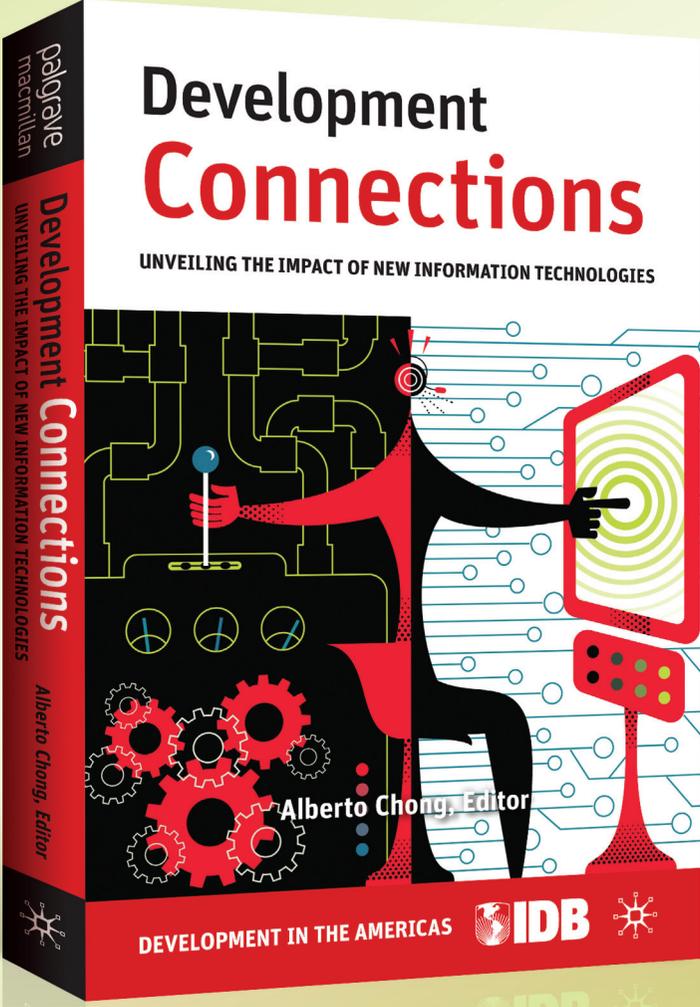


EXECUTIVE  
SUMMARY



Inter-American Development Bank



**T**he Development in the Americas (DIA) series is the flagship publication of the Inter-American Development Bank (IDB). Each year the IDB presents an in-depth comparative study of an issue of concern to Latin America and the Caribbean. This year's edition, titled **Development Connections: Unveiling the Impact of New Information Technologies**, reviews recent advances in the world of Information Communication Technologies (ICT)—cell phones, computers, internet—and uses rigorous methods to evaluate their impact on the welfare of societies. It finds that greater access to ICTs alone cannot bring about economic development in the region. The quality of institutions and regulations, people's skills, and physical infrastructure are crucial for ICTs to have a positive impact on development. Prior to investing in acquiring and expanding access to ICTs, governments must evaluate and strengthen their countries' capacity to use them.

This executive summary describes the motivation behind this book, the methodologies used, and both the breadth and limits of the studies. The impact evaluations on which the book is based cover the use of ICT in finance, institutions, education, health, the environment, and labor, as evidenced in the table of contents of the report presented on the next page. Together, this summary and the table of contents provide just a taste of the rich information and innovative approach that distinguish this year's edition of the DIA.

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To order *Development Connections* go to [Amazon.com](https://www.amazon.com)

# A Field of Dreams or a Dream Come True?

## If You Build It, He Will Come

In the well-known novel *Shoeless Joe* (Kinsella, 1982), inspiration for the movie *Field of Dreams*, the main character, Ray, is obsessed with a voice that tells him that if he builds a baseball field in the midst of a corn field in Iowa where he lives, his hero will appear. Ray steadfastly follows the voice, and eventually the field becomes a sort of conduit to the ghosts of legendary baseball greats, who show up in his field to play ball. At some level, the expansion of information and communication technologies (ICT) is analogous to the behavior of Kinsella's main character.<sup>1</sup> For developing countries in particular, the implicit view has been that as long as countries adopt these technologies, their societies will be quickly rewarded in terms of both higher productivity and improved welfare.

Not without reason, the expectations assigned to these new technologies have been sky-high. ICTs have brought truly new and innovative possibilities to developing countries. To cite just a few far-flung examples: in Argentina, the citizens of La Plata can directly participate in the public projects pursued by the local government; in Peru, poor peasants in Cajamarca can use the Internet to improve health treatment; in Colombia, coffee workers in rural areas can

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<sup>1</sup> This book considers ICT to be the application of both traditional and modern communications and computing technologies to the creation, management, and use of information. This definition encompasses both equipment and services that facilitate the electronic capture, processing, display, and transmission of information, and includes the computing industry, the Internet, electronic and display telecommunications and related services, and related audiovisual equipment.

receive and make electronic payments; in Paraguay, the transparency of national elections can be easily monitored using cell phones and the Internet; in Mexico, firms use web-based tools to encourage people to recycle; in Bolivia, individuals receive text messages to remind them to save; in Haiti, following the 2010 earthquake, rescuers relied on ICTs to conduct help and recovery operations. In the last twenty years, the penetration of mobile phones has expanded more quickly in developing countries than in developed ones at a rate that is nothing short of remarkable. Similarly, the per capita growth rates of users of the Internet have been higher in developing countries than in developed ones. It took about 100 years for the telephone to reach a critical mass of people around the world, and about 50 years for the television to reach that point, but it has taken only 15 years for the mobile phone and the Internet to reach a critical mass of users (Kenny, 2006). However, for all the instant access to far-flung markets, political empowerment, virtual health diagnosis, and other enhancements, it is unclear whether ICTs have been able to deliver actual economic development to Latin America and elsewhere. The available evidence has been based mostly on anecdotal cases that describe success stories but provide very little solid empirical evidence on the link between ICT and purported related gains in productivity and welfare. While evidence of this link is minimal at both the macroeconomic and microeconomic levels, it is particularly scarce in the case of the latter.<sup>2</sup>

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<sup>2</sup> Roller and Waverman (2001) and Waverman, Meschi, and Fuss (2005), among others, have studied the macroeconomic link between ICTs and economic growth. Although they find a positive association between both, the results have remained open to question, as it is unclear whether ICT is the driving force of economic growth or economic growth is driving the use of ICTs. Furthermore, it is not clear whether there is an additional variable, not included in their empirical work, that may be responsible for their findings. These two issues deem these and other related findings as promising—but perhaps not credible enough.

## The Genie in Aladdin's Lamp?

There are compelling reasons to expect significant economic development from the adoption of ICTs. The most obvious way in which these technologies can help achieve economic improvements is by improving the quantity and quality of information available: or, more precisely, in economic terms, to reduce asymmetric and imperfect information in markets. This can help tasks related to search and coordination, which in turn may increase market efficiency. Individuals and firms can use ICTs to search for prices of products, look for jobs, find potential buyers of products, get ready for weather and natural disasters, connect with colleagues, and remain connected with friends and family (Aker and Mbiti, 2010).

Furthermore, some argue, the most recent ICTs enable a country to leapfrog development stages. They allow multiple agents to transmit and share information immediately, without the physical movement of information or individuals. Put more abstractly, ICTs enable information to be decoupled from other factors that were previously embedded together (Evans and Wurster, 1997). Unlike typical technological innovations in the past, ICT also increases the knowledge content of products and services and introduces previously unknown products, jobs, and livelihoods, among others (Torero and von Braun, 2006). As a result of these network externalities, ICTs have the ability to help create entirely new industries and, as a consequence, to create jobs that are directly and indirectly linked to these new industries. For instance, the mobile phone sector has spawned a wide variety of business and entrepreneurship opportunities, many in the informal sector. Several of these new jobs are directly linked to the mobile phone growth strategy of firms. Many mobile phone companies, for example, have partnered with formal and informal shops throughout Latin America and the Caribbean to sell prepaid phone cards in small denominations (Aker and Mbiti, 2010). Finally, ICTs play a role

in the development of public policies by augmenting the range of possibilities and the manner in which policies can be implemented. For instance, policies to alleviate poverty can be much better targeted with ICT tools, producing less waste, more efficiency, and higher returns (see Chapter 8). Similarly, policies that focus on women can be much more effective using these new technologies.

Although ICTs are promising, these technologies may not be the silver bullet that some policymakers believe them to be. First, it is difficult to provide networked services in areas where population densities are low, such as rural areas and small towns—where a considerable share of the Latin American population lives. Problems related to the cost and complexity of physical access to ICTs are not even the most significant barriers to their greater utilization (Kenny, 2006). Lack of human capital is an equal or more relevant problem. Illiteracy poses a major problem for ICT-related technologies, particularly the Internet.

Language barriers also pose a problem. A large share of the population in Latin America, and most of its poor, cannot read, much less write, in English, the language of the Internet.<sup>3</sup> (For many Latin Americans living in rural areas, their first language is a minority language such as Quechua or Aymara, not even Spanish, Portuguese, or French.)

Moreover, a large percentage of people in Latin America and the Caribbean eke out a subsistence living and hence are less reliant on market transactions; for them, it is doubtful that the utility of ICTs will be particularly significant. Finally, institutional barriers, such as laws and regulations, also play an important role in the development of ICT applications in the region and are difficult to adjust.

While it is crucial to keep in mind the limitations of ICT, it is equally important to understand that even within particular ICTs, not all applications and technologies are created equal. Some have

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<sup>3</sup> About 80 percent of the world's websites are in English (Kenny, 2006).

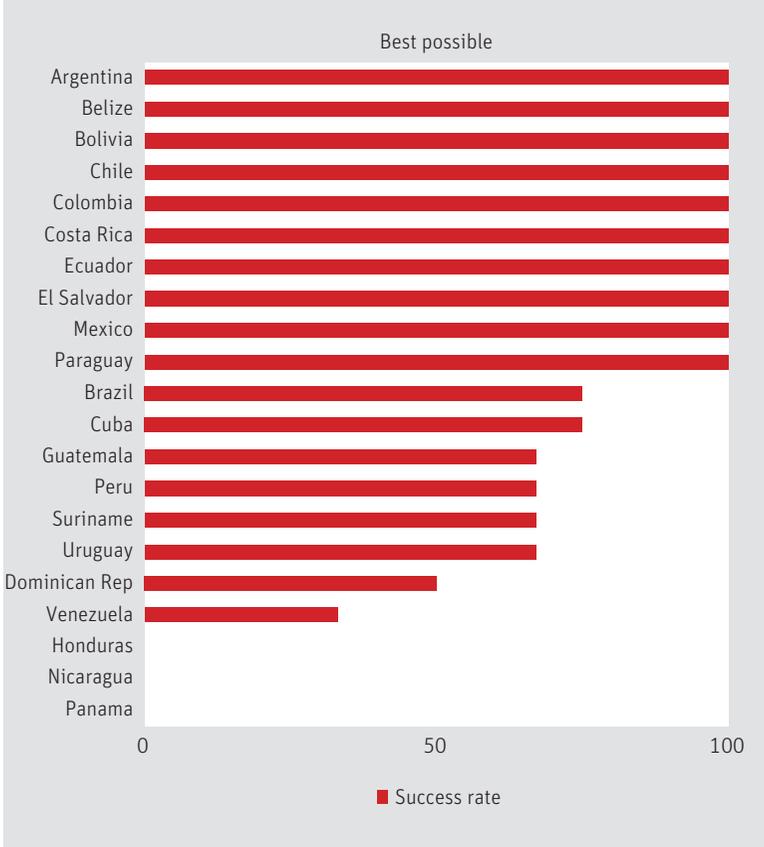
proven more useful than others and have had a greater impact in the short run. Along with the “old” ICTs such as radio and television, “new” ICTs such as mobile technology have proven to be extremely valuable to societies in developing countries, regardless of the area of application.

## Taking Everything into Account

This book takes an agnostic view of the possible link between ICTs and their economic impact, as seen from the point of view of individuals, and focuses instead on applying rigorous research methods to study the issue. In evaluating the impact of ICTs—in Latin America and the Caribbean and elsewhere—a critical problem has been the lack of reliable data that may allow the specific role of a particular ICT tool to be isolated. While some advances in data collection have been made in recent years, this central issue persists for the most part. A solid understanding of what ICTs are able to achieve cannot rely on unproven success stories that sometimes end up being not so successful after all, as they are quite costly and carelessly widespread (Kenny, 2006). Indeed, projects with ICT-related components have been widely supported by multilateral organizations, bilateral aid agencies, and nongovernmental organizations (NGOs)—without rigorous evaluation of their impact.

A simple way of illustrating a proper assessment of the extraordinary potential that ICT can have in contributing to economic development is by comparing new ICT tools and applications with the world's first two-way ICT: the postal service. Chong and others (2010) carried out a simple exercise by mailing 347 letters from the United States to nonexistent addresses in 107 countries around the world and measuring how long it took for the letters to be returned to the sender, as well as the percentage of the letters that were returned within 90 days of being mailed (see figures 1 and 2). They found that the success rate of sending three letters to any particular country in Latin America and the Caribbean was highest in countries such as Argentina, Belize, Bolivia, Chile, Colombia, Costa Rica, Ecuador, El Salvador, Mexico, and Paraguay, while it was lowest in countries such as Honduras, Nicaragua, and Panama. On average, it took the postal service nearly 76 days to return the letters to the

**FIGURE 1** Efficiency of the Postal Service: Percentage of Letters that Were Returned within 90 Days of Being Mailed

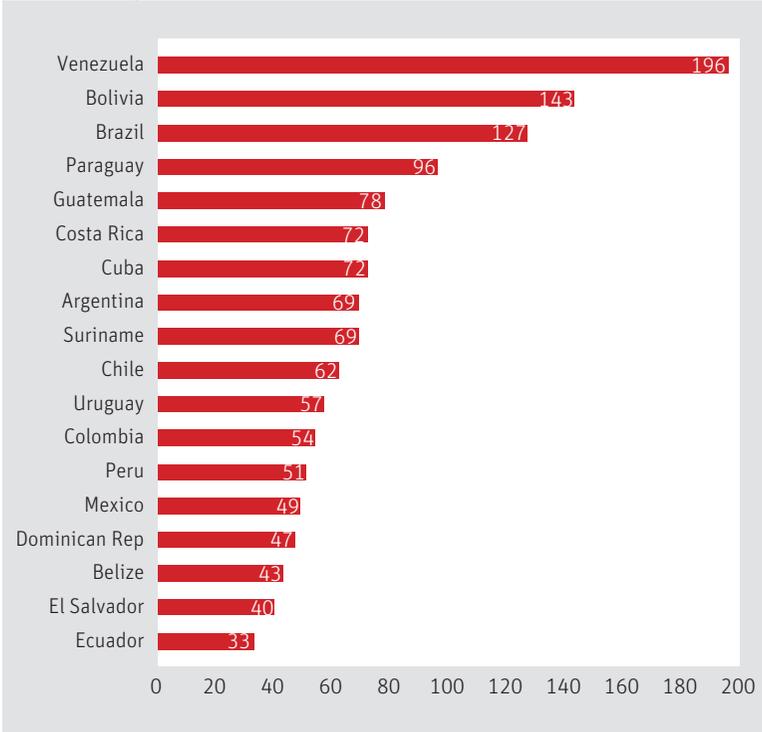


Source: Chong et al (2010).

sender, ranging from 33 days in the case of Ecuador to 196 in the case of Venezuela, excluding the countries whose postal services did not return the letters to the sender. Somewhat unsurprisingly, the study found that there was a strong correlation between the level of development of the country and the efficiency of the postal service.

In this context, the potential of new ICT tools is clear. In the case of both mobile phones and e-mail, the equivalent success rate would be 100 percent. Similarly, the equivalent rate would be

**FIGURE 2** The Case of Traditional ICT: Return to Sender Postal Service (in Days)



Source: Chong et al (2010).

measured not in days, but in minutes. More importantly, the level of development of the country is not associated with the efficiency of the ICT tool: that is, this technology is actually leapfrogging a development stage. The case for new ICTs is seemingly straightforward. Or is it?

To better assess the potential contribution of ICTs to development, two additional factors must be considered. The first is the institutional structure that makes it possible for the technology to work. The second is the costs and benefits of employing the new technology in relation to the old one. Thus, in the case of this simple example, one would have to consider the fixed costs of installing the

new technology and related networks, as well as factor in the cost of first-class international mail delivery—US\$0.98 in relation to the cost of the electronic transmission of information, including the cost of maintenance. Proper evaluations are crucial in order to ascertain whether resources are being wasted. Sometimes it is hard to obtain this kind of information. Other times, policymakers place blind faith in the new technology and assume that benefits will more than compensate costs. Yet even if the benefits do outweigh the costs, the technology will probably not have all the desired impacts.

The simple example described earlier lies at the heart of what this book tries to do. The aim is to assess the impact of ICT when taking into account meaningful outcome variables of impact in the proper context. Not only does the seemingly simple exercise noted earlier permit a better understanding of the potential of new ICT tools with respect to old ones, but it also helps illustrate the objective and method of the volume. The next section describes the basic methodological approach of this book.

## The Cost of a Streetlight

A well-known joke in economics tells the tale of a drunk on his way home from a bar one night. He realizes that he has dropped his keys and gets down on his hands and knees and starts groping around beneath a streetlight. A policeman asks what he is doing. “I lost my keys a block ago,” says the drunk. “Then why are you looking for them under the streetlight?” asks the policeman. “Because,” the drunk says, “that is where the light is.”

This joke illustrates the fact that data in economics are scarce: there are many dark patches where the light of investigation cannot shine. Data are even scarcer in the case of development economics. The lack of adequate data to better understand basic problems in development economics has been a recurring problem for decades. This book avoids this problem by “installing a new streetlight.” It relies on a large set of field experiments—actual projects that were tested in the field—in several countries in Latin America and the Caribbean. It focuses on randomized experiments: that is, experiments in which the members of treatment groups and control groups are randomly assigned to those groups. Pure random assignment guarantees that, similar to medical trials, the treatment and control groups will tend to have identical characteristics (Bruhn and McKenzie, 2009). Randomized experiments are increasingly used in formal empirical research in development economics. This relatively novel approach in empirical research in the social sciences helps shed light on topics that went previously unexamined, as data were inexistent. Randomized controlled trials (RCTs) allow researchers to uncover new data and thus provide new and novel approaches to study a broad array of applications. In short, randomized experiments allow researchers to avoid having to do empirical research only where there is light. The issue then becomes the cost of the streetlight. Some argue that RCTs are expensive. They are. However, the question is not how much a field experiment costs

but, as argued earlier, the returns to the investment. Viewed this way—the correct way—there is no question that field experiments are worth their value. After all, the private sector has been using them extensively and today, perhaps, more than ever.

## From Red Lobster to Field Experiments

It might be argued that randomized trials, as nice as they are, have little practical use in the real world. But the private sector is already using them widely—and with good results. Capital One has become the world’s largest credit card issuer over the past twenty years, for example, largely because of the aggressive use of experimental methods (Pearlstein, 2010). The firm developed an elaborate system for constantly testing the success of new products and marketing pitches with customers in every region of the United States. ICTs have accelerated the spread of randomized testing to other industries and firms, such as Google, Amazon, and eBay, which frequently run real-time trials, and TD Bank from Canada, which insists that some kind of experiment be used in every major initiative.

Other firms use special software to run their own randomized tests (Pearlstein, 2010). By mining the wealth of data already in a company’s computer, such software makes it possible to test the impact of a new product or tactic by comparing the outcomes against those of a “placebo” control group. Red Lobster, for example, used such software to test nine remodeling schemes for its restaurants, mixing and matching low-, medium-, and high-cost options for interior and exterior designs. The winning combination boosted sales by 8 percent, with an ICT investment that was worth \$200 million. Similarly, Kraft can now predict what products will do well in what markets among which consumers, broken down by the size of the store, the time of the year, and the type of packaging and promotion. Family Dollar Stores used randomized trials before installing refrigeration units in its 6,800 outlets that, up to that point, had sold only dry goods. Based on a small test of only a few dozen stores, it found that the impact was far greater than the sales gains from

milk, eggs, and frozen pizza. The bigger impact on profit came from increased volume in its traditional dry goods (Pearlstein, 2010).

The reason why the private sector is so keen on field experiments is the same reason why academics and policymakers have become so interested in them. Field experiments—and, in particular, RCTs—allow researchers to identify whether the change in one parameter has an impact on an outcome variable. That is, they are able to provide evidence on the direction of causation between two variables. As simple as this may sound, it has been a persistent problem in business and academic research for decades, as correlation is not equivalent to causation—a difference that may have deep strategic and policy implications.

Another reason why RCTs are becoming such a widespread method of testing is that they help identify the specific variable that may have caused the particular result under investigation. RCTs help to disentangle a particular outcome from the various factors that may have caused it. Thus, the method can have many uses in policy-relevant applications. For example, in education, it can be focused to better understand computers in schools programs and, in particular, the impact on rural areas and the poor. With respect to health, relevant and serious impact evaluations can be conducted on e-diagnostics, health education, and electronic medical records. In finance—an area in which RCTs have been more broadly applied—efforts to use text messages to remind people to save can be tested, for instance. In the area of the environment, ICT-information-based campaigns to recycle can be evaluated. With respect to building institutions, steps to monitor voting can be tested, and the role of voting monitoring to sustain democracies and minimize corruption can be determined more precisely.

## Why Bother with Lifeboats If Everyone Can't Fit In?

This book takes a microeconomic approach and focuses on a group of ICT-related projects in Latin America. Dozens of ICT-related initiatives are currently under way in the region. It is virtually impossible to evaluate them all. This, however, does not mean that an effort should not be made to assess the impact of some of them.

In this microeconomic exercise, this book tries to assess the impact of select ICT tools for specific policy-relevant cases. While the studies in this book review formal empirical evidence produced in recent years both in Latin America and elsewhere, they place a great deal of importance on producing new evidence on the role of ICT on development in the region. The reasons are straightforward.

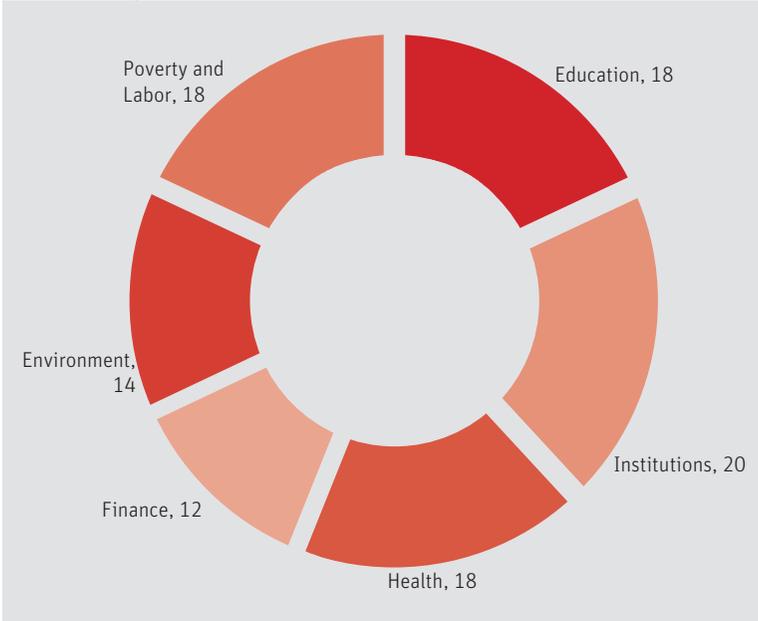
First, there is almost no evidence on the role of ICTs on socioeconomic outcomes in developing areas, and even less for Latin America and the Caribbean. Second, most of the existing evidence is biased toward finding positive results. As Ravallion (2008, p. 26) explains, “It is often difficult to publish an academic paper that reports unexpected, negative, or ambiguous impacts, when judged against current theories and/or past evidence. The prior belief is that the project will have positive impacts, for that is presumably the main reason why the project was funded in the first place. Then a bias toward confirming prior beliefs will mean that our knowledge is biased in favor of finding positive impacts.” It is easy to confirm that negative impacts or no impacts will barely get reported in published papers in academic journals. Ravallion continues by arguing that “researchers will tend to work harder to obtain positive findings, or at least results consistent with received wisdom, so as to improve their chances of getting their work published. If one collects 20 indicators, then there is a good chance that at least one of them will

show statistically significant impacts of the project even when it had no impact in reality. A researcher keen to get published might be tempted to report results solely for the significant indicator” (2008, p. 27).

In addition to a comprehensive review of the literature, this book tries to avoid the potential bias described by Ravallion by selecting ICT-related projects based on how frequently they have been cited in the main newspapers in most countries in Latin America. A list of the most common types of ICT-related initiatives in the region was compiled and ranked, taking into consideration geographic diversity, sectoral diversity, and to some extent, the innovativeness of the project. Forty-six were selected. Some of them are government-sponsored initiatives that were about to begin; others are projects designed and implemented specifically for this effort; others are the result of direct partnerships with NGOs in different countries; and still others result from partnerships with specialized not-for-profit institutions, academics, and universities. Most of the projects—forty-one of them—were initially conceived as experimental exercises (mostly RCTs) or quasi-experimental exercises. The rest employed traditional econometric methods.

Clearly, this is not a book about ICT innovations per se, but one about the application of innovations to development and whether they work. In a field in which there has been almost no serious research on the topic, this is the most sensible approach. Figure 3 shows the distribution by sector of the RCTs selected for investigation. About 18 percent of the projects are on topics related to education. These projects range from evaluating national programs such as the well-known “one laptop per child” initiative in rural areas in Peru, to the use of special software to help educate handicapped children in Ecuador, to the use of webcams to monitor the performance of children in the classroom in Lima. Another 20 percent of the projects focus on institutions; they range from the use of text messages to help formally register people displaced by the

**FIGURE 3** Distribution of Randomized Controlled Trials with ICT Components (Percent)



war in Colombia, to a natural experiment<sup>4</sup> in Bolivia that measures the productivity increase in the public sector when ICT elements are introduced. Another 18 percent are health-related projects that contain an ICT element. They range from the use of web-based tools to educate teenagers on sexual education issues in Bogota, to the use of the Internet to give incentives to individuals so they can commit to making healthy choices in terms of smoking, weight, and exercise. About 14 percent of the projects have an environmental component. These projects range from a comparison of old and new methods of ICT diffusion to teach people to recycle garbage and refuse materials in Mexico, to the use of ICT to study environmental degradation in Brazil. Another 18 percent of the initiatives are related to poverty

<sup>4</sup> In a natural experiment, the assignment of treatment has been made “by nature” and was not “designed” by experimenters.

and labor. The projects range from the use of mobile phones to learn about prices in Honduras and Colombia, to using ICT methods in order to track the production cycle of cow herds in Argentina. Finally, the remaining 12 percent of projects are initiatives linked with finance. They include the use of text messages to encourage people to save, as well as the development of innovative devices to encourage electronic banking.

Although the forty-one studies represent the original universe of RCTs, some of the initiatives could not be fully pursued for reasons that went beyond the control of the corresponding researchers in charge. Five projects had to be discarded altogether. While this experience highlights the difficulty in designing and implementing field experiments, it only reaffirms the importance of doing them—as valuable lessons were learned from each of the failed trials. In one case, for example, despite the interest of all parties in pursuing the initiative, and after many attempts, it was not possible to include the desired number of participants because they lacked the minimum computer-related capabilities to benefit from the program. As this book illustrates repeatedly, complementarities between ICT tools and other forms of capital (in this case, human capital) are critical.

Nearly 90 percent of the studies were successfully completed. Table 1.1 presents a breakdown by sector of the success rate of the RCTs undertaken. Overall, nearly 39 percent of the field experiments that were conducted strongly benefitted from having an ICT component.

Nearly 60 percent of the field experiments that had a component related to finance, and 57 percent of those with a labor and private sector component strongly benefitted from ICT tools. Not so in the case of education and environment, where the strong positive impact of ICT tools is less clear. Furthermore, there was no significant link between ICT applications and sectoral economic outcomes in nearly 22 percent of the initiatives.

**TABLE 1.1** Randomized Controlled Trials and Sectoral Impact  
*Percent*

	Strong ICT Link	Partial ICT Link	Minimal Link
Education	14	57	29
Institutions	50	38	13
Health	38	38	25
Finance	60	40	–
Environment	17	33	50
Labor and Poverty	57	29	14
Overall	39	39	22

Source: Author's calculations.

## Sectoral Policies for ICT

A clear policy implication emerges from these findings. With adequate economic policies in place, governments can take great advantage of ICT tools for development. ICT helps address market failures caused by problems of coordination and asymmetric information. The great risk of ICT tools is expecting too much of them. While not exhaustive, this book focuses on the basic areas in which ICT applications have been most commonly applied or may be vitally important for the design of some public policy in the region. One of the key conclusions of this study is that ICT, while potentially very useful, is not a silver bullet. Policymakers may have set expectations too high—to the point that when ICTs fail to live up to these expectations they, either alone or pressured by disenchanted constituencies, may ignore the potential these tools have to change lives and eventually lose interest in them as a development tool.

### *A Way to Increase Financial Inclusion*

As financial sectors develop, financial inclusion increases and income inequality diminishes. Despite the benefits of establishing links with the financial system, very few households in the developing world use such links. On average, only 35 percent of Latin American and Caribbean households have a bank account—a low percentage compared to advanced economies, where no less than 90 percent of the population has this type of link with the financial system. Expanding access to financial services to cover a larger population is costly. Most of the activities performed by financial institutions have traditionally been carried out through their branches. However, branching in places where the population is scant or where geographic or security conditions are difficult can be so costly that the benefit of including new people in the business of the institution is outweighed by its cost. Here is where technology can play a crucial

role. ICTs can decisively reduce the cost of expanding financial services and spread the benefits of financial inclusion, particularly among the poorest.

Households can enjoy access to financial services through several types of technological improvements. The development of the Internet has allowed many households across the world to exploit the benefits of online banking, such as paying utilities or transferring money. The possibility of banking through cellular phones is a popular and expanding avenue in the financial world. It can help diminish financial exclusion by offering services to low-income groups that have access to mobile telephones but not to financial services. ICTs can also be a useful tool to provide information to help people make better financial decisions. For example, financial literacy campaigns can be delivered with the help of ICTs, as well as reminders to individuals to save more money and thus to achieve their savings goals. Governments can also take advantage of the improvements in technology by finding new ways to design subsidy schemes for the poor. Such government-backed efforts can help the poor overcome traditional barriers to access the financial system. Beyond national boundaries, ICTs allow relatives living abroad to remit money home in a faster and cheaper way, improving the well-being of recipient households.

In spite of the enormous benefits associated with these new financial technologies, up to now, Latin America and the Caribbean have lagged well behind the rest of the developing world. There still is a long way to go before the poorest households in Latin America will be able to afford a computer and Internet service of their own. In terms of regulation, even though nothing outright forbids the provision of these new types of financial services, there are regulatory barriers that affect the way mobile banking services are provided. One of the major issues associated with potential partners is the difficulty in defining a sustainable business model around small payments, uncertainties related to countries' regulatory frameworks, and the need for sufficiently reliable nonbank

correspondents. Nonetheless, many pilot projects have taken off in the region with an eye on achieving what Asian and African countries accomplished some years ago in terms of electronic financial transactions. Latin America and the Caribbean have the advantage of being able to take stock of the lessons learned.

### ***Benefits to Institutions***

Countries with lower institutional quality are more likely to have slower economic growth, higher economic inequality, more social conflicts, and fewer and lower-quality government services. The level of institutional development in many Latin American and Caribbean countries is similar to the world average. However, compared to developed countries, the region lags far behind in terms of institutional and governance indicators. A large body of evidence points to the need for the countries of the region to adopt policies aimed at improving institutional development. Different experiences around the world have proved that ICTs can be useful in improving the quality of institutions. For the special case of Latin America, recent evidence shows that ICTs are becoming an effective instrument not only to improve the efficiency of the public sector, but also to help the population hold the government more accountable.

One of the main outcomes of the ICT revolution is the faster and more transparent diffusion of information. In the political sphere, information dissemination has the power to affect political behavior and voting decisions—no minor issue considering the fact that a more informed and politically active electorate increases the incentives of the government to be responsive. New channels of information can also affect the way people perceive their societies and adapt their own behavior. This has important policy implications, especially for developing countries. In societies where literacy is relatively low and newspaper circulation is limited, new forms of communication can play a crucial role in circulating ideas. Policymakers can use this channel to transmit important social and

economic messages. Thus, ICTs may be employed as a public policy tool.

### ***The Health Potential Is There***

Individuals and government alike want their health services to provide care that is patient-centered, available, accessible, safe, reliable, effective, and equitable. The application of ICT tools in the area of health care shows high potential to improve health care provision, cost-effectiveness, and health outcomes in the region. In most countries, however, it is still in its infancy. Scaling up such tools will require significant increases in human resources, hardware and software, and infrastructure. It is probably neither cost-effective nor feasible at this stage for Latin America and other developing countries to replicate the solutions of developed countries. The region needs to adapt solutions according to each country's health priorities, the development of the health system, and existing national ICT infrastructure.

One of the priorities for the region at this stage is piloting and implementing more comprehensive ICT-related health interventions for chronic care. Telemedicine has been implemented with relative success and seems to be a promising intervention to reduce costs and improve care of patients in isolated areas.

The next stage in ICT innovation for many of the health systems in the region involves implementing electronic medical records. This will allow health systems to take advantage of the full benefits of other health innovations such as systems to monitor and track patients with chronic conditions, telemedicine, and ICT epidemiological surveillance systems. Carefully evaluating and disseminating the results of the pioneering experiences in the region is key for replicating the successful experiences and learning from mistakes.

Even though e-health, in general, is perceived to be a key cost-effective innovation to enhance the performance of the health

system, its implementation has been slow even in developed countries. The limited adoption of ICT by health care providers, especially hospitals and insurers in the United States, can be explained by a confluence of factors: lack of demonstrated cost-effectiveness of ICT for specific providers because of the underlying fragmented structure of health provision and financing; the high financial risk of adopting new technologies; the costs and difficulty of the behavioral change needed for technology adoption; the temporary efficiency losses and potential medical errors during the transition; and the significant legal issues concerning adoption, such as licensure, liability, malpractice, confidentiality, and compliance with insurance. These concerns highlight the important role of the government to pilot and be an early implementer of many of these innovations, following strict evidence-based criteria.

Many countries of the region have not yet overcome basic problems in their health sectors. Even though a serious assessment of the costs and benefits of many health innovations must be undertaken, many of them may absorb too many resources compared to the current amount spent on health in the region. The risk is that these innovations—especially those that involve network effects—may be less effective when implemented in fragmented systems that already suffer from coverage, equity, provision, and financing problems. Thus, policymakers should balance gradual implementation of health innovations with continued reform of the overall sector in order to ensure that the full benefits of these innovations are realized.

### ***An Educational Fad?***

The last few years have witnessed a flurry of high-quality research on the impacts of ICT in education. Yet significant uncertainties still surround these interventions, especially in the case of highly visible initiatives, such as one laptop per child. ICT in education can be costly and may crowd out important alternative programs with

significant returns. Given their irreversible nature due to the high initial costs, the unknowns regarding their impacts, and the limited capacity of governments to manage these complex interventions, it seems reasonable to proceed gradually with initiatives. Taking baby steps rather than leaps and bounds, planners can learn from experience, evaluate the impacts generated, and change decisions based on new information.

The studies in this book show that increasing access to computers in schools by itself has low returns, at best. Complementary inputs are critical, including the proper hardware, software, electricity, teacher training, and technical and pedagogical support. However, over and over, countries tend to put all their eggs in one single basket by simply providing computers. Budgeting for all the complementary inputs needed would minimize the waste of resources—and, crucially, provide a golden opportunity to improve the quality of education.

Furthermore, certain uses of ICT can yield large positive results. Hence, it seems reasonable for governments to channel limited computer access to these more promising uses. In particular, providing one or two hours a week of ICT training to students seems optimal, given the evidence regarding the large impacts of this training on ICT skills and the wage premium that workers with these skills may eventually receive in the labor market. Also, computer-assisted instruction has been shown to have significant potential to accelerate learning in math—a remarkable outcome, given the low level of achievement in this area within the region. In areas such as math and language, in programs where computers can be used to support teaching practices, teacher training plays a critical role, in addition to the use of computer-assisted instruction. Hence, carefully planning the component and allowing sufficient funds to support the needed complementarities, such as teacher training, should be prioritized.

While research has demonstrated mostly null effects of computer access at school on educational achievement, recent research has shown that increased computer access at home can have *negative*

consequences. Studies have also shown that these negative effects are concentrated among students with weaker adult supervision. Interventions aimed at increasing access at home should take these considerations seriously into account to implement mechanisms to ensure proper use. In particular, computers could be loaded with interactive educational software and certain competitions can be launched to stimulate their use. Also, violent and sexual content should be blocked.

### ***Love Is Not in the Air***

ICTs can improve environmental behaviors, environmental policy, or the environment itself by influencing individuals to undertake environmentally friendly actions, aggregating information necessary for more intelligent policy (such as climate monitoring), or directly reducing resource consumption and environmental degradation. This book reviews each of these channels, with a focus on both the ways in which ICTs impact the environment and the existing evidence quantifying this impact.

A variety of studies seek to quantify the impact of environmentally friendly consumption made possible by ICT, such as replacing paper communication with e-mail. These benefits, however, must be weighed against the environmental costs of ICTs, in particular, electricity consumption and the disposal of electronic waste. Studies of isolated technologies help quantify the potential of ICTs to directly mitigate environmental concerns, but research is needed to understand these tradeoffs, particularly at an aggregate level.

Similarly, clear evidence is scarce concerning the impact of the creation and aggregation of ICT-enabled information on environmental policy, the actions of firms or other agents, or environmental outcomes. At a national and regional level, considerable resources have been invested in developing monitoring systems that use ICTs, primarily to track climate change,

deforestation, and wildlife, and to assist in natural disasters. The task of rigorously evaluating the environmental consequences of this investment using statistical approaches is formidable. The task may be better met with careful documentation and analysis of the spread and uses of information generated by these systems.

At a micro level, ICT-generated information may also be useful in solving localized environmental challenges. Understanding whether these efforts result in the solution or mitigation of localized issues will be important to policymakers concerned with environmental issues and to officials tasked with the aggregation of local environmental information.

The results from several recent RCTs designed to test the effectiveness of ICT information campaigns in inspiring pro-environmental behaviors offer little evidence on the effectiveness of this strategy. Similarly, using the Internet to engage individuals in actions to reduce their environmental footprint does not appear to be a viable strategy, either because of the ineffectiveness of this medium or the still-limited extent of Internet access in many parts of Latin America.

Therefore, the use of ICTs to enable behavioral change must take a more direct role. Innovative uses of ICTs to influence individuals' choices, such as smart chip technology, which can make it easier to repay loans to buy natural gas vehicles, are emerging and represent a promising development.

National actors may be able to boost the environmental impact of ICTs by adopting policies that encourage individuals and firms to adopt technologies that have a proven net-positive environmental impact. In addition, governments should consider leveraging ICTs to create more efficient information aggregation and communication systems, which can facilitate more rapid and efficient responses to natural disasters and other environmental developments.

## If Not a Silver Bullet, Then What to Do?

*Be sensible and recognize that ICTs are not an end.* Although Latin America and the Caribbean still lag in terms of overall ICT penetration, policymakers are tempted to “load up” on ICT-related hardware and software, with the stated objective of catching up to reduce the digital divide. This book shows that this is the wrong policy. ICTs are a means to an end—not the opposite. Policies must be sensible and consonant with the realities of the national landscape. Policymakers should beware of fads, internalize cost-benefit considerations, and, in particular, consider opportunity costs. Newer does not mean best.

*Be aware that complementarities are essential.* ICTs do not arise and spread in a vacuum. The quality of institutions and regulations, the skills of the population, and the physical infrastructure are all crucial to the success of ICT applications. In short, ICT technology does not replace the nuts and bolts of everyday life; it complements them.

*Define policy goals in terms of use, not access.* Policy goals are potent conduits for prioritizing and using resources. Hence, they should be defined so as to achieve certain milestones that are expected to generate positive impacts. The evidence reviewed in this book shows that access by itself does not generate impact, but that certain types of use do. Therefore, it seems reasonable that countries should aim to attain goals defined in terms of achieving certain measures (and types) of use rather than in extending mere access.

*Foster cooperation to develop public goods.* The interest in using ICT in different sectors is growing among countries in the region. There are important ways in which countries can cooperate to increase their chances of success. To do so, they should channel resources to

activities that generate benefits for all (public goods), either through their own domestic spending or by pooling resources internationally. The first of such activities is the implementation of large-scale rigorous evaluations. These evaluations generate significant benefits for all countries in the region, as they produce evidence about what works and how to improve effectiveness. However, such evaluations are costly and can carry political risks, as some of their results may not be what was expected. Countries (and international donors) must be able to absorb bad news (negative or null results) and adjust programs or activities accordingly.

*Explore private-public partnerships.* Private firms, especially those producing mass-market goods, are striving to make the most of ICTs in the developing world in both urban and rural areas. They are exploring countless innovative ICT applications that range from product placement on Internet-based soap operas to Internet boats that bring web connectivity to one port a day. For different reasons, multilateral institutions and the public sector have the same interests. This perfect storm provides a unique opportunity for potentially fruitful collaboration.

*Encourage large-scale projects to increase relative returns on investments.* Producing computer software, say, to translate from Spanish to Quechua, requires significant fixed costs that are spread over the number of computers that will use it. In small programs, producing specialized software is economically unfeasible. But as programs expand, the returns to investing in software increase dramatically. For example, for a laptop program that has distributed 1 million computers in a country, it makes perfect sense to spend US\$10 per computer in software (a tiny part of the total cost of ownership). This amounts to US\$10 million, clearly a budget large enough to fund the development of sophisticated software.

This cost-benefit equation is similar to the development of a vaccine. Its production entails large fixed costs, and the ultimate

outcome is unclear. Once developed, significant testing is needed to assure its effectiveness. But once produced and tested, the marginal costs of using the vaccine an additional time are negligible. Countries could pool resources for the development (and testing) of a variety of software and produce a free inventory of tested software. How can countries agree to fund these activities? Multilateral institutions may be the solution. They are mandated to fund activities to foster development in the entire region. What better allocation of funds than to produce certain public goods that will be enjoyed by most of their members?

*Recognize that one seagull does not a summer make.* The most important things to learn from any evaluation relate to its lessons for future policies, as Ravallion (2008) explains. It is natural to want research findings not to be too specific, but to be applicable to guide practice in other settings. However, this is seldom warranted. A special case of the general problem of external validity is scaling up. Much can change when a pilot program is scaled up: the inputs to the intervention can change, the outcomes can change, and the intervention can change. The actual impacts of scaling up can differ from the trial results, because the socioeconomic composition of program participation varies with scale. Trial results could over- or underestimate impacts on scaling up.

For all these reasons, policymakers should not be satisfied with limited ICT evaluations. Longer-term randomized trials repeated across varying contexts and scales should be used to decide what works and what does not. This is particularly important both from the perspective of assessing development effectiveness and for assuring the reliability of the policy applications. A common criticism of RCTs is that they have little validity beyond the specific exercise undertaken. Repetition in different contexts and scaling up go a long way toward improving their general applicability, as well as their development effectiveness.

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