million). Next year's capital stock is therefore

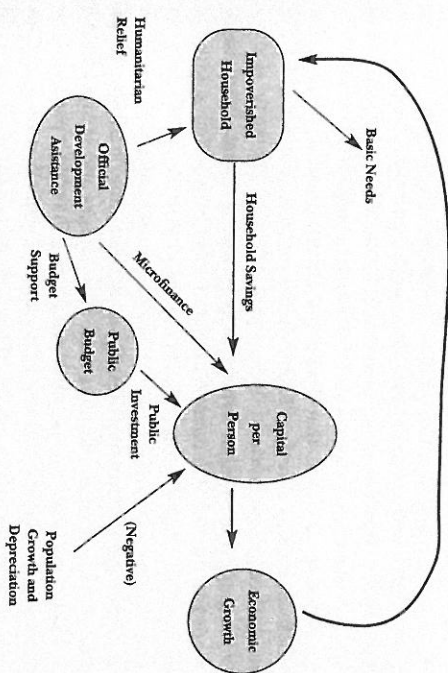


Figure 3: The Role of ODA in Breaking the Poverty Trap

\$1.854 billion (\$1.8 billion plus \$54 million). This amount of capital produces a GNP of \$618 million (\$1.854 billion divided by 3). The population also grows by 2 percent, and so stands at 1.02 million. Per capita income is equal to \$606 (\$618 million divided by 1.02 million). Per capita income has increased by 1 percent (in comparison with \$600), and will increase each year through the decade. Actually, the growth rate will rise gradually over time, reaching more than 2 percent per annum toward the end of the decade as household incomes rise further above the \$300 threshold of basic needs. If you use a spreadsheet to repeat the calculations for ten years rather than one year, the GNP per person at the end of the decade is \$687, up 15 percent during the decade.

Voilà. With the same economic structure as the first economy, but starting with twice the capital stock, the economy grows rather than declines. The reason is that at an income of \$600 per person, the economy is wealthy enough to save for the future; at \$300 per person, it is not. Therefore, starting at \$600 per capita, the economy finds its way onto a sustainable growth path, whereas starting at \$300 per capita, the economy sinks into further misery.

This is not all. As capital accumulates from the income base of \$600 per person, and the ratio of capital per person increases, not only does the economy grow, but the economy is likely to get an *extra* boost from

increasing returns to scale of capital. An economy with twice the capital stock per person means an economy with roads that work the year-round, rather than roads that are washed out each rainy season; electrical power that is reliable twenty-four hours each day rather than electrical power that is sporadic and unpredictable; workers who are healthy and at their jobs, rather than workers who are chronically absent with disease. The likelihood is that doubling the human and physical capital stock will actually *more* than double the income level, at least at very low levels of capital per person.

A graphic illustration of increasing returns to capital is the case of roads like the one that connects the port at Mombasa, Kenya, with the landlocked countries Uganda, Rwanda, and Burundi. The transport costs on this road are extremely high because the road is in very poor condition on various stretches. From time to time, transport is disrupted entirely when the rains wash away bridges and sections of the road. Suppose that, at some point, around half the road is paved and usable, and the rest is unpaved and impassable, with alternating sections of paved and unpaved roadway. Repairing the missing sections would amount to doubling the kilometers of paved road, but would much more than double the economic benefits of the road, since it would become usable along its entire length. This is an example of a threshold effect, in which the capital stock becomes useful only when it meets a minimum standard.

Thus targeted investments backed by donor aid lie at the heart of breaking the poverty trap. Donor-backed investments are needed to raise the level of capital per person. When the capital stock per person is high enough, the economy becomes productive enough to meet basic needs. Households can thus save for the future, putting the economy on a path of sustained economic growth. In my illustration, foreign aid (over several years) that raises the capital stock from \$900 per person to \$1,800 per person would enable the economy to break out of the poverty trap and begin growing on its own. It would also enable the economy to benefit from increasing returns to capital.

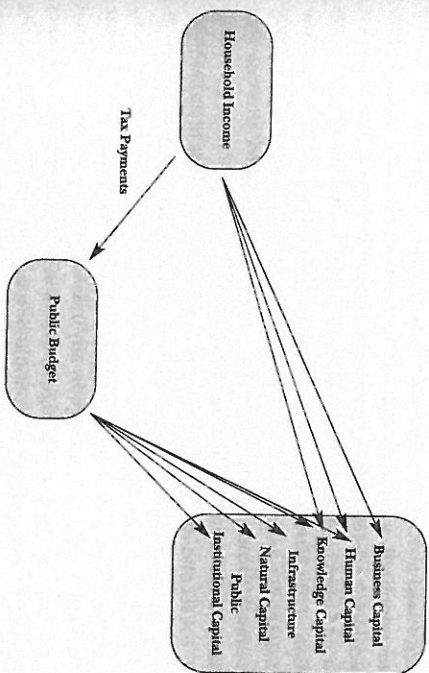
Without donor funding, alas, the necessary investments simply cannot be financed. No matter how hard a government might try—through taxes, user fees, or privatization—the poor households at \$300 per person simply do not have enough income to meet their basic needs and at the same time finance the accumulation of capital. They need the \$300 just to eat and provide clothing, shelter, and other basics.

### Differential Diagnosis and Capital Accumulation

In a simple illustration, or model, as economists call it, it is easy enough to talk about capital as a single item, something that can be doubled or halved fairly straightforwardly. Much of the complexity of real economic strategy, however, is that capital comes in numerous, almost unlimited, forms. Suppose that an economy successfully negotiates an extra \$1 billion in foreign aid. Should that go to building roads, or schools, or power plants, or clinics, or to pay doctors, or teachers, or agricultural extension officers? The answer, in general, is yes to all of the above. The mix will differ markedly country by country. At the core of an effective investment strategy is a rigorous differential diagnosis. The differential diagnosis should build on the appropriate division of labor between the public sector and the private sector, as shown in figure 4.

The public sector should be mainly focused on five kinds of investments: human capital (health, education, nutrition), infrastructure (roads, power, water and sanitation, environmental conservation), natural capital (conservation of biodiversity and ecosystems), public institu-

Figure 4: Private and Public Investments in Capital



tional capital (a well-run public administration, judicial system, police force), and parts of knowledge capital (scientific research for health, energy, agriculture, climate, ecology).

The private sector (funded largely through private savings) should be mainly responsible for investments in businesses, whether in agriculture, industry, or services and in knowledge capital (new products and technologies building on scientific advances), as well as for household contributions to health, education, and nutrition that complement the public investments in human capital. Occasionally the public sector will want to provide direct financing for some private-sector activities, for example, to help farmers adopt new technologies, or to help impoverished rural families to start small businesses or buy critical inputs for the farm, or to encourage the start-up of new urban industries. The general lesson of successful economies is that governments are wise to stick mainly to general kinds of investments—schools, clinics, roads, basic research—and to leave highly specialized business investments to the private sector.

Why should government finance schools, clinics, and roads, rather than leave those to the private sector? There are five kinds of reasons, all compelling in the proper context. First, there are many kinds of infrastructure, especially networks like power grids, roads, and other transport facilities—airports and seaports—which are characterized by increasing returns to scale. If left to private markets, these sectors would tend to be monopolized, so they are called natural monopolies. If such capital investments are left to the private sector, the privately owned monopolies would overcharge for their use, and the result would be too little utilization of this kind of capital. Potential users would be rationed out of the market. It is more efficient, therefore, for a public monopoly to provide network infrastructure and set an efficient price below the one that would be set by a private monopolist.

A second category of publicly provided capital goods includes those that are nonrival, when the use of the capital by one citizen does not diminish its availability for use by others. A scientific discovery is a classic nonrival good. Once the structure of DNA has been discovered, the use of that wonderful knowledge by any individual in society does not limit the use of the same knowledge by others in society. Economic efficiency requires that the knowledge should be available for all, to maximize the social benefits of the knowledge. There should not be a fee for scientists, businesses, households, researchers, and others who want to utilize

the scientific knowledge of the structure of DNA! But if there is no fee, who will invest in the discoveries in the first place? The best answer is the public, through publicly financed institutions like the National Institutes of Health (NIH) in the United States. Even the free-market United States invests \$27 billion in publicly financed knowledge capital through the NIH.

Third, many social sectors exhibit strong spillovers (or externalities) in their effects. I want *you* to sleep under an antimalarial bed net so that a mosquito does not bite you and then transmit the disease to *me*! For a similar reason, I want you to be well educated so that you do not easily fall under the sway of a demagogue who would be harmful for me as well as you. When such spillovers exist, private markets tend to undersupply the goods and services in question. For just this reason, Adam Smith called for the public provision of education: "An instructed and intelligent people . . . are more disposed to examine, and more capable of seeing through, the interested complaints of faction and sedition . . ." Smith argued, therefore, that the whole society is at risk when any segment of society is poorly educated. Natural capital is another area where externalities loom large. Private actions—pollution, logging, overfishing, and the like—can lead to species extinction, deforestation, or other kinds of environmental degradation with serious adverse consequence for the whole society, or even the whole world. Governments therefore have a crucial role to play in conserving natural capital.

Fourth, societies around the world want to ensure that everybody has an adequate level of access to key goods and services (health care, education, safe drinking water) as a matter of right and justice. Goods that should be available to everybody because of their vital importance to human well-being are called merit goods. The rights to these merit goods are not only an informal commitment of the world's governments, they are also enshrined in international law, most importantly in the Universal Declaration of Human Rights, as follows:

- Everyone has the right to a standard of living adequate for the health and well-being of himself and of his family, including food, clothing, housing and medical care and necessary social services, and the right to security in the event of unemployment, sickness, disability, widowhood, old age or other lack of livelihood in circumstances beyond his control.



- Everyone has the right to education. Education shall be free, at least in the elementary and fundamental stages. Elementary education shall be compulsory. Technical and professional education shall be made generally available and higher education shall be equally accessible to all on the basis of merit.

Moreover, according to Article 28 of the Universal Declaration, "Everyone is entitled to a social and international order in which the rights and freedoms set forth in this Declaration can be fully realized." A follow-through on commitments to the Millennium Development Goals would mark a major practical application of that article.

Fifth, government will want to help the poorest of the poor not only by providing infrastructure and social investments, but also by providing productive inputs into private businesses if that, too, is required to help impoverished households get started in market-based activities. Thus government might want to provide subsidized fertilizers to subsistence farmers so that they can produce enough to eat or microcredits to rural women so that they can start microbusinesses. Once these households successfully raise their incomes above subsistence, and begin to accumulate savings on their own, the government subsidies can be gradually withdrawn.

At the same time, except in the case of the poorest households, governments generally should *not* provide the capital for private businesses. Experience has shown that private entrepreneurs do a much better job of running businesses than governments. When governments run businesses, they tend to do so for political rather than economic reasons. State enterprises tend to overstaff their operations, since jobs equal votes for politicians, and layoffs can cost a politician the next election. State-owned banks tend to make loans for political reasons, rather than on the basis of expected returns. Factories are likely to be built in the districts of powerful politicians, not where they can best serve the broader population. Moreover, governments rarely have the in-house expertise to manage complex technologies, and they shouldn't, aside from sectors where the government's role is central, such as in defense, infrastructure, health, and education.

It is one thing to identify the general checklists of public investments and another to apply the checklist to specific contexts. In Sauri, Kenya, and thousands of villages like it, the priorities include the Big Five: agriculture, health, education, infrastructure (power, transport,

and communications), and water and sanitation. Natural capital needs bolstering, especially land reclamation, pollution control, and limits on overfishing, logging, and deforestation generally. Support should come both as direct public provision of services and as public support for private capital accumulation via microfinance and provision of critical farm inputs for smallholder farmers.

A distinct package of public investments will be needed in the urban areas. The higher urban population density makes it feasible, and indeed necessary for public health and economic reasons, to reach households through infrastructure grids for water, sewerage, and power. It is often claimed that in urban areas, private markets can provide these infrastructure services on the basis of market prices. This claim typically overlooks the fact that a sizable proportion of low-income households will be unable to purchase their basic needs at market prices, and will therefore require significant subsidies. One successful model for combining a market approach with subsidies is through lifeline-tariff pricing. In this approach, all households (or all poor households, if they are easy to identify) are guaranteed a given supply of free infrastructure services, for example six thousand liters of water per household per month in South Africa's program. Above that amount, the household pays by the meter.

Urban areas are also vulnerable to intense environmental damage, though in ways quite different from rural areas. Urban environmental hazards include outdoor air pollution (especially from fossil fuel combustion), the release of toxic chemicals into the environment from factories, excessive mining of water aquifers, urban garbage, coastal erosion and destruction of fragile marine ecosystems close to urban centers, and the transmission of airborne infectious diseases (such as tuberculosis) in the crowded living conditions of urban slums. These conditions need to be ameliorated by targeted environmental investments, though impoverished cities rarely have the financial means to undertake these investments on their own.

#### *Why Good Investments Come in Packages*

One of the weaknesses of development thinking is the relentless drive for a magic bullet, the one decisive investment that will turn the tide. Alas, it does not exist. Each one of the six identified types of capital is needed for an effective, well-functioning economy. Each one is needed

to escape the poverty trap. Even more to the point, success in any single area, whether in health, or education, or farm productivity, depends on investments across the board.

Let me focus on child survival to make the point. The solutions for child survival will not be found in the health sector alone, although investing in the health sector is crucial overall. Here are ways that each of the six forms of capital contributes to healthier children and reduced child mortality (the list is hardly comprehensive):

- Business capital. Higher household incomes on the farm and in the cities allow households to invest in safer shelter (with screened doors to keep out mosquitoes), piped water, modern cooking fuels, access to doctors, improved diets, and the like.
- Human capital. Key human capital investments include nutrition (micronutrient and macronutrient supplementation), health care (immunizations, routine monitoring, emergency interventions, preventative interventions like antimalarial bed nets), family planning (birth spacing and smaller family size), mother's literacy, and public health awareness.
- Infrastructure. This includes safe drinking water and sanitation, power supplies for safer cooking, emergency transport to clinics, and information and communications technology to underpin routine and emergency health services.
- Natural capital. Investment in natural capital includes protection against natural hazards such as El Niño-induced droughts, control of disease vectors and pests, conservation of ecosystem services to support crop productivity, and avoidance of toxic wastes in the air and water.
- Knowledge capital. Investments here are for improved organizational procedures for fighting epidemic diseases, development of new drugs and immunizations, development and diffusion of improved seed varieties to improve food intake, and low-cost energy sources for the household for food preparation and storage.
- Public institutional capital. These investments provide the operation and extension of public health services, nutrition programs, and community participation schemes involving public health.

The same approach would apply in addressing each of the Millennium Development Goals. Fighting hunger, disease, lack of education, environmental degradation, and urban slums all require *packages* of investments to attack these ills from a variety of directions.

#### *Investing in Technological Capacity*

In both rural and urban areas, increased investments not only increase the amount of capital per person but also the quality of the technology embedded in the capital. A cell phone, or personal computer, or high-yield variety seed brings the latest in science to the benefit of the poor. Yet using these new technologies requires training and technical competence. Even in the poorest societies, primary education alone is no longer sufficient. All school-aged youth should be provided a minimum of nine years of schooling, and most should have more than that. The society as a whole should promote a significant cohort of university-trained graduates. These teachers, medical officers, agricultural extension officers, and engineers will be needed to harness technologies for local use.

Indeed, rapid economic development requires that technical capacity suffice the entire society, from the bottom up. But how can we accomplish that task in a setting of widespread illiteracy, where most adults have very few years of formal education? The trick, I believe, is to train very large numbers of people at the village level in creative and targeted ways, specifically for the main tasks at hand. For example, every village should aim to have a group of village experts, who, like the barefoot doctors of China, have enough formal training to address basic technical needs at the village level.

A literate community health worker, trained for one year, could be taught to prescribe antimalarial medicines, observe patients taking their daily anti-AIDS drugs, distribute and explain the use of antimalarial bed nets, give children medicine for helminthic (parasitic) infections, give immunizations, track the body weight and size of the community's children, explain the use of oral rehydration solutions, and with colleagues, keep track of all of this. Ideally, the community health worker would be a member of the community selected to be trained for this purpose, so that the problem of attracting a trained worker from outside the village would not arise—nor would the problem of brain drain of doctors and nurses, since one year of training would not qualify the individual for a health career outside the village.

Similarly, we could also imagine in each village a community-based agricultural extension worker with much less formal training than a traditional agricultural extension officer. The community-based worker would understand the basics of soil chemistry (measuring the adequacy of nitrogen, phosphorus, potassium, soil pH, and structure) and related soil tests, as well as the basic techniques of agroforestry, seed selection, and water management. One year of training for a high school graduate could suffice. A community-based engineer could similarly be trained in the operation—and routine maintenance—of diesel generators, electrical wiring, hand pumps, road grading, and the village truck.

Villages of several hundred to a few thousand people have an added advantage: the ability to gather together on the village green for discussions of village issues. With some planning, villages around the world could be helped to engage in continuing adult education on issues of pressing, life-and-death concern, such as, for example, how AIDS is contracted and spread, how malaria can be controlled, the role of hygiene in food preparation, the use of fertilizers, and so forth. Such relevant knowledge, if suitably presented, could inform rural societies on a massive scale. The nearly costless production and distribution of CDs and DVDs with educational materials prepared for village discussions could make it easy to disseminate such information.

In addition to training technical workers and educating villagers, national governments should promote scientific research activities as well. It used to be thought that research could be left to the rich countries while poor countries focused on raising their basic education and literacy levels. When India created its Indian Institutes of Technology in the 1950s and 1960s, development experts expressed skepticism that such advanced and rarified educational programs really belonged in such an impoverished country. Decades later we see the remarkable fruit of those investments in scientific research capacity. The institutes not only produced the generation of information technology engineers that are now powering India's IT boom, but they also created teams of scientists able to harness that technology specifically to meet India's needs. Dr. Ashok Jhunjhunwala, a professor at the IIT, Chennai, for example, designed appropriate local-loop wireless technology that has helped millions of Indian villagers to get online. In any developing country, similar homegrown technologies will be needed to adapt global processes to local needs in areas ranging from energy production and use, construction, natural hazard mitigation, disease control, and agricultural production.

India and China are both on the verge of technological breakthroughs from technology importers to technology producers and exporters on a large scale. This rise of homegrown high technology will fuel the growth of these countries for decades to come. Similar efforts are needed to create scientific capacity in sub-Saharan Africa and other very low-income regions. The task is particularly difficult, since it is swimming against the powerful current of brain drain. The few scientists trained in Africa go abroad in search of laboratory equipment, colleagues, and grant support. The infrastructure for science—well-financed universities, laboratories, and a critical mass of research funding and collegial support—will have to be built, and just like other infrastructure, this one will require the backing of rich-country donors. They will have to understand the critical importance of investment in higher education alongside primary education.

#### EXAMPLES OF SCALING UP IN THE FIGHT AGAINST POVERTY

The world is filled with pilot projects showing that one intervention or another has proven successful time and again. It has been shown repeatedly that antimalarial bed nets save lives in rural Africa, that anti-AIDS drugs can be administered in low-income settings, and that immunizations can be delivered in the most difficult places in the world, even in the middle of war zones. The main challenge now is not to show what works in a single village or district—though these lessons can be of great importance when novel approaches are demonstrated—but rather to scale up what works to encompass a whole country and even the world.

There are several significant examples of programs that have been scaled up massively to remarkable success. Here are ten dramatic examples that prove the naysayers wrong:

##### *The Green Revolution in Asia*

The Green Revolution is one of the most important triumphs of targeted science in the past century. Fearing the possibility of massive hunger because of a rapidly rising global population, the Rockefeller Foundation took the initiative in developing and promoting high-yield varieties (HYVs) of staple crops, first in Mexico, and then in Asia and more

broadly elsewhere. The start was in 1944, when the Rockefeller Foundation set up an institute to develop HYVs of wheat for Mexico, under the lead of Dr. Norman Borlaug. Scientific breeding, using crosses of strains brought from Japan after World War II, led to a breakthrough. Mexico went from a large net importer of grain to a significant net exporter between 1944 and 1964. Borlaug then persuaded donors to invest in similar crop-breeding efforts for South Asia, and also helped to introduce the resulting technologies to local crop breeders who successfully developed new strains. As the result of its Green Revolution, India went from eleven million metric tons of wheat production in 1960 to twenty-four million tons in 1970, thirty-six million tons in 1980, and fifty-five million tons in 1990, far outstripping the increase in population. High-yield varieties were similarly developed for other crops and locations through a network of international institutions, such as the International Rice Research Institute in the Philippines and the International Potato Center in Peru.

#### *The Eradication of Smallpox*

A concerted global effort ended the scourge of smallpox after thousands of years of epidemics that claimed the lives of hundreds of millions of people. In 1796, Edward Jenner demonstrated the use of a cowpox vaccine to prevent smallpox; that breakthrough provided the technological basis for eventual eradication. By the 1950s, most of the rich world had already become free of smallpox, but the disease continued to rage in poor countries, where vaccine coverage was very low. As recently as 1967, the disease struck around 10 to 15 million people and claimed 1.5 to 2 million lives. That year, the World Health Organization established the Smallpox Eradication Unit, and began to implement a campaign of mass vaccination worldwide, backed by strong efforts on surveillance and containment. In 1980, the World Health Organization declared the world free of smallpox. The campaign had successfully reached the farthest corners of the world, including impoverished regions in the hinterlands of Asia and Africa, and regions in the midst of violent conflict.

#### *The Campaign for Child Survival*

In 1982, the executive director of UNICEF, James Grant, launched the Campaign for Child Survival. The campaign promoted a package of interventions known as GOBI: growth monitoring of children; oral rehydration therapy to treat bouts of diarrhea; breastfeeding for nutrition and immunity to diseases in infancy; and immunization against six childhood killers: tuberculosis, diphtheria, whooping cough, tetanus, polio, and measles. As in the smallpox eradication effort, the campaign depended on standardized technologies that could be massively scaled up in low-income settings. During the decade, particularly in the latter years, dozens of poor countries conducted all-out campaigns to introduce these measures, especially to reach at least 80 percent coverage with the immunization package. The results were striking. Child mortality rates fell sharply in all parts of the low-income world, including Africa, where the rates were (and are) by far the highest. The campaign was estimated to have saved around twelve million lives by the end of the decade.

#### *The Global Alliance for Vaccines and Immunization*

By the late 1990s, the campaign for childhood immunizations needed fortifying in two major ways. First, many new immunizations had been developed and adopted in the rich countries, but because of costs and lack of training and facilities, they had not been introduced into poor countries. Second, coverage rates achieved by the early 1990s had slipped, often the result of intensifying poverty and economic crisis in sub-Saharan Africa and other regions. Bill Gates stepped up to the effort, announcing an initial gift of \$750 million from the Bill and Melinda Gates Foundation to reenergize the effort. The Global Alliance for Vaccines and Immunizations was launched in 2000 to guide the new effort. In the first years of its operation, the alliance made commitments of \$1.1 billion to poor countries, and it has achieved a series of striking results. As of 2004, the alliance reported 41.6 million children vaccinated against hepatitis B; 5.6 million children vaccinated against Haemophilus influenzae type b (Hib); 3.2 million children vaccinated against yellow fever; and 9.6 million children vaccinated with other basic vaccines. Once again, its strategy has depended on the coupling of standardized

technologies with systems of mass distribution, in this case based on proposals developed and submitted by the recipient countries.

#### *The Campaign Against Malaria*

During the 1950s and 1960s, the World Health Organization launched a series of efforts directed at eradicating malaria. Sometimes judged to have been a failure, since malaria was certainly not eradicated, these efforts can be seen as a stunning success for certain parts of the world where the scourge of malaria was eliminated or brought dramatically and decisively under control. Well over half of the world's population living in endemic regions in the 1940s were largely freed of malaria transmission and mortality as a result of WHO's concentrated efforts, mainly in the areas where disease ecology favored the control measures. Africa, alas, was neither part of the program at the time, nor a beneficiary of its results until today. The standardized technologies that produced these regional, if not global, successes were two: the use of DDT and other pesticides to reduce the transmission of the disease and the use of chloroquine and other new antimalarial drugs to treat cases of it. (Newer technologies, especially antimalarial bed nets and artemisinin combination therapies to treat the disease, combined with DDT where appropriate, can dramatically reduce the burden of the disease in Africa but will not eliminate the transmission entirely.)

#### *The Control of African River Blindness*

The Onchocerciasis Control Program (OCP) was launched in 1974 as a collaboration of WHO, the World Bank, Merck, the Food and Agriculture Organization (FAO), and the United Nations Development Program (UNDP). OCP aimed to reduce the transmission of African river blindness (onchocerciasis), a disease transmitted by a species of black fly. The program adopted a multipronged, scaled-up strategy in eleven hard-hit countries of West Africa based on a combination of prevention activities (including airborne spraying of insecticides to reduce the black fly abundance) and treatment. In the 1980s, Merck and WHO scientists realized that one of Merck's drugs used in veterinary medicine, ivermectin (Mectizan by trade name), could also effectively treat African river blindness. Merck agreed to donate ivermectin in a massive effort to control the disease. The OCP now reports the following accomplish-

ments: an estimated six hundred thousand cases of African river blindness prevented, twenty-five million hectares made safe for settlement and cultivation, and roughly forty million people protected from disease transmission. The economic benefits have been significant.

#### *The Eradication of Polio*

As there is for smallpox, an immunization technology is also available to achieve global eradication of polio. There are technical differences between the two diseases, which make the polio effort a bit harder. Still, polio eradication is feasible and well on its way to being achieved. In 1988, the World Health Assembly (the governing board of the World Health Organization), voted to launch the Global Polio Eradication Initiative. At the time, polio was still endemic in more than 125 countries. Today thanks to massive efforts by official institutions such as WHO, UNICEF, and the U.S. Centers for Disease Control and Prevention, as well as actions within poor countries and a remarkable and tireless effort by Rotary International, polio remains in only six countries (Nigeria, India, Pakistan, Niger, Afghanistan, and Egypt); and it is being contained. Only 784 cases were reported worldwide in 2003, compared with 350,000 in 1988. An estimated two billion children have been immunized since 1988, with the cooperation of twenty million volunteers and international funding on the order of \$3 billion.

#### *The Spread of Family Planning*

Modern contraception has contributed to a dramatic reduction in total fertility rates, from a world average of 5.0 children per woman in the period 1950 to 1955 to 2.8 children per woman in the period 1995 to 2000. Family planning programs have played an enormous role in providing advice and information, advocating and assisting in the empowerment of women, and promoting modern contraception, although many other factors (women's literacy, women's entry into the nonfarm labor force, reduced child mortality, and urbanization) have played important roles. The United Nations Population Fund (UNFPA) was established in 1969 to help coordinate this effort, and it currently operates in 140 countries. It has helped to spur a massive increase in the use of modern contraceptives among couples in developing countries, rising from an estimated 10 to 15 percent of couples in 1970 to an estimated 60 percent in 2000.

This program has been an example of scaling up par excellence, but the unmet needs are still massive, since funding for contraceptive availability in the poorest countries is far below needed levels.

#### *Export Processing Zones in East Asia*

To a remarkable extent, the early industrialization of East Asia after World War II depended on a new organizational technology, the Export Processing Zone (EPZ), or free-trade zone. The free-trade zone is an industrial zone (sometimes a whole region or country) in which special tax, administrative, and infrastructure conditions are applied in order to encourage foreign companies to set up export-oriented manufacturing facilities. The general key has been physical security within the zone, ample land for manufacturing operations, easy connections to reliable water and power, low-cost proximity to a seaport or airport, tax holidays on profits, and tax-free imports of inputs and exports of finished products. Free-trade zones have been the basis for East Asia's leap into global production in garments, footwear, toys, automotive components, electronics, and semiconductors. In almost all cases, the East Asian countries began with very low-skilled, labor-intensive operations (such as the manual assembly of components onto electronics motherboards or the cutting and stitching of fabrics into ready-made garments), and then progressed to higher technology parts of the value chain, including product design. The result was an export boom at national, indeed global, scale. *Asiaweek* magazine once referred to free-trade zones as "Instant Industry." Manufactured exports from East Asia rose at an astounding compound rate of 12 percent per annum between 1978 and 2000, or in dollar terms, from \$37 billion to \$723 billion (in 1995 dollars).

#### *The Mobile Phone Revolution in Bangladesh*

Bangladesh's Grameen Bank, already justly famous for its microfinance lending, has also opened the world's eyes to expanding the use of modern telecommunications technologies in the world's poorest places. Grameen Telecom went into the business of mobile phones in 1997, reaching half a million subscribers by 2003, roughly equal to the total number of landlines. It used that mainly urban base of operations to launch a village phones program, whereby a village woman borrows funds for a mobile phone that is then used throughout the village at a

small charge. With the fees she collects, the woman gradually repays the loan. Grameen estimates that each phone reaches an average of about 2,500 people in the village. With 9,400 villages covered by early 2004, the estimated access would be on the order of 23 million villagers. The model is being widely adopted now in dozens of other countries.

These cases demonstrate some common themes. First and foremost, scaling up is possible when it is backed by appropriate and widely applicable technology, organizational leadership, and appropriate financing. In many cases—such as smallpox or polio eradication—the technologies had long existed, but had not been applied in the poorest settings. In other cases, such as with the high-yield varieties of food crops at the core of the Green Revolution, the appropriate technologies had to be developed and then promoted through a targeted effort. In almost every case, technologies had to be adapted to local conditions (for example, solving the problems in tropical settings of maintaining the "cold chain" for immunizations that must remain cold until used, or adapting crop-breeding technologies to the local conditions of land, climate, and labor).

In the case of the Millennium Development Goals, the promising technologies exist, but have not yet been scaled up. Antimalarial bed nets, just to name one pertinent example, are used by fewer than 1 percent of rural Africans living in endemic malaria regions. It is time for that to change. Next, I consider the operational ways to get the job done.