ICTs and Rural Development in India

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(Revised)

Summary

This monograph compares the methodologies and progress of the different existing models of information and communication technology (ICT) use for broad-based development and economic growth in India. It will examine the role of complementary reforms in government administration and policies. The focus is chiefly on the rural economy, where the developmental needs are the greatest, and the use of ICTs presents the most challenges. It examines the nature of benefits in areas such as education, health, market efficiency, and democratic participation, the channels through which impacts can be realized, and the practical means for realizing potential benefits, including organizational innovations and government policy as well as structural changes.

Keywords: India, ICTs, Internet, development

JEL codes: O12, O3, L31, P2

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Preface

At the height of the Internet boom of the 1990s, a fashionable saying was "the Internet changes everything." The subsequent dot.com crash seemed to prove the skeptics right – it was all froth and hype, irrelevant to the vast majority of the world's population. Five years later, however, we are just beginning to see the real Internet revolution, as the tools and technology becomes pervasive in the rich world. Nevertheless, skepticism remains about the implications of the Internet (and ICTs in general) for the masses in developing countries. My original interest in this issue was from the perspective of India's software export boom, and whether it could lead to broad-based, sustainable development. As I began to explore this wider issue, I became fascinated with various attempts to provide Internet access in rural India. If this could be done to the benefit of the majority of Indians living in its villages, it would represent a significant validation of the "world-changing" possibilities of the Internet. As I read glowing journalistic pieces, however, my economist's training led me to seek a more precise understanding of the process and outcomes of these experiments, including questions of technology, organization, costs and benefits. With funding from the Rajiv Gandhi Institute for Contemporary Studies, my own university, and, most recently, International Development Enterprises (India), I began to explore the issues systematically.

This monograph summarizes my conclusions based on my own fieldwork in India over several years, from 2001 to 2004. I was not the first to make this kind of exploration, and not the last. In the period in which I conducted the field research, numerous other research projects, ranging from individual graduate student theses to large, government-funded teams, made similar forays. While it is impossible to be totally

comprehensive, I have tried to incorporate the lessons of other studies, while sticking to my core analysis and understanding of how rural ICT initiatives have evolved, and their potential for positive impacts on rural development in India.

There are too many people to thank in a project like this. The most important are all the people in the field, who generously gave their time at various sites I visited around India, and who would probably prefer to be anonymous – they have had enough distraction from curious researchers already. This research has been supported by grants from the Rajiv Gandhi Institute of Contemporary Studies, International Development Enterprises (India), and the Division of Social Sciences and the Academic Senate of the University of California, Santa Cruz. I am indebted to S. Sivakumar of ITC, P.G. Ponnapa and Gautam Mukherjee of n-Logue, Ranjit Khosla of TARAhaat, and Satyan Mishra of Drishtee, for providing me with detailed information on their respective organizations, and for their extensive cooperation. I have received valuable suggestions and guidance on this research from Bibek Debroy, and from P.D. Kaushik, who has been a valued collaborator on related work. Detailed and extremely valuable comments on a previous draft were provided by Gautam Mukherjee and Rafiq Dossani. I alone am responsible for remaining errors and omissions.

Contents

1. Introduction

It may seem paradoxical that modern information and communication technologies (ICTs), associated in our minds with developed country markets and capital-intensive methods of production, has any relevance for a country where hundreds of millions still lack basic needs. Nevertheless, there are many efforts underway in India and other developing countries to demonstrate the concrete benefits of ICTs for rural populations, and to do so in a manner that makes economic sense.[1]

Besides the obvious – though we would argue, superficial – paradox of introducing modern technologies before satisfying basic needs, the issues involved are not straightforward, since the implementation of rural ICTs involves organizational and social changes, as well as the adoption of a complex set of modern technologies. Indeed, two points to be brought out in this piece are the catalytic role of ICTs in spurring complementary innovations, and the special nature of ICTs, distinguishing them from other types of modern technologies, even others that have a general purpose, infrastructural nature, such as electric power. Among the questions that can be posed with respect to the use of ICTs for rural development are:

- What are the uses to which ICTs can be put, and what are the positive developmental impacts?
- What are the effects of rural ICT introduction on existing inequalities?
- To what extent is government involvement necessary or desirable?

[1] See Singh (2002) for a broader discussion of the potential role of IT in India's development. This monograph also draws on Singh (2004), which presented an abbreviated version of the ideas and research elaborated here.

- What technologies are the best ones to deploy, in terms of costs and benefits?
- What organizational structures must be developed to support the economically sustainable implementation of rural ICT access and use?

Attempts to apply ICTs to problems of rural economic development are widespread in developing countries, and there are benefits from examining implementations across various countries and continents.[2] However, India is itself large and diverse, permitting one to compare a variety of different approaches to introducing rural ICTS. At the same time India has enough institutional and economic similarities across states and regions to allow meaningful lessons to be drawn at a national level. These can be an intermediate step toward broader, cross-country comparisons.

This monograph therefore examines the conceptual and empirical case for the use of ICTs in India's rural development. Chapters 2-6 lay the groundwork for the subsequent discussion of impacts of ICTs. Chapter 2 provides an overview and discussion of the potential role of information technology (IT) in broad-based economic development. Chapter 3 examines the conceptual issues from the perspective of demand for ICT-based services by rural populations in a developing country, in the context of the particular household and institutional environment. Chapter 4 discusses various institutional and policy issues, while Chapter 5 summarizes the technological opportunities and physical infrastructure constraints. Chapter 6 introduces some of the efforts underway in India, including the work of Aksh, Drishtee, ITC, n-Logue, TARAhaat and others. Chapters 7 through 11 examine various aspects of development

[2] See, in particular, Best and Maclay (2002), Caspary and O'Connor (2003), McNamara (2003) and Tongia *et al* (2005).

impact, and the potential role played by ICTs. These chapters cover, respectively, education, health, market efficiency, agriculture and employment. Chapter 12 provides an overall look at enabling rural development through the deployment of ICTs, bringing together ideas from the previous five chapters. Chapter 13 takes a specific look at the crucial area of governance and policy reform, as both enablers and beneficiaries of ICT deployment. Chapter 14 focuses on the critical role of organizational innovation and entrepreneurship, and draws out the lessons of the many experiments tried out so far. Chapter 15 is a brief concluding chapter, summarizing the lessons of the study, and suggesting both avenues for further research, and areas for policy attention.

2. ICTs, Economics and Development[3]

In abstract, there are two types of potential economic gains from the use of ICTs. First, there are both static and dynamic efficiency gains. Static gains are one-time, and come from more efficient use of scarce resources, allowing higher consumption in the present. It is useful to distinguish two kinds of static efficiency gains. One kind pertains to increases in operating efficiency, while the other comes from reduced transaction costs, where the latter can be interpreted broadly to include costs of opportunism and rent-seeking.[4] In both cases, the channel for gains is through more effective and lower cost information storage, processing and communication – the last of these including wider networks and richer information exchange. Dynamic gains come from higher growth, potentially raising the entire future stream of consumption. Reductions in transaction costs can increase growth rates as well as providing static efficiency gains. ICTs can also spur innovation, which is a key factor in economic growth.[5]

The second type of potential benefit comes from reductions in economic inequality, to the extent that such reductions are an agreed-upon social goal, and therefore a social benefit. The two types of gains may conflict, if growth requires increased inequality, or they may be mutually reinforcing, where broad sharing of the benefits of growth enhances the rate of growth. We can discuss the role of ICTs in achieving greater economic gains along both dimensions, without having to commit to a

[3] There is a growing literature on this topic: see McNamara (2003), Tongia et al (2005) and Kaushik and Singh (2004) for references. Singh (2003, 2004a) provides analytical discussions and some formal modeling.

[4] This broad interpretation of transaction costs is due to Williamson (1981): opportunism results from information asymmetries that can be reduced through the use of ICTs.

[5] This point is made in Mokyr's (1990) historical analysis, as well as in many theoretical analyses of "endogenous growth."

particular position on the relationship between inequality and growth. However, a focus on using ICTs for rural development is, at least on the surface, supportive of reduced inequality along with increased efficiency and growth, to the extent that rural residents of developing countries are relatively deprived in their access to modern communications. On the other hand, if rural ICT access and use is restricted to the privileged component of those societies and communities, inequality within rural areas would be exacerbated.

Of course, benefits that are measurable as increased market-based economic activity, and hence show up in national accounts statistics, are not the only component of development. Development can also include improvements in the capabilities of the population, such as education, health and nutrition, independently of any direct or indirect economic impact. The ability to participate in democratic decision-making also falls into this category. Broad-based improvements in capabilities can also have positive impacts on long-run economic well being, but this is not a necessary condition for desiring such improvements. The role of ICTs in effecting improvements along non-economic dimensions is also considered in this monograph.

Turning to specific impacts, note that digital ICTs involve the electronic processing, storage and communication of information, where anything that can be represented in digital form is included in the term 'information'. Thus news, entertainment, personal communications, educational material, blank and filled-out forms, announcements, schedules, and so on are all information. Software programs that process data (searching, tabulating, and calculating, for example) are also information in this sense, representing a particular kind of intermediate good. We can use standard economic characterizations to classify the different kinds of information. For example,

entertainment, personal communications, and sometimes news, are final goods. Educational material, job announcements, or some kinds of news (weather news for farmers, for example) are intermediate goods, typically used for improving income-earning opportunities.

Information goods typically have the characteristic that one person's use does not reduce their availability for another person. Thus, a message or weather news can be viewed by many people, simultaneously or sequentially. Depending on the content of the news or message, different people may place different valuations on the information. Only friends and relatives may be interested in a personal message, all farmers in a district may be interested in local weather news, and so on.[6] The ability to share information among users can impact the feasibility of providing it on a commercial basis. Digital IT dramatically increases shareability of information, and this affects the economics of private provision of information goods and services: free riding may lead to suboptimal private provision.

The government may therefore provide information goods because they are shareable and non-excludable (pure public goods). The classic example of a pure public good is national defense, but such goods may also be local in nature, such as public parks or law and order. Of course many local shareable goods can be provided exclusively, in which case private provision is a feasible alternative, in a club-like arrangement. Here, government provision may be justified more on equity grounds than on the basis of failure of private provision. In some cases, government financing through taxes or

[6] The valuation of information may also depend on social roles (e.g. gender, caste) and therefore overcoming mismatches between utility and ability to pay may have implications for the equity impacts of rural ICT use. Therefore, pricing of services is an important aspect of the models we consider in this monograph.

statutory user charges can be combined with outsourcing of delivery to private providers to achieve both equity and efficiency goals. In the case of rural ICTs, the benefits may come from a mix of privately and publicly valuable information.

Often, private provision is feasible, but neglects the spillover benefits that it creates, in which case government subsidization may be socially beneficial. For example, primary education has private economic benefits that people are willing to pay for, but it can also have substantial non-economic benefits to the individual and to others in the society (improved understanding, ability to make sound judgments, political decision-making capacity, and so on). Positive spillovers and shareability may both provide an economic rationale for some degree of government cost-sharing or subsidization, e.g., for ICT infrastructure. Of course, many kinds of physical infrastructure, such as roads and ports, have similar public good-type benefits.

Additional roles of government that are important to bring out are in redistribution to achieve equity objectives, and in regulation of private activities through licensing and certification. In both cases, the government also uses economic resources, and ICTs has a potential role in increasing the efficiency of government. This comes under the rubric of 'e-governance' and is considered below, and in Chapter 13.

For both government and private provision, one of ICTs' main direct benefits is in increasing efficiency by economizing on resource use in the operations of firms as well as in market transactions. Information that would otherwise be conveyed through face-to-face contact, post, courier, print delivery, telegraph or telephone may instead be communicated in digital electronic form via the Internet, saving time as well as physical resources. Efficiency gains from Internet use are not automatic: the telephone, in

particular, is an efficient means of communication for many types of information. ICTs also require new investment, so the benefits of trips, time and paper saved must be weighed against the costs of installing and maintaining the new infrastructure. Yet another significant cost, often more than the infrastructure, is that of training and transition to new work practices. In this case, however, one can argue that there are lasting spillovers through the creation of human and organizational capital.

Efficiency benefits of ICTs are not restricted to the communication itself. Information technology (IT) can improve the efficiency of the telephone network, and they can make it possible to track and analyze communications. Word processing, maintaining accounts, inventory management, and other such activities that may not require long-distance communications are also made more efficient by IT. IT also improves the accuracy, updating, retrievability and backing-up of data required for a range of personal, business and governmental activities.

Experience with Internet use in developed countries suggests that information exchange related to the completion of market transactions is especially valuable. The ability of IT-based communications (combined with storage and processing) to bring together buyers and sellers more effectively represents major potential gains. These gains can come about through lower search costs, better matching of buyers and sellers, and even the creation of new markets. The successes of auction and employment websites in the US illustrate these gains. In the rural Indian context, farmers selling their crops and buying inputs, parents seeking matrimonial alliances for their children, and job seekers are all potential users of Internet-based matching services. Depending on the nature of the market, including type of good or service, mobility of participants and the length and

value of the transactional relationship, the overcoming of geographical barriers can be significant. Thus, in the Indian context, job markets have seen the greatest benefits in shrinking distance, followed by marriage and then crop markets.

Efficiency gains of ICTs can also come about through the enabling of new goods and services. In many cases, the new good is related to something available earlier, but is presented in a form that reduces costs and expands the size of the market. For example, recorded music is a mass-consumption item, whereas only a small minority of the population could afford or have access to live performances by the highest quality musicians. Educational material is another example where recording and duplication can replace more expensive, skilled-labor-intensive alternatives for delivery. The possibilities for interactivity with IT-based educational materials illustrate the advantages of digital ICTs over older technologies based only on recording and duplication and analog broadcast communications. Interactivity also implies personalization, in that an individual can select the precise content that he or she wishes to see. This feature also distinguishes digital IT-based content from what was available through previous technologies. Finally, the sheer volume of information that is accessible through IT is much greater than before: this also allows new kinds of services to be provided at a cost that is affordable to larger segments of the population.

We have outlined the potential static efficiency benefits of ICTs, but the direct dynamic benefits in terms of higher growth are harder to identify empirically. Of course, if IT economizes on current resources, more is available for investment, which can increase growth. If ICTs increase the efficiency of education delivery to the broader population, this investment in people (human capital acquisition) is also likely to lead to

higher growth.[7] IT may also have positive impacts through impacts on the innovation process. For example, IT can make innovation easier by allowing simulation and low-cost testing of new designs or searching through possible chemical compounds for beneficial drugs. Furthermore, IT may speed the diffusion of innovations through better communications, which may stimulate further innovation.[8]

One possibility is that ICTs may increase growth by reducing transaction costs.[9] This is analyzed by Singh (2004) as follows. In his model, a reduction in transactions costs increases the number of intermediate goods that are produced and in turn this number influences growth. This is because the productivity of intermediate goods is increasing in the number of varieties, representing a type of complementarity in production. While there is no long-run growth in the model, it can be added in through learning or labor force growth. The steady state of the economy, however, depends crucially on the level of transaction costs. Transactions costs may arrest the process of development in the sense of keeping the number of varieties of intermediate goods at their initial level and/or reduce their long run level, thus reducing short-run growth and long-run productivity and welfare.

An important barrier to realizing the economic benefits of ICTs is the often-substantial up-front cost of investment in new infrastructure – both hardware and

[7] Investing in health and nutrition provides a different kind of human capital accumulation, and is clearly complementary, and in important ways, prior to educational investment. I am grateful to Bibek Debroy for emphasizing this point.

[8] See Singh (2003) for a suggestive model in which ICTs have this kind of role. The idea is based on Weitzman's (1998) model of recombinant growth.

[9] As noted at different points in this chapter, information technology can reduce transaction costs in several ways, e.g., reducing search and matching costs, speeding up and making more reliable the completion of transactions, substituting long-distance communications for physical transportation, and improving tracking and logistics of delivery. These benefits can be obtained in transactions for intermediate or final goods and services.

software. In developed countries such as the US, large potential customer bases and efficient capital markets help overcome this barrier. Hardware and software designed for developed country markets can easily be adapted to serve higher income consumers in developing countries, but this leaves out the majority of the population in developing countries. In this scenario, one potential consequence of IT use is an exacerbation of inequality, as only higher income groups enjoy its benefits – this is the so-called 'digital divide.'[10]

On the other hand, because government-provided goods and services, including redistributive transfer payments, are often aimed at lower income groups, to the extent that ICT use can increase the efficiency and effectiveness of government, the benefits of IT will be more widely spread, partly reducing 'digital divide' concerns. However, achieving these benefits requires more than just internal use of IT: beneficiaries of government services (particularly the economically disadvantaged) must be able to access IT resources also. While governments may invest in such front-end interfaces with citizens (and have done so in developed countries), the cost of doing so for governments in developing countries may be prohibitive. Such governments typically already have difficulties in raising sufficient resources through taxes and user charges. Again, the equipment costs may be compounded, or even dominated, by the training and other process transition costs.

[10] Bibek Debroy has pointed out to me that hardware costs have dropped substantially. Furthermore, open source software reduces software costs substantially. The remaining hurdle is the development of customized, local-language software for applications suitable for rural India. These points are taken up later in the monograph.

While successful examples exist of conventional implementation of 'e-governance' initiatives,[11] exclusively through government action, there is a conceptual alternative. This comes from recognizing the fact that citizens typically incur private costs (often substantial) in availing of government-provided services. If the use of IT can reduce such costs, even low-income individuals may be willing to pay at least some fraction of the cost savings, and there is scope for private provision of intermediate services that reduce the cost of access to government. Of course, this idea is not specific to IT: private intermediaries already help in filling out forms, getting access, and so on.[12] One difference that IT can make is in reducing costs even further, often by an order of magnitude. In broad terms (as is also the case with electronic marketplaces and job-matching boards), IT changes the scope and nature of intermediation.

Private providers may therefore have a role in delivering IT-based information services that are complementary to government services, as well as in providing conventional private goods and services. However, the private individual benefits that determine the prices charged by private providers may not reflect the overall social benefits of provision. As discussed earlier, these may include benefits such as greater awareness and participation in the political process. In such cases, there may be a role for government subsidization of private provision. This assumes that government provision is likely to be less efficient than private provision, which seems to be true in some cases

[11] In India, these include Bhoomi in Karnataka, e-seva in Andhra Pradesh, Lokmitra in Rajasthan, and the CHOICE Project in Chattisgarh. See also Parthasarathy *et al* (2005) and Bhatnagar and Schware (2000) for further examples.

[12] In some cases, government officials themselves illegally take on these intermediary roles, demanding 'speed money' or other payments. The transparency and routinization introduced by IT can help to reduce these rent-seeking costs. Some of the impact is purely redistributive (from citizens to government employees who act as gatekeepers), but there is also a genuine potential efficiency gain from curbing rent-seeking: see, e.g., Murphy, Shleifer and Vishny (1993).

in developing as well as developed countries. In either case, richer information flows can increase the transparency with which the government operates, thereby promoting better monitoring, and potentially – depending on whether electoral and legal institutions are effective – greater accountability. The ultimate payoff is more efficient delivery of government services. These issues are discussed in greater detail in Chapter 13 of the monograph.

Looking at the case of India, in cities and larger towns, cyber kiosks have already begun to proliferate. Urban population densities, income levels, cultural attitudes and telecom infrastructure all seem to be sufficient for the commercial success of these enterprises.[13] The falling cost of hardware and the availability of a variety of English language software have also supported this trend. Finally, the government's belated opening up of Internet service provision to competitive entrants has been a crucial supporting development. In non-Internet IT-related services, IT education has clearly taken off in cities as well, inspired by India's success in software exports.

In rural areas and smaller towns, however, the various demographic and socioeconomic factors such as income levels, cultural attitudes, and geographic and social fragmentation may not be present in configurations that would easily enable the diffusion of commercial access to various IT-enabled services. Furthermore, the market power of traditional rural intermediaries may act as a barrier to partial innovations in how matching of buyers and sellers is conducted. Finally, vernacular language requirements

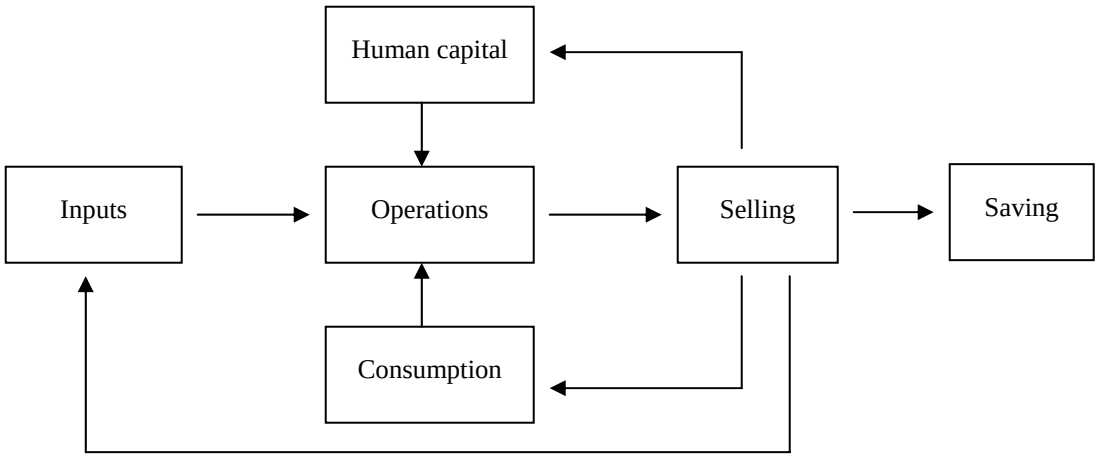
[13] In December 2005, based on survey data, the Internet and Mobile Association of India reported that the number of Indian Internet users increased by 54% over the previous year, to 38.5 million, while the number of cybercafés increased from 18,000 in 2001 to 105,000 in 2005 (http://www.iamai.in/r5_home.php3).

and different demand patterns imply the need for software that is tailored for fragmented rural markets. All these issues are discussed in more detail in this monograph.

3. Rural ICTs: Household and Institutional Environment

One can examine the potential for rural IT use from both the supply side and the demand side. On the demand side, we provide an overview of the potential benefits that IT can bring to these populations, if the implementation is successful. We begin with the demand side, as a way of motivating the supply side issues. Further, specific aspects of demand are taken up in Chapters 7 through 10. The supply side, discussed in Chapters 4 and 5, deals with the technical and organizational issues that arise for delivering IT-based services to rural populations in India.

Figure 1: Rural Household Economic Decisions



Potential sources of demand for IT-based services can be framed in terms of a simple flow diagram representing the decisions of rural households. We will treat a typical household as engaged in farming or related agricultural occupations: though this is not true for all of them, farming probably constitutes a significant activity for the majority of rural households. For example, the 1993-94 NSS survey estimated that 63%

of rural income was generated by agriculture, which can be taken as a lower bound on the percentage of agricultural households.[14] Figure 1 presents a simplified representation of the various economic decisions that a rural agricultural household would undertake.

Beginning from the left of Figure 1, input decisions include material inputs such as seeds, fertilizer and pesticides; and capital inputs such as tractors and land (whether through purchases or rentals); as well as the credit required for such purposes. Much of the focus of our analysis for potential applications of ICTs will be on market transactions for inputs. In all cases, there is a potential for benefiting through improved information about prices, quality and availability. Labor is also an important input, but the labor market has special characteristics that reduce the importance of such information in rural contexts. This contrasts with urban settings, where online job posting sites have been quite successful.

Farming operations include decisions with respect to quantity and timing of inputs. A crucial aspect of agricultural operations is risk management, as both the weather and pest incidence are extremely variable.[15] *Ex ante* decisions in the face of uncertainty, as well as *ex post* responses to realizations of uncertainty are both important. Predictive and technical information are both important for agricultural operations.

Continuing to the right of Figure 1, marketing of outputs primarily requires price information. Increasingly, producing for sale also requires knowledge of quality requirements in different markets. This was emphasized by ITC managers as an

[14] See Lanjouw and Shariff (2002), Table 1 for this number, and further data and analysis of rural non-farm incomes.

[15] Townsend (1994) is a seminal quantitative analysis of risk and risk mitigation in rural India. Additionally, India's trade and internal liberalization has the potential to increase market risk and uncertainty (e.g., World Bank, 1996). In particular, reducing the role of public procurement and opening up futures markets will make price information more important for farmers. I am grateful to Bibek Debroy for emphasizing this point.

important motivation for, and benefit from its e-choupal initiative. Selling of produce provides income for consumption, investment and inputs (the reverse arrows in the figure), as well as generating information about demand that can influence future input and production decisions.

Non-production decisions of households can be roughly divided into pure consumption activities, as well as human capital investment in education and health. The boundary is fuzzy, since even basic food consumption has nutritional impacts and therefore a human capital component. These activities generate impacts on operations, since they affect the quality of decision-making, as well as household labor inputs: we indicate this with the vertical arrows. Health and education are obviously two of the most important areas where rural India suffers severe deficits compared to generally acceptable societal standards, and the possible role of ICTs in correcting these deficits is considered in Chapters 7 and 8. While poorer households may be severely limited in their consumption, a significant proportion of rural households in India have incomes sufficient to support some discretionary consumption. In some cases, consumption may be only superficially discretionary – social norms may dictate spending on activities relating to marriage and other life cycle events.

Finally, the rightmost box captures household saving, again something that is not feasible for all rural households, but nevertheless an activity of growing importance – specifically in the case of financial saving. Saving may be for consumption smoothing, investment, or precautionary reasons. In India, bank nationalization and postal savings schemes have provided rural households with convenient opportunities for financial saving. However, channels for borrowing (i.e., dissaving) have been less well developed.

Typically, nationalized banks have rural branches, but they do not have levels of efficiency (including low enough transaction costs) sufficient to effectively provide credit to small farmers or non-farm rural households. Microcredit institutions are a well-known alternative, but have limits on scalability. ICTs have a potential role to play in enhancing the provision of rural credit: this possibility is discussed further in Chapter 12.[16]

Even this simplified and summary picture of rural households' economic activity illustrates that they engage in a broad range of transactions and decisions with economic impacts. What is noteworthy besides this complexity is that many decisions are made with very limited information, and that market interactions are often subject to high transaction costs, due to imperfections and asymmetries in information, as well as high transportation costs, inefficient intermediation and time delays. High transaction costs will always prevent marginal transactions from being undertaken; in extreme cases, the market may fail to function at all. Given this scenario, the role of IT can be understood in terms of reducing transaction costs, as well as improving the efficiency of decision making within households (both as producers and as consumers).

Reductions in communication and transaction costs are particularly beneficial where they can allow new markets to develop, in the sense that existing goods and services, otherwise restricted to urban areas, or to a very limited segment of rural populations, now can be offered to broader cross-sections of the rural population.[17] Examples include financial services, particular types of education, health services, long distance communications, and expertise on a range of production-related decisions.

[16] In addition to providing rural credit, ICTs may help in delivery of low-cost insurance products, including life, house and crop insurance. See Chapter 12 for further discussion of these possibilities as well.

[17] See Singh (2004a) for a model that develops this point formally. The original insight that transaction costs can lead to certain markets being non-operational is due to Romer (1994), but he emphasizes tariffs rather than internal transaction costs in his formal analysis.

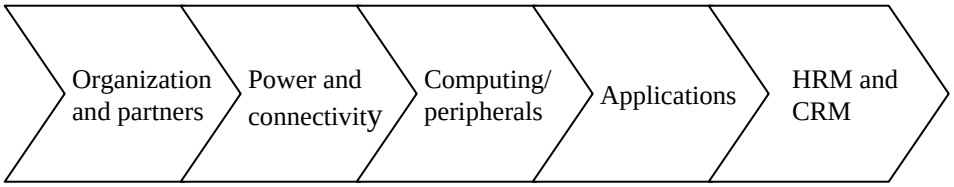
Whether this can be done in a sustainable manner depends on the supply conditions for ICT-based rural services.

It must be further understood that the activities outlined, in Figure 1 and the accompanying discussion, take place within a particular institutional environment. This includes private actors as well as governments. For example, farmers may obtain credit and inputs, as well contract their output, to private 'commission agents,' even in the presence of government procurement and government-run local markets. Governments play a major role in subsidizing inputs, providing infrastructure, and enforcing property rights. To the extent that these activities are also subject to inefficiencies, it may be the case that, in order to be successful, IT-based interventions geared towards rural households will have to simultaneously alter the institutional environment, or else achieve sufficient scale and scope in order to impel changes in it. We will return to this idea in various ways in Chapters 12-14 of the monograph.

4. ICT Supply: Organizational and Policy Issues

Turning to the supply side, we can illustrate the various stages of decision-making and delivery of ICT-based services in terms of a typical value chain, as shown in Figure 2. At each stage of the chain, the ICT components include a mix of hardware, software and services. For example, an Internet kiosk would have a computer, printer, web cam, modem, power back up, and software to enable standard Internet browsing, as well as handle specialized tasks such as education in the local language, agricultural information, e-governance and entertainment. At the other extreme, an alternative might be just a mobile phone, for basic voice and text communications. These choices and their components are discussed in more detail in the next chapter. The creation of an organizational structure and value network is a critical first step, while managing human resources and customers is vital for successful final implementation.

Figure 2: Value Chain for IT-Based Services



Organizational and policy issues relate to all the stages of the value chain in Figure 2, albeit to varying degrees. The organizational structure necessary for the delivery of rural IT services typically requires commercial goals of profitability to be built in at some level, if scalability and sustainability are to be achieved. In the absence of commercial goals, the organization's incentive structure is unlikely to be financially

sustainable without continual external infusions of support. The organizational models of experiments such as the MSSRF in Pondicherry and DHAN in Tamil Nadu[18] both rely on ongoing external funding. The reason for this is an emphasis on "developmental" goals over financial sustainability. As will be clear, however, all rural ICT projects require some degree of initial subsidization, and some ongoing cross-subsidization: the difference in the organizational models therefore lies in the balance between pecuniary and non-pecuniary motives as sources of incentives for efficient action. There is no unique answer, but it can be argued that a proper role for commercial incentives is essential if positive impacts are to be long-term and large-scale. These issues are discussed further in Chapter 14 of this monograph.

At the other extreme, a standard corporate structure is used: ITC is the most significant example of this approach. Aksh, an optical fiber company, and EID Parry, a processed food company, have both been involved in rural ICT efforts, though not as comprehensively as ITC.[19] It is clear that, for scalability, some minimum size of the organization is required, to spread the fixed costs of administration efficiently. In addition, there are fixed costs of innovation that can be spread more effectively across a larger organization. Note that the organization referred to in this case is not necessarily the whole company, but could be the division that implements the rural ICT service project. A variant on the corporate model is where there is a producer organization that

[18] MSSRF is the MS Swaminathan Research Foundation, which operates 12 Village Knowledge Centers in Pondicherry, a Union Territory south of Chennai (Dossani *et a*l, 2005, Parthasarathy *et a*l, 2005). DHAN is the Development of Humane Action Foundation, which operated 37 kiosks as of June 2004, in Madurai district of Tamil Nadu (Parthasarathy *et al*, 2005).

[19] ITC has several thousand kiosks spread across multiple Indian states. Aksh attempted to manage over a hundred kiosks in Jaipur district in Rajasthan. EID Parry is involved with several dozen kiosks in Nellikuppam district in Tamil Nadu.

controls the project, as in the case of the Warana sugar cooperative in Maharashtra (Dossani *et al*, 2005).

By far the most common organizational model that is emerging is a hybrid one, combining non-profit and profit motives. For organizations that are dedicated specifically to rural ICT-based services delivery, social goals can be incorporated by vesting controlling ownership of the corporation in a non-profit entity that has an explicit social focus. This model has been followed by n-Logue, TARAhaat and Drishtee, for example. A variant on this involves controlling ownership through the public sector, typically the state government (e.g., Akshaya in Kerala – see Parthasarathy *et al*, 2005), though in smaller-scale cases, a rural local government may be the main stakeholder (e.g., Bellandur Gram Panchayat, Karnataka – see Dossani *et al*, 2005).

Even in the case of existing for-profit corporations with broader businesses, social goals may enhance reputation, meet corporate social responsibility guidelines, or otherwise be consistent with the mission and values of the organization. In other words, including social goals may make good bottom-line business sense. In the case of ITC, this is clearly a factor in their efforts, though the supply chain efficiencies that are realized are critical to the expansion and continuation of their efforts. In another case, Aksh was not immediately able to realize commercial objectives in its support of kiosks in Rajasthan, and the reputational enhancement alone was insufficient to provide quick sustainability of that ICT initiative. Nevertheless, Aksh has used a recent increase in state government interest and consequent possibilities for e-governance to expand its efforts in Rajasthan, as well as enter Andhra Pradesh: the commercial motivation comes from the

provision of fiber optic cable and cable TV delivered over that cable, with rural Internet services being an "add-on".

For all types of organizations, building the right capabilities requires some effort. Creating what amounts to a brand new infrastructure for rural ICT service delivery requires a broad mix of skills, and finding talented and trained people who can be effective in a role that mixes entrepreneurial tasks with corporate line responsibilities, all in an unfamiliar rural environment, can be a challenge. In the case of new efforts such as n-Logue, TARAhaat and Drishtee, we observed this organization-building task as a major challenge. One significant aspect of this challenge is finding skilled people willing to work in rural areas. In one case, we observed that the field managers of an organization were more comfortable in an urban corporate setting, rather than dealing with villagers and "small-town" people. N-Logue found that hiring in cities was very expensive, and has tried to identify and train middle-level field managers from the villages and towns in which it operates kiosks.

For existing organizations, the problem of hiring, training and organization-building is somewhat mitigated – nevertheless, there is apparently a need for high level direction to ensure that resources are allocated for the effort, including human resources. In the case of ITC, the heavy use of management trainees to interact with and support the e-choupal effort appears to be a crucial success factor, providing a continuous supply of fresh young talent, and ensuring that over time, the larger organization will have a deep understanding of the role of e-choupals in ITC's global business. In the case of smaller, non-commercially oriented efforts, of course, these organizational challenges are less significant. Running a few kiosks may involve additional paid staff, but a major source of

the required skills comes from a rotating pool of volunteers. One important question that will only be answered with time is the long-run sustainability and scalability of this volunteer model. The level of external resources required to maintain it may also be a concern.

Where the government is involved as the controlling organization, the experience in India suggests that a centralized and personalized model is adopted. Typically, someone high up enough in the government hierarchy develops an enthusiasm for using ICT for e-governance or other services, and this enthusiasm translates into a "big push." Also typically, these efforts do not involve essential modifications in governmental structures or processes, and hence there is not a systemic innovation that can lead to sustainability. This is a common feature of several rural e-governance efforts in particular, as described in Dossani *et al* (2005) and Parthasarathy *et al* (2005). These issues are discussed further in Chapter 13 of the monograph.

One response to the significant challenges of collecting the necessary talent and skills is to enter into partnerships with other organizations that may provide specific pieces of the overall package that is needed: application software, content, maintenance services, technology, marketing, and so on. In particular, the ICT components in the middle three stages of the value chain may require partnerships, though less so for commoditized components such as PCs, and more for infrastructure pertaining to connectivity and applications. These partnerships can pose their own problems, particularly in goal alignment and consequent performance monitoring requirements. The relatively unsuccessful partnership between Drishtee and Aksh to manage kiosks in Rajasthan is an example of these problems. In cases such as this, the different resource

scales of the partners also can make collaboration difficult to sustain. In several cases, various informal as well as formal partnerships have worked better, and have involved various mixes of NGOs, government and private sector entities. In only one case that we are aware of, namely n-Logue, has there been a significant, ongoing university collaboration, in that case, IIT Madras. This collaboration has spanned infrastructure as well as applications. Given the nature of these initiatives, with substantial room for organizational and technical innovations, it is noteworthy that other technical institutes and management schools have not been more involved.

Of course all the organizational issues involved in setting up rural ICT efforts are well recognized in management writing and experience: what is important is to recognize their criticality in a setting that has more typically been the arena of pure 'social service' entities such as governments and NGOs. It is also critical to recognize that the organizational innovation required in this case is an order of magnitude greater than the task of selling consumer goods in rural areas, something that is now accepted as a given in India. The greater complexity and variety of the services being delivered through ICT is the root cause of this difference.

Government policy has been reasonably accommodating from the perspective of organizational issues. NGOs and hybrid organizational forms are well-established methods of bringing together the components of the rural ICT value chain, and individual government officials and departments have been supportive and cooperative at various times and places. The key organizational challenges, as noted, involve the functioning of government itself, and the systemic reforms required there are discussed in Chapter 13.

The final stage of the value chain in Figure 2 refers to human resource management (HRM) and customer relationship management (CRM). In this context, these more general terms take on specific focuses. Training of rural kiosk operators, whether they are formal franchisees or independent farmer operators, becomes a key aspect of the delivery model. Training the field personnel at various levels (village and district hub) is also critical. Gathering customer information on usage patterns (nature and timing of use), revenue streams, responsiveness to pricing, social acceptance, and so on is also vital, as these are brand new markets in terms of the nature of service delivery. Furthermore, being able to respond to this information with appropriate and timely changes in strategy is also necessary for successful implementation. In the case of n-Logue, "local service providers," as partners-cum-franchisees, handle some of these ongoing functions, with initial support provided by n-Logue. In other cases, this ongoing management is handled without partnerships.

One might expect that a 'labor surplus' developing economy such as India's would not have a problem with the more labor-intensive tasks at either end of the value chain as it has been mapped in Figure 2. However, it seems that these value chain activities are the most difficult to carry out successfully, because those with the requisite skills are more likely to be taken up by more traditional corporate organizations, in urban environments. This does not minimize the challenges associated with technical implementations and adaptations for rural areas, whether in software, hardware and maintenance. However, solutions in these cases are often one-time and replicable, whereas building organizational expertise involves much more of a situation-specific or local approach.

5. ICT Supply: Technology, Infrastructure, Applications

The second stage of the supply chain in Figure 2 concerns access to electric power and Internet connectivity. In both cases, a major constraint on ICT initiatives is the failure of the public sector to deliver adequate power and telecommunications to rural India. This is no longer because these technologies are too expensive or sophisticated for a poor country – the failure is purely institutional. Privatization has helped in the case of telecommunications, as has technological change. In particular, the widespread adoption of cellular phones has been driven by the opening up of this sector to competition almost from its inception.

Of course, innovation in digital communications technologies is the foundation of all rural ICT-based service delivery. While conventional telephone connectivity has often proved inadequate for Internet access in rural areas, because the quality of existing voice lines is too poor to sustain data transmission, several innovations provide alternatives that are likely to be cost effective. These include wireless in local loop (WLL), fiber optic cables, and high-powered versions of Wi-Fi and Wi-Max (i.e., various versions of the 802.11 and 802.16 wireless standards). The Internet boom in the United States clearly played a role in pushing down costs and speeding innovation in fiber optics and wireless transmission. In some cases (ITC in particular), VSAT (very small aperture terminal) satellite connectivity has been used for Internet access, but it is not very cost effective. The major challenges for connectivity are likely to be regulatory, having to do with interconnection to the main network, and with maintenance, rather than with the fundamental technological choices and implementation.

Combinations of a fiber optic backbone (which is now extensive in India), and wireless technologies for last-mile access (specifically, newer versions of Wi-Fi and WLL[20]) are likely to emerge as cost-effective solutions, provided the government is able to implement socially desirable policies for investment as well as interconnection charges. The main thrust of the report of Dossani *et al* (2005) is to argue for using Universal Service Obligation (USO) funds collected from telecommunications providers to finance improved rural ICT access. This perspective is a valuable one. Digital convergence in ICTs means that separating voice from data in formulating policies for rural access no longer makes sense. Similarly, calls to focus on mobile phone access rather than Internet kiosks (*Economist*, 2005) neglect the convergence in technologies as well as the different functions served by the two access modes.[21] The government and its regulatory agency, TRAI (Telecoms Regulatory Agency of India) have announced a move toward unified regulation, but the roadmap is unclear and progress slow. One problem is that the interests of the large government-owned incumbent BSNL are protected through restrictions, e.g., on the use of VoIP.

Electric power is in many ways more of a problem than telecoms connectivity, and this is true throughout India. The reason, as noted, is a serious institutional failure.

[20] WLL technologies can use single tall towers with line-of-sight, or more numerous, smaller towers. The former is n-Logue's current common technological approach, but the latter is likely to replace it, since it is cheaper and more flexible. Caspary and O'Connor (2003) provide additional discussion of technological options.

[21] Shared mobile phones are very effective for certain types of communication, and their capabilities keep increasing. However, for many types of information access, where quantity and ease of reading and processing matter more than mobility, the use of desktop PCs is more efficient. In addition, a desktop PC with printer is able to provide a wide range of services that are not communication-related, but just involve processing of information. These points will be apparent when we discuss different applications in health and education, in later chapters. Nevertheless, mobile phones can be sufficient and significant for conveying basic information such as market prices in multiple locations, in advance of travel to a particular market. See Eggleston, Jensen and Zeckhauser (2002), and Jensen (2005). This case of using mobile phones for market price information is discussed further in Chapter 9.

The production, transmission and generation of electricity in India are seriously inefficient, as a consequence of poor organizational incentives and vested interests in the traditional public sector.[22] For rural ICT access, the lack of power for long periods seriously hinders accessibility. Battery backups are an essential part of rural Internet kiosks, though they are a very partial solution to the lack of reliable power supplies since they cannot provide sustained power during long power outages. The need for heavy duty battery backups also adds significant capital and maintenance costs for these kiosks. Of course, this is a microcosm of the problem faced by all electricity consumers in India – they are forced to use inefficient, small-scale backup power supplies, because of the total inefficiency and unreliability of what should be much cheaper large scale provision of electricity. Solar technologies may be more promising in the near future: they are already in use in existing rural IT efforts, particularly that of ITC. Realistically, electricity supply in India will not improve dramatically any time soon, and innovation in solar panels, battery technology and electricity storage may eventually provide attractive alternatives for rural India in general.

The third stage of the supply chain is the most straightforward, because of the standardization of components of desktop computing and peripherals, rapid technological improvements, falling costs of production, and, most recently, price reductions resulting from changes in tariffs on imported hardware. It is now possible to fully equip a single-computer rural Internet kiosk for less than Rs. 50,000, including CD drive, printer, scanner, power backup, and web cam.

[22] This has also had the consequence of serious financial burdens on state governments, further complicating the problem of making improvements in functioning. The problem of reliable power supplies is more general in developing countries. See Caspary and O'Connor (2003) for an overview of problems and possible solutions.

Potentially, the highest cost component is the operating system, since Windows has enjoyed a virtual monopoly on the desktop. However, Microsoft does have some concessional pricing for socially oriented developing country initiatives, and this helps to reduce costs. The continued development of Linux as an open-source alternative for the operating system also helps to bring costs down, both directly, and through providing competition for Microsoft. In fact, government adoption of Linux and the development of browser-based applications can both hasten the use of Linux. Large scale adoption of Linux by companies such as n-Logue might also provide an impetus for domestic entrepreneurs to develop Linux-based applications targeted for regional rural markets. Browser-based applications may also make "network appliances" more feasible. On the other hand, if bandwidth and reliable connectivity are the key constraints, the falling costs of processing power will favor the continued use of conventional desktop computers.

The operating system is still typically in English, but as long as simple visual (using icons) and keyboard drills can take kiosk operators to local language applications and content, this is not a substantial usage barrier. Kendall and Singh (2006) find, in a sample of n-Logue kiosks, that an operator's having a college degree or even having completed high school does not significantly increase kiosk revenue: the minimum level of education needed to be successful is not very high, provided adequate training is provided. One can conclude that this stage of the supply chain is easiest to implement, with a highly standardized, almost cookie-cutter approach – although ongoing maintenance can be a challenge. The major business decision is whether to have more

than one computer per kiosk, but experience suggests that one is sufficient for almost all situations, at least in the beginning.[23]

The next stage of the supply chain, namely applications, presents more challenges. The range of possible applications is vast. Many IT-based services require non-IT logistics or processes as complements. Availability of local language software becomes more of a constraint. There is much more variation across localities, not just regions. Delivery of services or development of content often stretch the resources and expertise of the primary provider, and require varied partnerships or other contractual relationships. Local language content development can be hindered by a lack of software and hardware standards (see, e.g., Bajpai and Singh, 2005, for the case of Hindi).[24] Deciding the sequencing, scope and sophistication of various applications can be a major challenge, since many of the services are being offered for the first time, or are being delivered in novel ways that challenge existing institutional frameworks and relationships. However, one of the benefits of the numerous rural ICT experiments that have been conducted throughout India is that the kinds of applications that are valuable to rural households have been identified and refined. As one would expect, computer games are popular with children, and some kinds of communication and information retrieval (e.g., forms, certificates, examination results) are highly valued. Word processing is often needed by children and adults, and digital photographs are also very much in demand. One can generalize somewhat, to say that basic digital applications, often taken for

[23] This will obviously be a function of population densities and incomes. Our fieldwork suggested that centers with multiple computers are not commercially viable in villages, even in high-income states such as Punjab. However, they are more effective in small towns. In some southern states, such as Kerala, population density and literacy are both high, and this makes larger kiosks more viable.

[24] More general discussions of local language content issues for ICTs in India are in Kumar (2004) and Sangal, Bharati and Chaitanya (2004).

granted in developed countries, are the basis for any rural IT kiosk's financial sustainability.

Pricing for low income markets, where market penetration is limited in any case, and where some services may be perceived as public goods that are traditionally unpriced, presents another major challenge. In the case of financial services or government records or services, substantial government cooperation and organizational and regulatory innovation may be required, which raises political and bureaucratic hurdles. In some ways, of course, the essence of the success of the rural IT-based-service business model depends on the selection, quality and pricing of the services being offered. What is interesting is that a substantial amount of learning has occurred in this arena, in just a few years. One of the keys to success appears to be pricing low enough to attract high enough volumes of users, and gain acceptance. It is risky, in the Indian context, to offer free trials (especially in contexts where the government is involved in any way), as the expectation of continued free services becomes ingrained, but low prices for most services (Rs. 5-Rs. 25) are standard.[25]

[25] Horoscopes for matchmaking purposes are substantially more expensive, at about Rs. 150, but the bulk of the revenue goes to an outside provider for these rather lengthy documents.

6. Overview of ICT Initiatives

The overview of several rural-IT initiatives is based on three main sources: (1) field visits conducted by the author over a two-and-a-half-year period, from December 2001 to July 2004, as well as detailed discussions with various members of each organization;[26] (2) field visits and interviews conducted by a team of Stanford researchers, working in collaboration with the National Informatics Centre of India (Dossani *et al*, 2005); (3) field visits and interviews conducted by a team led by Balaji Parthasarathy, of the Indian Institute of Information Technology, Bangalore, and funded by the Infosys and the Department of Information Technology, Ministry of Communications and Information Technology, Government of India (Parthasarathy *et al*, 2005). None of these sources is exhaustive in covering all the initiatives that exist, and the different reports have particular foci (infrastructure in the case of Dossani *et al*, and e-governance in the case of Parthasarathy *et al*). A broader summary of various initiatives, but without critical analysis, is provided in a survey compiled by the NISG (National Institute for Smart Government, 2004). We cannot, and do not provide an exhaustive description or analysis of any single organizational effort, but give some background on each initiative in the context of the conceptual framework of Chapters 2-5, to bring out common features as well as differences.

Drishtee

Drishtee.com had its origins in Gyandoot, a government project in Dhar district of Madhya Pradesh, in central India. Gyandoot provided an intranet for 33 village

[26] It is important to note that the description based on these discussions represents a subjective assessment, and does not reflect the views of any of the individuals or the organizations they represent.

information kiosks, offering a range of mainly e-governance-related services. The most prominent of these is land record certificates, which are needed by landowners for transactions such as sale or leasing of land. While Gyandoot was a specific local initiative, involving heavy support from the District Collector,[27] Drishtee has attempted to take that model and rapidly replicate it across the country. In this process, it has undergone several ups and downs. Currently, Drishtee has over 100 rural Internet kiosks in several states (primarily now in Assam), run by franchisees according to a revenue sharing arrangement. In Drishtee's case, a kiosk has, at least initially, just one computer. The set-up cost is in the range of Rs. 50,000.

Drishtee is a commercial organization, with specific social objectives of targeting benefits to the rural poor built into its vision and strategy. Drishtee has developed some software on its own, but also relies on various partners for software development, as well as, in some cases, other partners for management of district hubs, from which kiosks in a district are managed. Thus Drishtee's model involves not only franchising individual kiosks, but also potentially franchising district hubs. Partnering with local district hub 'channel partners' allows Drishtee to expand faster without creating a bulky organization, spreads risks, and also insulates Drishtee from some of the commercial pressures that might conflict with social objectives. At the same time, it reduces Drishtee's ability to monitor and implement the achievement of social objectives. This tension between commercial success and meeting social objectives is a general challenge for all the rural ICT initiatives examined here. Despite some challenges, Drishtee appears to have built a

[27] In India, the district is in many ways the primary unit of practical administration, and the Collector (or Deputy Commissioner in some states), is a member of the elite Indian Administrative Service, and wields considerable power at this quasi-local level.

capable but lean organization, with learning having been systematized in a manner that makes it transferable across locations, permitting more effective scaling up. In its initial efforts, in Sirsa district of Haryana, there were considerable problems with creating an organization that could deliver to the level that kiosk operators expected: some of this problem was a function of difficulties in partnering with the local government, some a consequence of the quality of local partners, and some because of Drishtee's own somewhat thin capabilities.

Electric power and telecom connectivity have posed challenges for Drishtee, since it is a pure startup, without resources for heavy investments in infrastructure. It uses standard battery backup for power interruptions, and has relied mainly on dial-up Internet access. It has experimented with high-powered Wi-Fi for district-level intranets, but this has not been successful so far (Parthasarathy *et al*, 2005). In some cases, it has set up kiosks even without phone connectivity, relying on physical delivery of information. Typically, this has been only a short-run fix, and has not been viable in the long run. Software has also been developed that economizes on bandwidth for information exchange, making the constraint of dial-up access less severe.

As we have noted, the software and hardware for basic kiosk operations are quite standardized, and their cost has been falling. Drishtee was able to get concessional terms for using the Windows operating system. Various local language software applications have been developed, for e-governance, market price information, buying and selling, and so on. Some of the initial content was adapted from Gyandoot, taking advantage of the commonality of the Hindi language across northern India.

With the origins in Gyandoot playing a role, simple e-governance, such as making government forms available and allowing a variety of complaints to be relayed to the district level government, was initially the lead service in setting up operations in a new district. In this context, informal partnerships with district level government officials (both state and local) were very significant. For example, in Sirsa and Jaipur districts, Drishtee was able, at first, to act as a significant intermediary for information exchange between the district government and constituents. As is emphasized in Parthasarathy *et al* (2005), these initiatives, even when some government departments or officials are involved, are severely limited in their ability to force improvements in the internal functioning of government. In the case of Drishtee in Sirsa, resistance from government employees, loss of local support as a result of the transfer of the Deputy Commissioner, and the organization's own inability to 'keep up' led to a withering away of much of the initial e-governance effort (Parthasarathy *et al*, 2005). Nevertheless, Drishtee's approach can be viewed as achieving some level of 'embedded autonomy' at the local level, to use Peter Evans' term, meaning a societal structure with coherent institutions that are autonomous, but nevertheless connected through institutionalized channels for continual negotiation of goals and policies (Evans, 1995, p. 12). These issues are discussed in more detail in Chapter 13.

Expanding the range of services has meant tying up with content partners, particularly organizations such as Agriwatch, which provides a substantial quantity and range of agricultural information to farmers. Agriwatch is essentially developing into a large-scale Internet portal for farmers, and Drishtee's role can be seen as providing last-mile access to this rich information, through its kiosks. It is difficult to quantify the

benefits of this service, but its popularity with farmers suggests that it is valuable. Related examples from the cases of ITC and n-Logue will provide a more definite assessment of these benefits. Chapter 10 provides an overall assessment of the role of ICT initiatives in benefiting agriculture.

Drishtee's pricing scheme for e-governance services follows a set model, common across most of the initiatives surveyed. The full cost of a transaction such as obtaining, filling out and submitting a government form is estimated, including imputing the value of time spent in travel. The kiosk owner's fee for this is then set at about 10 percent of the estimated transaction cost, also taking into account possible willingness-to-pay considerations in choosing "pricing points" such as Rs. 5, 10 or 20. Assuming that these fees can cover the full cost of the kiosk owner and Drishtee (which depends largely on generating sufficient volume) the saving in transaction costs is substantial. The savings in such cases are generated by reductions in travel and time costs. There would be benefits in terms of improving the effectiveness of transactions (e.g., if a complaint through this channel is more likely to be addressed), but these are harder to quantify, and have been difficult to realize in a sustained way.

In the case of other services, such as matching buyers and sellers, or providing horoscopes or matrimonial advertising, additional services require partners who can provide software, maintenance, content or other components of the complete service. Education initially played a limited role in Drishtee's offerings, though kiosk owners often used the presence of a computer and peripherals to offer computer training, as well as other offline services such as printing and games. More recently, it successfully expanded offerings of computer education and spoken English courses through its kiosks.

The benefits in these examples are reductions in transaction costs for existing transactions, improved quality of successful matches, and potentially most significant, completion of activities (e.g., training, entertainment, communications) that would otherwise not take place because of high transaction costs.

Finally, Drishtee has appeared to learn rapidly with respect to the selection and training of kiosk owners, and eliciting the preferences of rural Internet kiosk users. Strengthening the training of kiosk owners and deploying a broad enough range of services became key aspects of Drishtee's rapid strategic adjustment to its initial experiences in locations such as Sirsa and Jaipur. This adaptability partly reflects the organization's own structure and character. As a lean start-up, it seems to have attracted people who are relatively in tune with rural market environments.

In sum, Drishtee has emerged as a typical start-up. Without very substantial financial resources, it has still managed to expand, and it has built an organization with strong competencies in what may be broadly termed 'rural IT-based service delivery.' This judgment holds despite Drishtee's lack of any clear strength in technology, applications, partnerships or ability to scale. In all these dimensions, it is 'good enough,' but it appears to have built a strong, low-cost organization from scratch, one that may be suited to delivering at least some components of the overall service. This competence is discussed further in the context of Aksh, a former Drishtee partner.

Aksh

Aksh is essentially a fiber optic cable company, with its core competence in laying and maintaining cable. Its revenue model is driven by the content and data that can

be delivered over this cable. Therefore it has an interest in increasing such content delivery. While urban areas in India have seen substantial penetration of cable TV, through a model (now in transition[28]) of largely unregulated local operators, the rural market remains largely unserved. The bottleneck has been the lack of last mile infrastructure, since there are a significant percentage of rural households (especially in richer districts) that can afford cable TV. Aksh, along with other companies such as Reliance, has received licenses for laying a new fiber optic network in rural areas.

In the case in point, Aksh rapidly laid a large fiber optic network in rural Jaipur district (excluding the city itself). It initially partnered with Drishtee for the development and maintenance of kiosks that would act as distribution points for cable TV access, as well as Internet kiosks. The Drishtee franchise model, interface and services were adopted, but with the brand name of "Gramdoot." Aksh therefore appeared in the value chain as the provider of connectivity, with Drishtee handling all the other value chain stages illustrated in Figure 2. However, this asymmetry between Drishtee and Aksh was fairly quickly reversed, and now Aksh stands as the main service provider, with Drishtee reduced to a limited (and declining) role of providing software and related services.

There are several reasons for this shift in the business relationship. Most obviously, Aksh's far greater size, resources and hardware capabilities give it an advantage in setting up and maintaining the hardware aspects of the kiosks. The rapid expansion of kiosks in Jaipur, with over 100 being set up within six months, stretched Drishtee's human resources beyond their limits. It was also not feasible to hire and train

[28] Under pressure from content providers, governments (at the state and national level) are trying to implement new regulations that require small local cable providers, and hence subscribers, to pay more for "premium" content.

large numbers of people for servicing the kiosks. Second, the needs of the cable TV business, and some degree of competition that emerged with another cable TV provider in the same district created additional problems of maintenance (e.g., Aksh's cables were cut by the competitor) and conflicts in terms of priorities for bringing Internet-based services online – essentially, Internet services were the tail of the cable TV dog. Finally, Aksh's incentive was to control and brand the effort to score points for corporate social responsibility.

In any case, the model of rural IT-kiosks managed by a large company with incentives to provide access to large numbers of rural households appears to be scalable and sustainable. Cable TV over fiber optic networks provides a strong revenue base, and a range of Internet-based services and content can be provided through partnerships. As companies such as Drishtee also scale up, they may be more effective in providing the necessary scale for ongoing management of the kiosks, including training services and customer relationship management. For now, providing software is easier for start-ups in such cases.

The history of Aksh's initiative means that the range of services provided in their kiosks, the revenue model, and pricing structures have followed the Drishtee model. Hence the earlier discussion of benefits transfers over to this case. The importance of cable TV revenues, however, suggests that these kiosks may emphasize a range of entertainment services more than utility services such as agriculture-related information or e-governance. It is conceivable, however, that kiosk operators will be able to span the entire range of services. The bandwidth available will certainly support a full range of offerings, and the issues will be managerial attention and the perceptions of rural users.

One important implication of greater bandwidth is that video interactions are possible, and Drishtee and Aksh have been able to test several communication services based on this. The power of video over text is in increasing the richness of information exchange, as well as greatly increasing the attractiveness and acceptance of all the services offered by the kiosks.

n-Logue[29]

While Aksh and Drishtee are mostly active in north India, n-Logue has its origin and chief presence in the south. It is a for-profit corporation, with majority ownership residing with a nonprofit organization. The main impetus for n-Logue came from the IIT Chennai research group headed by Professor Ashok Jhunjhunwala. This group has been responsible for a stream of hardware and software innovations that enable rural IT-based service delivery, through connectivity and applications.

The core innovation at the heart of n-Logue's operations is a WLL technology, Cordect, which provides joint wireless Internet and voice connectivity. The kiosk-level hardware is relatively inexpensive, and adds only marginally to the overall cost of a kiosk. However, the construction of WLL towers and maintenance of the WLL hub is relatively costly, and this fixed cost requires a substantial density of kiosks within a particular radius of the tower. The n-Logue model is designed to achieve this density, with kiosks generating returns from fairly small user populations (somewhat smaller than in the case of Drishtee and Aksh). Another constraint on this connectivity model is the requirement of clear lines of sight, and therefore relatively flat topography. Nevertheless,

[29] Paul (2004) provides a more detailed case study of n-Logue, providing many technology details in particular.

large parts of India are still suitable for this implementation. Furthermore, n-Logue has progressed well beyond being simply a connectivity provider, to delivering a range of services – these can be adapted to different connectivity technologies. N-Logue is the second largest organization in this field, supporting over 1000 rural-IT kiosks.

The WLL technology does provide several strengths. It overcomes lack of dial-up connectivity, and provides an extra revenue stream for kiosk operators, through voice calls. Furthermore, it has greater bandwidth than traditional fixed line dial-up, which allows a wide range of applications to be delivered. In particular, the IIT Chennai group has been able to develop video applications that are sufficiently compressed to work within the constraints of the WLL.

In general, the close links with the IIT Chennai group have given n-Logue access to a range of software innovations for delivery and implementation of various applications in the fields of education, health and agriculture. For example, web cams have been used for remote diagnostics for diseases of people, animals and plants. A considerable amount of local language software has been created quite rapidly and effectively. The university connection is important, and stands out as a model for other providers to emulate.

N-Logue has also been able to leverage its university connections to build strong partnerships across the board. The Tamil Nadu government has been supportive of n-Logue's operations in Madurai district, where numerous innovations have been piloted and showcased. MIT's Media Lab has also been involved in the initial stages, and ICICI Bank is piloting various financial services products in kiosks in Madurai. In Nellikuppam district, n-Logue has partnered with EID-Parry to improve sugar farmers' access to

information, and reduce their transactions costs in dealing with Parry's large sugar factory in the district, through improved tracking and settlements of payments. In this case, the factory chimney has also served as a base for the tower, and the control hub is housed in the factory, substantially reducing fixed costs. Parry plans to use those kiosks that are under its own brand (several dozen in total) to offer processed foods to farmers.

N-Logue also appears to have developed a very capable organization, and has expanded beyond Tamil Nadu into other southern states, as well as the west and north of India. One advantage that emerged in discussions with n-Logue managers was the relative ease of establishing organizational capabilities, training kiosk operators, and serving rural communities in the south relative to the north of India. This reflects higher proportions of the population with basic education, greater population densities, and, in general, a more structured and stable civil society. A factor that also seemed to emerge was the greater average success of women kiosk operators, possibly reflecting the fact that there is greater untapped potential for rural women, given their otherwise more restricted employment opportunities.[30]

Overall, n-Logue has several strengths compared to Drishtee, in terms of access technology, software applications and partnerships. Nevertheless, the two organizations are quite similar in terms of the range of services offered, and their ability to deliver close to an 'end-to-end' solution. Their social goals are more salient than those of Aksh, and each has achieved a substantial geographic reach and partnership capability. There are some differences in emphasis in terms of applications, services, and revenue models

[30] However, in testing this hypothesis with data from 74 n-Logue kiosks, we have been unable to find any gender effect on gross revenue, after controlling for other operator and kiosk characteristics, such as operator education and kiosk location. On the other hand, the breadth of services offered matters significantly.

(Drishtee relies more on overall revenue sharing, whereas n-Logue charges mainly for connectivity). In each case, however, there has been a demonstration that rural IT-based services are commercially feasible, and as a corollary, provide quantifiable economic benefits. Since estimates of the overall market size suggest that it can support at least 50,000 kiosks (roughly one per 10,000 people), and these two organizations, plus Aksh, have less than 2,000 kiosks, there appears to be substantial room for further growth.

ITC[31]

ITC stands out among all other initiatives as a large Indian corporation serving global markets. Its kiosks are called e-choupals, and they have several differentiating features. The key distinguishing factor is that the e-choupals are totally designed to support ITC's agricultural products supply chain. This gives them a focus that is not present even in EID-Parry's kiosks in Nellikuppam. In addition, the e-choupals are totally owned and set up by ITC, with the operators not having any investment or risk of their own. Furthermore, e-choupal operators are, because of the focus, always substantial farmers, and therefore always male. All these features make the e-choupals different from the three initiatives discussed earlier.

The e-choupal initiative has involved a clear focus and strong direction from the head of ITC's International Business Division. ITC has been able to turn its substantial organizational and managerial capabilities toward this initiative. Management trainees are heavily immersed in the e-choupal model as part of their inculcation into ITC's

[31] As the largest initiative in rural ICTs, ITC has been the subject of numerous case studies – the most celebrated being that reported in Prahalad (2005). That study also provides information on EID Parry's efforts in this area.

workings. There are four kinds of e-choupals, tailored very specifically for four different products: shrimp, coffee, wheat and soybeans. The first two of these involve large commercial farmers, and the focus is on creating Internet access to global market information to guide production and supply decisions. There are a few dozen of these e-choupals. In the case of wheat and soybeans, there are many small farmers, and over 2,000 e-choupals have been set up, in several states of India.

The following description is based on soy-choupals. Wheat-choupals are somewhat similar, with an important difference being that final market and products are less globally oriented. Soybeans are pressed to extract oil, which is sold domestically, while the remainder is exported as animal feed. Thus they are a cash crop, without the regulated market conditions or subsistence consumption associated with a food grain such as wheat. Soy-choupals are used as registry points for procurement of soybeans. Actual procurement is done at factories and warehouse hubs, but the initial logging in is done through the e-choupal, which provides price information and therefore price certainty. In fact, the e-choupal price acts as a floor price for procurement – the factory or warehouse price can be higher, but not lower. E-choupals also provide access to local market (*mandi*) prices and global market price information on soybeans and derivative products, to allow farmers to compare prices. They give access to operational information, developed by ITC experts, pertaining to cropping, seeds, fertilizer, and so on.

E-choupals are set up by ITC, with solar power backup and VSAT connectivity. The equipment cost for the e-choupal is borne by ITC, with the selected farmer providing the location. In addition to the adoption advantages that come from using a farmer with

high social status as the operator, the house should be spacious and sturdy enough to house all the required equipment, including the VSAT and solar panel on the roof. E-choupal farmers take an oath to serve the village, and they are trained by ITC. While there is an important element of social pressure and pride of work, the operators also receive commissions on soybean shipments booked through the e-choupals. This provides substantial revenue to the e-choupal operator.

The narrow – at least in initial terms – focus of the e-choupals and the substantial commitment of financial and human resources by ITC has made rapid expansion possible, as well as quick acceptance by farmers. The narrow range of applications has limited software requirements, and operators bear no risk in the ITC model. The longer-term goal is, however, to use e-choupals and warehouse hubs as sales points for soybean oil, tractor rentals, and eventually a range of ITC-produced consumer goods. This step is under way, with the expanded choupals being termed "choupal sagars."

The initial benefits of the ITC effort include a substantial reduction in transaction costs, from approximately 8 percent of a transaction, down to 2 percent. It is estimated that these gains are shared roughly equally between ITC and individual farmers. Some of this gain may be at the expense of traditional intermediaries, who operate in *mandis*, but much of it comes from genuine efficiency gains, including clearer quality guidelines and measurement, greater timeliness and reduced waits, quicker payments, and reduced uncertainties. To some extent, traditional intermediaries are co-opted in the new process, by being hired to perform tasks such as handling payments at ITC's receiving points.

Clearly the use of information technology is just a part of ITC's overhaul of its supply chain, but speedy delivery of complex information pertaining to market conditions

makes digital IT essential. It might be asked what acts as a check on ITC's market power in this process. Clearly, the traditional *mandi* system, with its accompanying government regulation and oversight, acts as continuing competition.[32] More significantly, ITC's concern with its reputation acts as a disciplining device. Finally, the long term goal of selling back to farmers as customers also gives ITC an incentive to cultivate relationships with individual farmers. In fact, field interviews indicated that farmers view ITC as treating with greater respect and dignity than is the case in traditional *mandi* interactions.

It is quite conceivable that the ITC model will not broaden significantly beyond the two-way flow of agricultural produce from farmers to ITC, and processed foods, consumer goods and inputs from ITC to farmers, not extending to e-governance, entertainment, health or education-related services. Instead, other firms may provide these services in similar locations to ITC e-choupals. What exactly happens will depend on the tradeoff between economies of scale (sharing fixed costs) and diseconomies of scope (difficulty in managing a wide array of services). It is also likely that e-governance services are less likely to be offered from kiosks belonging to a large corporation than in more neutral locations.

TARAhaat

TARAhaat has evolved in a somewhat unusual manner. It achieved well-publicized success with Internet kiosks in Bundelkhand, a relatively backward region of Uttar Pradesh. These kiosks were very much along the lines of those implemented by

[32] *Mandis* typically have monopolies under state-level Agricultural Produce Marketing Committee (APMC) Acts, designed to protect farmers from exploitation by traditional middlemen. In practice, these monopolies can hurt farmers by reducing competition. To implement its e-choupal model, ITC had to obtain permission from state governments to bypass the *mandi* system. While there are interest groups seeking to preserve the current system, it is possible that reform will take place to increase competition for farmers' outputs.

Drishtee and n-Logue, with a mix of e-governance services, market price information, and so on. Some of the most successful and celebrated kiosk operators were young women. TARAhaat's long-range plans include a comprehensive portal for rural information services and an extended vision of its 'TARAkendras' as community centers. However, in its expansion into Punjab, at the invitation of the administrator of Bathinda district, its model evolved quite differently.

While the Bundelkhand model had used VSAT connectivity (funded by external grants), this was not economical for a commercially sustainable expansion. While Punjab is a high-income state with relatively good infrastructure, the level of telephone connectivity turned out to be too poor for practical Internet use. Other issues arose with the substantially greater investment required by TARAkendra operators, since the model assumed that each kiosk would have three or four computers. Perhaps the greatest problem was in building an organization for implementation. While TARAhaat is a subsidiary of Development Alternatives, an established NGO, it is set up as a corporation, with social goals meant to be enforced through ownership by the nonprofit parent. The expansion of TARAhaat required building an organization from scratch, and this turned out to be a slow process, with several difficulties in hiring effective field managers and representatives. There were also problems with establishing effective partnerships with local and state government, and TARAhaat has mostly gone it alone, moving away from any e-governance ambitions, though these were prominent in its early strategy.

TARAhaat does have an educational content partner, called TARAgyan, also under Development Alternatives. In association with various partners, TARAgyan is

developing local language content and software for use in TARAkendras.[33] Basic IT education is an important part of TARAgyan's actual and potential offerings, but it is not the exclusive focus. In fact, there has been a substantial diversification into developing materials for English language instruction, rural marketing, personality development, and so on. This development was initially very slow, though it may be picking up steam. One significant example of computer-based education was the development of classes in the Tally accounting software program, which has proved popular with small business owners.

The constraints faced by TARAhaat pushed its Punjab effort in the direction of locating in *mandi* towns rather than villages, and focusing on offering offline education rather than a full array of IT- and Internet-based services. Thus, the few dozen TARAkendras in Punjab have emerged as quite distinct from the Internet kiosks of the other organizations discussed in this paper. It is conceivable that TARAhaat will end up occupying a very distinct niche in small town India, quite different from a direct impact on the rural, agricultural part of the country.

Interestingly, Punjab may have been the wrong place to try to create efficiency improvements in agriculture, since there are relatively strong market and related institutions for existing crops such as wheat, rice, cotton and sugar cane, as well as better infrastructure, originally created in the state through *mandi* fees. Efficiency gains in Punjab agriculture are more likely to come about through the intervention of the

[33] This was similar in intention to what n-Logue has done with educational content in Tamil Nadu, but our field interviews suggested that TARAgyan's efforts were much slower and costlier. In practice, the TARAgyan effort on developing educational materials may have involved overkill.

government to create a new infrastructure to support alternative, higher value-added crops, or through concerted efforts by large agribusiness firms such as ITC.

Akshaya

Akshaya is located in Malappuram district in Kerala, and has 630 kiosks. Kerala has the advantages of high literacy rates, strong local governments, and high population density. The initiative for the project came from the district level local government, and strong support came from the state government. The project was launched in late 2002. Village level governments were involved in the selection of kiosk operators, and significant funds were expended in training the local populations in computer use ("e-literacy").

The kiosks were divided into six groups each with a specialization, for which further training was provided to operators. One group would focus on data digitization for the state government, a second on hardware servicing activities, a third on insurance, financial services and tourism related activities, a fourth on multimedia, animation and design, a fifth on IT-enabled services such as health-mapping, Ayurvedic plant cultivation information and market linkage support, as well as health services, and the last group on product sales. In practice kiosk activities were not limited to these specialties, and adapted to local needs and circumstances.

Connectivity proved to be a problem, and was severely delayed, so that the range of services that could be provided was limited. Kiosks initially relied mainly on training services. The kiosks had multiple computers, and in this respect the scale of investment was comparable to the TARAhaat model. Operators are entrepreneurs, though there is an

initial subsidy from the government. Despite initial problems, as documented in Parthasarathy et al (2005), the Akshaya project is being expanded to the rest of the state, with 9,000 kiosks being planned. Presumably, this is an indicator that the project is providing some social benefits. In some respects, the heavy involvement of the state and local governments, along with local enterprise and community participation, may provide some lessons for other initiatives. More likely, however, Kerala may be somewhat of a special case, in terms of governance and societal conditions.

Other Initiatives

The half-dozen rural ICT initiatives described above all have the potential for scalability, or have already scaled up. Scalability depends on organizational capabilities and partnerships, the sustainability of the financial model, and achieving standardization to the extent possible. While there are over 100 ICT initiatives in India by some counts, these vary considerably in scope and success potential. Of the initiatives described in this chapter, all except Akshaya are based on our own fieldwork.

Of initiatives not described above, Parthasarathy et al (2005) also examine rural e-Seva in Andhra Pradesh, and the MS Swaminathan Research Foundation (MSSRF) information centers in Pondicherry. Of these, the former is similar to Akshaya in having government support and attempting some scalability. The latter relies on external funding, and is bound to remain very localized. Dossani et al (2005) examine these two cases, as well as Bellandur Gram Panchayat and Boodikote Jagruthi Resource Center (both in Karnataka), the Gyandoot Government-to-Citizen Network (Madhya Pradesh), the HP iCommunity in Kuppam (Andhra Pradesh) and the Warana Wired Village Project

(Maharashtra). All these projects have features that overlap with the initiatives surveyed here. NISG (2004) summarizes two dozen projects, including ones already mentioned, as well as various NGO and government initiatives which are quite localized. Some of the local projects can coalesce under a common umbrella which borrows some aspects of the business model inherent in private initiatives, but with government support. This appears to be what is happening in the development of Jagriti e-Sewa as a common platform and model for northern India (see www.jagriti.com).

Rather than repeat descriptions found elsewhere, the reader is referred to these other sources. In addition, references such as Hawkins (2002), McNamara (2003) and Tongia et al (2005) provide discussions of international experience. Many of the same issues arise in other countries. In some respects, compared to other developing countries, India has the potential advantages of a single market and democratic institutions. These points will be touched on in later chapters.

7. Education

Resources for rural education in India are severely limited, and often not used efficiently. In some respects, the latter problem is more serious (e.g., Drèze and Gazdar, 1996; PROBE, 1999; World Bank, 2003, Chapter 3; Howes and Murgai, 2005; Chaudhury et al, 2006), and is a consequence of an over-centralized system with poor incentives for delivery of education. Experiments such as that in Madhya Pradesh, where local rural communities were empowered (through its Education Guarantee Scheme) to create and control their schools, illustrate the possibilities of moving towards more decentralized delivery of education, with greater efficiency through local monitoring (Sharma and Gopalakrishnan, 2001; Manor, 2004). Other examples of successful reform include better monitoring (Duflo and Hanna, 2005) and the use of teachers' aides (Banerjee *et al*, 2005). In such cases, ICTs have not necessarily played a role, though they might in the future be used to enhance communication and experience-sharing across localities.

ICTs can enhance the power of experiments such as the Madhya Pradesh case by allowing even greater decentralization, through the use of rural ICT kiosk operators who can act as teachers for smaller educational modules. The role of ICT kiosks is complementary to that of conventional schooling, as well as acting as a substitute. Since there are rural deficits in all the key components of education – teachers, textbooks and interaction – digital material and ICT-based interactions can ameliorate some of these deficits. Even more importantly, the use of ICTs allows for interactive, visually appealing content that appears to greatly enhance student interest, learning and retention.

The economics of production of digital media and use of digital services, with very low marginal costs, allow significant scaling up. In countries like India, development of appropriate educational materials (which can involve high fixed costs) can also be achieved economically, if target markets are defined and created by overcoming the relatively high fixed costs of obtaining access to IT resources. This is what the kiosk model provides.[34] Thus, the amount of content that can be delivered cheaply through CDs and the Internet dwarfs what is possible through the traditional textbook model. In this context, even computer games have educational value, and several of the initiatives discussed in Chapter 6 have demonstrated that children are very quick to assimilate and use all kinds of ICT tools for some mix of entertainment and education.[35] Rural ICT kiosk operators can provide such educational services at low cost, as part of an overall array of services.

In the case of experiments with local control of education, parents are able to provide teachers with incentives for actually showing up and teaching. In the ICT case, the kiosk operator has an incentive to deliver such services since they increase the operator's income. Clearly the scale and cost of educational services in one-computer kiosks limits their effectiveness in providing anything like general education. There is thus no presumption or expectation that the use of ICTs in kiosks can substitute for basic education. Nevertheless, educational services through rural ICT kiosks can provide an

[34] Note that educational services are a major example of greater economies of scope with the kiosk model of rural ICT provision, versus the use of cellular phones, which provide advantages of mobility and cost, but lack the ability to offer a full range of IT-enabled services.

[35] The most famous example of children's' ability to adapt to and learn from new technology is the NIIT "hole-in-wall" experiment, in which a computer was made accessible to slum children through a hole in a wall, without any prior instruction or information. The children rapidly developed their own technology vocabulary and learned to make effective use of the computer for game playing, for example ((http://www.niitholeinthewall.com/home.htm).

important complement, and even a multiplier effect, for more traditional educational efforts.

One area where ICT-kiosk based rural education may have a significant role to play is in adult education, ranging from basic literacy to very specific skills for those who have received a conventional school education. The Indian educational system has no institutional mechanisms for adult education, and the quality and scope of vocational or skill-based education are extremely poor. ICT-based education cannot be sufficient for many vocational skills, where hands-on experience is essential, but it can provide training in simple "knowledge economy" tasks such as using spreadsheets for accounting, inventory management and other business processes. Since computer-based word-processing is largely replacing the use of typewriters, basic secretarial skills also require access to computing resources. In the case of basic literacy and numeracy for adults, ICT-based learning offers a flexible option with relative anonymity, and therefore without social stigma. In many ways, therefore, rural ICT-kiosks can fill significant gaps that exist in the educational infrastructure of developing countries to cover the needs of "nontraditional" students and skills.

Initiatives such as n-Logue have focused on developing local language content, including print, digital text and digital video, for various types of education, though most obvious being training in basic computer skills. In addition to specialized content, a major role played by such kiosks is in providing low-cost access to IT tools for students who do not have this access at home or in school. Even when computers are available in rural schools, their availability may be limited. Rural IT kiosks provide more flexibility in access. Students use these computers for typing reports and searching for information.

In an ideal world, government-funded schools would make these educational tools sufficiently available within their systems, but that does not happen due to constraints on funding and poor incentives for implementation within government bureaucracies.[36]

Even in cases such as Drishtee, where education services were not part of formal offerings, individual kiosk operators used the kiosks for offering basic IT education to children whose parents were interested and willing to pay even small fees. In such cases, the operators enhanced their incomes as well as improving their social standing in the community. In the case of some initial TARAhaat centers, women operators used the availability of the space where the computers were located to offer completely non-IT-related education (typically vocational, such as cooking and sewing classes) to village girls. This gender aspect was also important in cases where teenage girls had dropped out of school due to family pressures and social norms (e.g., the high school being "too far away" from home) but were able to receive some instruction from female kiosk operators. In such cases, rural IT kiosks have the potential to supplement more traditional correspondence courses, which have often been the educational avenue used by girls under social constraint with respect to mobility outside the home.

As noted in the last chapter, initiatives such as TARAhaat have focused on education delivery, primarily to secondary students and young adults who are interested in enhancing their skills. This is quite different from providing more basic, informal education to younger children. Certification by some recognized authority becomes important. In the case of TARAhaat, an initial arrangement was made to provide

[36] Of course, there are alternative solutions to this problem, which can again be seen as complementary to the use of rural IT kiosks for education delivery. For example, organizations such as School Net India (www.schoolnetindiacom) provide IT infrastructure to schools in exchange for after-hours use of the school premises for revenue-generating adult IT education.

certification from the office of the Deputy Commissioner. At the same time, the Punjab Technical University (PTU) was given permission by the state government to offer classes through such kiosks, and that alternative became a valuable source of revenue to the kiosk owners. Unfortunately, TARAhaat's management viewed the PTU classes as competition, and as having a possible negative impact on the nascent TARAhaat "brand." There was some upheaval in the relationships with the initial kiosk operators,[37] and an imposition of an exclusivity clause for TARAhaat franchisees. It is understandable that an educational content provider might seek to impose such restrictions to protect its reputation. However, in this particular case, the development of new content was slower than promised, and the kiosk operators had to struggle initially.

In any case, the TARAhaat experience illustrates the importance of identifying the manner in which educational services will fit into the existing system, which is relatively rigid and overly bureaucratic, but does provide some quality control mechanisms. It is a standard argument within the education bureaucracy in India that private education providers must be very tightly controlled and regulated, with respect to entry and scale; else they will cheat unsuspecting victims. This perspective is overly paternalistic, and appears to treat clients for educational services as incapable of making rational choices.

An alternative regulatory model would emphasize private certification, market-based reputation building, and government-supported information dissemination with respect to quality. With this kind of supportive institutional reform, more varied, flexible and small-scale educational programs could be offered in rural areas through ICT-based

[37] There were also issues involving contractual terms, the government's role, other promised services, and the nature of the rural market and demand.

methods. Enabling the private sector (possibly in partnership with NGOs) to do this at low cost can free up government resources for primary education and basic literacy, where the government role is essential. The kinds of programs referred to here are supplementary training programs outside basic education, such as learning business and conversational English, or particular software applications. In this respect, rural India has been ill-served by the Indian educational system, which favors the traditional urban, English-educated middle class.

To summarize, ICT-based rural education can fill many different gaps in the existing educational system in developing countries such as India.[38] The advantages of an ICT-based approach are its flexibility and lower cost, assuming that the fixed infrastructure cost can be spread over a range of services. However, complementary institutional reforms are essential,[39] and ICT-tools obviously cannot, by themselves, remove all of the education deficits faced by poor countries.

[38] For an overview of experiments in several developing countries, including India, as well as nations in Africa and Latin America, see Hawkins (2002).
[39] This statement is true for developing countries in general, see, e.g., Hawkins (2002).

8. Health

Health and nutrition stand with basic education as the two most glaring failures of the Indian state since independence. The problems with public health care delivery are similar to those with education: insufficient funding, severely compounded by ineffective institutions and incentives. For example, absenteeism in rural public health facilities is extremely high (Chaudhury *et al*, 2006). In a detailed survey in rural Rajasthan, Banerjee, Deaton and Duflo (2004a,b) found that health outcomes were poor, that public health facilities were poorly run and offered limited accessibility, that villagers often went to unqualified private practitioners, and that they did not have good information about these practitioners, or the potential for better quality health care and outcomes.

The role of ICTs in this situation can be multidimensional. One obvious possibility is the provision of basic medical information online or on CDs. The benefits of this will be limited by the ability of rural populations to absorb such information and act on it. It is important for basic medical information to be made available in local languages, but it is more likely that this would be a tool for rural medical practitioners, rather than something that can usefully be directly accessed by individual patients.

Another kind of information that can be valuable is online listings of information about availability of care; furthermore, tools for making appointments and providing health histories in advance of travel to a medical facility can also be made available online. While these kinds of ICT tools can substantially reduce uncertainty and transaction costs for individuals in rural areas, their adoption may require substantial investments and back-office reengineering by health care providers, whether public or private. Despite these set-up barriers, digital databases and information exchange can

play a role in improving health care delivery by reducing transaction costs. Some progress in this direction appears to have been made by the e-Health Care Foundation, based in New Delhi and operating in Madhuban district in Bihar and Sirsa district in Haryana. With support from Digital Partners, an NGO, electronic health cards were prepared and distributed to several thousand villagers, along with the development of an online medical database. However, it is not clear that these projects have gone beyond pilots, precisely because of the fixed set-up costs involved.

Rather than substituting for medical practitioners through access to digital databases, or improving patient databases, ICTs can improve remote access to medical consultation. For example, video conferencing software can allow for basic health consultations where bringing doctors and rural patients physically together is costly enough to be impossible. While subsequent consultations may well require the rural patient to incur the travel and time costs of going to the urban doctor,[40] this might never occur without the barrier to the preliminary consultation being overcome through the use of ICTs. In an intermediate model, rural health providers in Primary Health Centers (PHCs) can use ICTs to combine physical examination with expert consultation with an urban doctor. N-Logue, for example, has been proactive in developing experiments along these lines, partnering with Aravind Eye Hospitals (AEH). The AEH organization has pioneered low-cost health care and outreach to rural India through many channels, IT kiosks being just one of them.[41]

[40] See later in this chapter for a discussion of remote medical sensing trials being conducted by n-Logue.
[41] See Prahalad (2005) for a detailed case study on the Aravind Eye Care System. Basic visual examinations for conditions such as cataract, or for certain types of eye infections, are surprisingly quite feasible with just a web cam.

The collaboration with AEH illustrates some significant issues that arise in using ICTs for rural health. The key success factors are the goals and internal organization of AEH, which enable rural ICT-kiosks to serve as relatively easy extensions of that existing eye-care system. Organizational training creates the skills and culture necessary to interact successfully with large numbers of less-well-off patients. In contrast, the public health care system suffers from the typical problems of governmental organization in India: poor selection of personnel, poor training, and poor incentives for carrying out assigned jobs. While various state governments have announced schemes to use ICTs for improving aspects of rural health care delivery, they will have to overcome problems of internal organization if these efforts are to be successful. The advantage of including ICT kiosks run by private entrepreneurs in the health care supply chain, and not just relying on government PHCs is that the latter suffer from the incentive problems that have already been highlighted here.

One other alternative to the kiosk-based model was developed by Jiva, in Faridabad, near Delhi. Called TeleDoc, the initiative used Java-enabled mobile telephones or PDAs to provide rural health care workers with real-time ability to record and transmit diagnostic information. The model involved Jiva's panel of doctors analyzing this data, and then prescribing medication and treatment. Medicines were compounded at a regional office, picked up by TeleDoc field workers, and delivered to rural patients at their homes, at relatively low cost. While the project garnered favorable publicity and awards, it is not clear how well it has been sustained.

Current information suggests that the parent organization of this initiative (which was seed funded by a Soros Foundation grant) is now focusing exclusively on more

upscale Ayurvedic treatment, rather than expanding the rural health initiative. It is not clear what derailed the TeleDoc effort, but this illustrates the difficulty of building a sustainable, scalable ICT effort.[42] One conjecture is that the focus on health did not make efficient use of the IT hardware and software, or the human capital deployed in the field. In contrast, kiosk-based efforts can spread the infrastructure over more uses.[43] Another conjecture is that the existing institutional infrastructure was not used effectively, if at all. Another PDA-based initiative, the India Health Care project in Andhra Pradesh (funded by the infoDev project of the World Bank) has used customized PDAs provided to the staff of PHCs for medical database construction and patient tracking.

Based on the Jiva experience, the question arises whether private initiatives alone can be successful in leveraging ICTs to improve rural health care. Examples such as AEH may be exceptions, rather than general models. In particular, many of the potential benefits from using ICTs (e.g., epidemic disease control, improving basic hygiene, and improving provider capabilities) have strong public good components (McNamara, 2003). However, if government funding is involved, it is not clear whether a cost-benefit analysis would favor investment in ICTs over alternative methods.

Ultimately, it may be the government that has to piggyback on private initiatives and infrastructure, as in the case of public health providers using IT kiosks for aiding diagnosis or remote examinations. In this context, n-Logue is experimenting with expanding the range of its capabilities in ICT-aided health care. A pilot project plans to field test a low cost medical kit developed by a partner company (Neurosynaptic

[42] The Jiva TeleDoc effort was launched in 2001, and received a United Nations prize in December, 2003. Subsequently, however, almost all information relating to TeleDoc has been removed from the Jiva website.

[43] On the other hand, mobile devices are not hostages to the unreliable power grid. Battery-operated compact desktop devices, with wireless connectivity may represent a flexible intermediate solution.

Communications), that can work in conjunction with a rural IT kiosk's equipment, and transmit data remotely to a doctor in an urban area. The data that can be captured through this method are ECG, blood pressure, temperature, and heart rate. This remote sensing can significantly complement a visual examination via web cam. These methods do not economize on examination time, or the human capital of the doctor, but reduce travel time and uncertainty for rural patients. As discussed earlier, these travel costs are typically high enough to preclude any consultation taking place at all through traditional means.

ICTs may also play a very different role in improving rural health care in India, through the creation of databases and geographic mappings of various health outcomes. This approach can improve the targeting of rural health care delivery. While it does not solve the fundamental problems of incentives in field delivery of services, access to centralized health information databases may enable field providers to improve the quality and targeting of care. In general, one of the lessons of the studies by Banerjee *et al* (2004a,b) is the overall lack, and poor quality of information relevant for health care, both for patients and providers – surprisingly, this is true in urban and high-income areas as well. Thus, there is a general case for improving the availability and quality of health-related information in India through the use of ICTs.[44] Rural ICT kiosks are just one part of what is needed, but they can offer low cost access to health information for populations that are significantly underserved, as part of their overall offerings.

[44] See, e.g., the web site http://southasia.oneworld.net/article/archive/8491 for further cases of various initiatives that seek to use ICTs in various ways for improving health care in South Asia. The range of efforts described there is quite broad.

9. Market Efficiency

Rural markets in India are often thin and uncompetitive. Thinness of the market increases search costs, and often leads to poor matches, or to no match at all, between potential buyers and sellers. Uncompetitive markets also have efficiency losses, but their greater direct impact may be on distribution. Field interviews suggested that buyers of outputs, sellers of inputs, and intermediaries still exert considerable market power over Indian farmers. For physical goods and services, including farm inputs and outputs, ICTs have the potential to reduce search costs and improve price discovery (Eggleston, Jensen and Zeckhauser, 2002; Jensen, 2005). This can lead to new or better (in the sense of creating more surplus through exchange) matches between buyers and sellers. Jensen (2005) presents striking results from a controlled experiment where fishermen in Kerala were given mobile phones, and the observed price dispersion in the markets into which they sold their catches declined precipitously, implying an increase in market efficiency. In the case of ITC's use of e-choupals as procurement hubs, price discovery also plays a role in reducing the uncertainty and possibility of low prices that farmers face in selling their crops through traditional intermediaries.

For some kinds of physical services, where the information exchange or information transfer component of the service (i.e., information that is inherent to judging the quality of the service, or is part of the service itself, rather than simply price information) is significant, ICTs can change the delivery method in ways that improve access to or quality of service, as well as reducing transaction costs (including search costs). The discussion of IT-supported rural health and education services in the previous two chapters was based on this potential.

By reducing search and other transaction costs, ICTs can integrate geographically fragmented markets, thereby reducing their "thinness." This can increase the quality of buyer-seller matches that take place. In addition, it is possible that this integration can increase the competitiveness of some markets, by allowing the side of the market with less bargaining power a greater degree of choice. All these phenomena have been observed in developed country markets, to varying extents. It is an empirical question as to how strong these effects would be in markets in rural India. Since many of the initiatives surveyed offer some market-related services, at least the potential for improvements in market efficiency is worth discussing in the Indian context.

Consumer (retail) markets for physical goods, which are most salient in developed countries (e.g., Amazon.com), are actually least likely to be changed by ICTs in rural India. This is because the supporting infrastructure for payments and fulfillment is almost non-existent, and expensive to create. Even in urban India, this kind of consumer e-commerce will be slow to develop. Even price search for consumer items available through physical locations is irrelevant, or of extremely limited value, because this kind of information is mostly not available online. However, it is possible to use ICTs, specifically the Internet, to market rural handicrafts to widely dispersed consumers, in developed countries, as well as urban areas of developing countries. The role of kiosk operators in such cases becomes that of intermediaries in the marketing process. For example, in Drishteehaat, kiosk operators are trained to identify local handicrafts that might be marketed on the Internet, and to create the relevant content for advertising these products.

The role of ICTs does emerge also, more indirectly, in ITC's development of its rural supermarkets, or choupal sagars. These shops are situated at ITC procurement hubs, which serve farmers who are channeled through e-choupals. Thus, there is a substantial economy for farmers, in shopping there when delivering their output, as well as for ITC, in using an integrated physical and institutional infrastructure. In addition to consumer goods, a full line of farm inputs, including capital goods, is offered. Traditional middlemen, partially displaced by the e-choupals, are used as employees and managers in the choupal sagars. ITC has tested one such market in Madhya Pradesh, and plans to open several dozen more in 2006 and beyond. The efficiency gains in this case come from supply chain efficiencies, reductions in transaction costs and more competitive pricing: in particular, traditional retailers would be forced to give better prices to farmers. There is thus some redistribution from middlemen, who lose market power, to ITC and to rural consumers. ICTs are involved only indirectly, since this effort piggybacks on the e-choupal infrastructure, which does use ICTs directly.[45]

The case of farm inputs such as fertilizer and pesticides, available in the choupal sagars, illustrates another aspect of market power and efficiency in rural India. In some cases, these inputs are provided by intermediaries that also supply credit, and may even contract for the output. These are examples of interlinking, which has been much studied

[45] However, one can predict that IT will become more prominent in managing the rural retail supply chain that is being created in this manner. This is precisely what happened in US retailing, where IT allowed large chains such as Wal-mart to grow quickly without losing efficiency in managing distribution within their networks. The end result was a shift in bargaining power to retailers, and ultimately consumers ITC has the potential to transform Indian retailing, which is highly fragmented and inefficient. The possible parallel with Wal-mart is intriguing, since Wal-mart began its operations in smaller towns with relatively low income levels.

by economists.[46] The main implication for the current discussion is that switching costs are raised for farmers, and an integrated alternative, as can be offered by a large-scale player such as ITC, may be required if the nature of the market is to be changed. It is also worth noting that, in some cases, laws originally designed to protect farmers can make switching impossible or too costly – for example these laws can prevent manufacturers of inputs from directly selling to farmers and undercutting intermediaries.

In some cases, search and transaction costs for inputs may be lowered by using ICTs. Unlike the case of standardized manufactured inputs such as fertilizers and pesticides, bullocks and tractors, or their services, are lumpy, scarce, time-dependent inputs, and matching buyers and sellers becomes more important.[47] Word-of-mouth is geographically extremely limited as a mechanism for facilitating matching. Newspapers as a vehicle for classified advertisements can be of limited value in rural environments, where the costs of timely distribution may be relatively high. However, online classified advertisements are potentially a cost-effective method for bringing together buyers and sellers for specialized or differentiated input services. Online advertising may also be an alternative to traditional market fairs, by offering greater timeliness and flexibility for buying and selling livestock and machines. Experiments with these kinds of markets are in their infancy in the context of rural IT kiosks. One barrier to adoption is the existence

[46] See, in particular, the perceptive comments in Bardhan (1989), where the role of transaction costs in interlinking is emphasized. Ray and Sengupta (1989) provide a formal analysis of different types of interlinking, and further references. Bardhan and Rudra (1978) performed the seminal empirical work on interlinking. For recent empirical work on interlinking in Punjab, where TARAhaat is operating in the cotton belt of Bathinda, see Gill (2003).

[47] Land markets are the most imperfect input markets in rural India, and it is unlikely that ICTs can significantly improve matching of landlords and tenants, or buyers and sellers. However, ICTs can play an important role in reducing transaction costs, by making it easier and less costly to establish property rights. This is discussed in more detail in Chapter 13.

of network externalities, and the need for sufficient scale of the network for buyers and sellers to find online search a viable and valuable alternative to traditional markets.

The importance of matching also arises in other contexts. Marriage arrangements in India are much more like a conventional market, with material concerns entering explicitly throughout the process. In this case, digital information exchange offers important reductions in search costs for initial screening. In fact, several rural IT kiosk initiatives have incorporated marriage services into their mix of offerings. Of course, there are social constraints that can limit the amount of information that is posted online: in particular, prospective brides are very unlikely to have their photographs posted. Nevertheless, since the benefits from successful matches are high, and the traditional process is costly, IT-based services have a role to play. Rural IT kiosks have also been successful in offering services for preparation of horoscopes, which are an important input into marriage decisions.[48]

In addition to intermediary services, rural kiosk operators increase the efficiency of markets for several different kinds of services by shifting them to villages, and hence closer to rural users. Any kind of information service, including photography, word processing, and written communication can be offered through rural IT kiosks. Currently, these kiosks only have printers, but the falling costs of "all-in-one" office machines, combining printing, faxing and photocopying, further expands the scope of services that can economically be offered in rural areas.

[48] The kiosk again acts as an intermediary, inputting information and sending the order digitally to a centralized preparer. The horoscopes themselves, which are extremely detailed, are elaborately printed and sent by conventional mail to the client. Horoscopes are among the most expensive products or services offered by rural IT kiosks (costing about Rs. 150), though the kiosk operator's own share of this fee is still quite small.

A final set of rural markets where ICTs may be important is markets for financial services. While nationalization of banks in India, and the spread of agricultural credit cooperatives helped to improve the access to credit and banking services in rural India, the efficiency of these institutions remains low, and their reach is still limited. Rural bank branches are not necessarily accessible or available to the majority of the population, though postal savings accounts provide an alternative for some financial savings. In this context, the use of IT can reduce transaction costs, and allow efficient small-scale operations. For example, ICICI bank has been partnering with existing microfinance institutions, but also with various rural IT initiatives, to offer a range of banking and insurance services to rural customers.[49] In addition to traditional insurance services, the development of an effective crop insurance mechanism would be high on a list of priorities for being offered to farmers – again the advantages of using IT come in reducing transaction costs and creating economic feasibility. There are significant regulatory and monitoring issues involved in offering financial services, and field interviews in n-Logue kiosks in Tamil Nadu suggested that it requires a degree of sophistication to successfully meld them into the offerings of a typical rural ICT kiosk. However, this represents a critical market from the perspective of rural development, as we discuss further in Chapter 12.

[49] ICICI Bank has partnered with Drishtee and n-Logue, as well as other initiatives, to offer banking, credit and insurance services. Descriptions of various ICICI efforts may be found in Duflo (2005) and in ICICI (2004). Partnerships can involve using microfinance institutions or kiosk operators as collection agents, securitization of loans, and training of partners' personnel. The technologies for access and monitoring include smart cards and portable devices, as well as desktop computers in kiosks.

10. Agriculture

The preliminary evidence from various rural ICT initiatives suggests that ICTs can create an important delivery medium and mechanism for information through the entire range of operations of the developing country farmer. Information can be provided for better input use, cropping decisions, management of pests and diseases, animal husbandry, and marketing. Examples of improving operating efficiency include the use of a web cam and email in an n-Logue kiosk to identify the disease afflicting an okra crop and recommend a remedy, as well as less dramatic cases of information sharing or answering individual farmers' queries. The involvement of agribusiness firms such as EID-Parry, and, on a much larger scale, ITC, illustrates the benefits that these firms derive from improving their supply chains. These firms derive benefits from improving quality and reliability of yield for their numerous suppliers.

In addition to the cost and strategic benefits reaped by the agribusiness firms themselves, which appear to justify their investments in infrastructure, there seem to be substantial spillover benefits for farmers, who now have access to superior market information irrespective of to whom they choose to sell their output. Farmers can now use ICTs to judge buying offers from traditional intermediaries more effectively, and even eliminate unnecessary intermediation. We have discussed some aspects of these market efficiency improvements in the previous chapter. As discussed in Chapters 7 and 8, once an ICT infrastructure is in place, though driven by the desire of agribusiness firms for supply chain efficiencies, it can also be used as well for education, health and other rural development activities. In turn, there may be additional positive spillovers from these activities to agriculture (e.g., farmers are more productive through being

healthier and better educated), but this channel would be hard to establish, and not necessary for the main argument of this chapter: ITC works with farmers who are already beyond subsistence levels, and their e-choupal operators are typically from relatively well-off, high-status households.

In the context of ongoing economic reforms in India, where farmers are likely to become more exposed to the vagaries of global markets, empowering them with information access may be extremely beneficial, if it can improve the quality of decision-making in more complex environments. Knowledge of more distant markets and demands for more varied products would be particularly important in this context. Knowledge of new practices, especially emergency practices such as accelerated ripening techniques, rapid evacuation in case of untimely rains, and packing methods can be critical for mitigating risks with high value commercial crops serving distant markets. Beyond giving farmers more and better information, their choice sets can also be expanded: the same ICT infrastructure that channels information can be used to bring down the cost of delivery of credit and crop insurance to farmers, by lowering the costs of identifying potential users, and especially the costs of monitoring. These improvements in access to credit and insurance are likely to be particularly beneficial to farmers. However, for these kinds of benefits to be realized, complementary institutional reform is required.

Various kinds of institutional and legal restrictions are in place in Indian agriculture, which constrain the freedom of farmers to market their produce and even to buy inputs. These constraints were typically introduced to provide protections to farmers, but have often been designed and implemented poorly. Protection for small farmers and

landless laborers can be better provided through financial support policies and maintenance of competition, rather than restraints on trade. There are also strict regulations of financial services: these are less obvious candidates for reform, since protection of borrowers is important. However, relaxation of some restrictions, along with greater direct protection for those in distress (e.g., liberal personal bankruptcy rules with protection of certain assets from creditors) could improve the functioning of financial services for agriculture.

Another issue that needs to be discussed in the context of ICTs for agriculture is the role of computers versus more traditional, older communication methods. Radio and television have long been used to broadcast agricultural information for farmers (e.g., the venerable *Krishi Darshan* programs), and agricultural extension services have maintained telephone help lines for farmers, especially in richer states such as Punjab (see, e.g., the *Krishi Vigyan Kendra* site of the Punjab Agricultural University at www. pau.edu). Farmers who can afford to also use cellular phones for obtaining price information in a timely manner. In the Kerala fisheries case, mobile phones were sufficient in providing the market price information that the fishermen needed to decide where to bring in their catch. Thus, any advantages of more elaborate digital technology for agriculture must be clearly articulated. In fact, the case for using the Internet here is based on its fundamental value proposition (versus other communication technologies), which is providing access to large quantities of information on demand.

In fact, in the absence of widespread rural access, there have been limited attempts to make agriculture-relevant content available in local languages and contexts. The exceptions, as noted earlier, have been agribusiness firms such as ITC and EID-

Parry, and, to some extent, as we describe below, Agriwatch.com, an information intermediary. Governments and universities (which are essentially all government funded or controlled in India) have shown limited interest and ability to develop such content. Thus, the website of the Punjab Agricultural University (PAU) is solely in English, and offers little information through its extension portion. Farmers are expected to rely on traditional communication methods, either attending camps and fairs, or telephoning with queries. These methods of information dissemination, successful in the 1960s for the "green revolution,"[50] are not adequate now, particularly in the light of current resource constraints on state governments.

It is possible that initiatives such as Jagriti e-Sewa can provide incentives for development of appropriate online content by more traditional providers of agricultural extension services. Certainly, the rhetoric for Jagriti Punjab emphasizes the importance of supporting agriculture through Jagriti kiosks, which are essentially viewed as agricultural extension hubs as well as market centers (somewhere between e-choupals and choupal sagars), in addition to providing a range of non-agriculture-related information services (Sandha, 2004). There is evidence that Jagriti is collaborating with the PAU, but so far this appears to be in co-sponsoring more traditional fairs and informational camps for farmers, rather than providing online content in the local language.

Online agriculture-related information may also be generated by the private sector. Agriwatch.com is a globally oriented agribusiness portal, developed by Indian

[50] Kohli and Singh (2006) argue that information dissemination, along with infrastructure development and appropriate incentives, played a crucial role in enabling the green revolution in India's Punjab.

Agribusiness Systems (IASL), a privately held company started in 2000.[51] The portal provides subscription-based services for specialized content, including timely information and analysis. Thus, the portal is more than an aggregator of content. It also provides capabilities for online commodities trading and some e-commerce in agricultural inputs. This model has proved successful in that it has generated a profitable business, through providing this information and related services.

Clearly, the English language portal and pricing are appropriate for agribusinesses or larger farmers, rather than the average Indian agriculturalist. However, Agriwatch/IASL also brings out successful weekly newspapers in Hindi and Marathi, which can reach a wider audience.[52] Again, the spread of rural Internet access will allow such ventures to more economically reach farmers who are further down the income distribution. IASL has partnered with various rural IT initiatives (e.g. Drishtee and n-Logue), NGOs, kiosk owners,[53] and private sector organizations to develop Agriwatch into a more broad based knowledge dissemination tool for farmers and other agricultural supply chain participants, though it is unclear how far these efforts have progressed. IASL is also attempting to go beyond Hindi and Marathi to delivering content in other vernacular languages as well.

The Agriwatch model provides an alternative as well as a complement to agricultural information services provided by agribusiness companies and by

[51] A useful summary of Agriwatch may be found in A. Singh (2005).
[52] Apparently, some Agriwatch content was available in Hindi, but this no longer appears to be the case, except perhaps for subscribers.
[53] A specific example of these kiosks is the "Network of Agri-clinics and Agri-business Centres by Agricultural Graduates Scheme" of the Department of Agriculture and Cooperatives of the Ministry of Agriculture, Government of India. There are several hundred of these kiosks, and Sunil Khairnar, founder of IASL, argues that all kiosks must have agriculture-related services at their core to ensure long-run viability (see his weblog at http://www.ecademy.com/module.php?mod=blog&uid=38602).

government-affiliated organizations. One possibility is that intermediaries like IASL can partner more closely with kiosk initiatives such as n-Logue, Drishtee and Jagriti e-Sewa, providing content and certain kinds of services which enhance the revenue and financial sustainability of kiosk operators. This is somewhat similar to what has been attempted on a very limited basis by n-Logue and EID-Parry in Tamil Nadu. In the case of ITC, the firm has been able to provide its own integrated package of online and offline services, as well as required infrastructure. For other locations and situations, partnership models for delivery of ICT-enabled agricultural information and services may be effective alternatives.

11. Employment

ICT kiosks can create rural employment, particularly for young people who have some educational qualifications, but not enough to compete effectively for jobs in cities. Alternatively, such individuals may be constrained from moving by high search costs, or, in the case of women, social constraints. ICT kiosks have been demonstrated to provide attractive job opportunities for such people, particularly young women. In addition to direct income and employment generation (which might be relatively small), field interviews suggest that the confidence of these young people is boosted tremendously, and they provide attractive role models for others in rural areas who might consider non-traditional, non-farm rural employment possibilities. Based on these limited interviews, one can speculate that the empowerment effects of the spread of ICTs in rural India are likely to be substantial, though the caveat must be added that poorly functioning kiosks could have a negative effect.

The direct employment impacts of ICT kiosks cannot be very large. Even if the vision of 500,000 kiosks nationwide, projected by firms such as n-Logue, is realized, this translates into at most just that many jobs, based on the assumption of a single full-time operator.[54] This is a very small percentage of India's labor force, which exceeds 400 million people. If some kiosks are run by farmers, as is the case with ITC e-choupals, the direct employment increase will be even smaller. One should also factor in the number of people involved in support, training and management in the headquarters organizations and field offices (e.g., local service providers), but if the business model is to be

[54] In many cases, the kiosk owner or operator hires help, but this is usually someone who fills in part-time since the owner has other part-time employment or business activities. Sometimes, several family members will share in the running of a kiosk. Larger information centers, with several computers, may effectively create more than one full-time job, but the 500,000 number is based on single-computer kiosks.

sustainable, these numbers would have to be relatively small. For example, if five support staff are required for 50 kiosks, this would add just 10% to the half-million employment figure. However, it must be recognized that no single industry or business can generate a significant fraction of India's job growth requirements, and therefore any improvements can help. The real economic test of the value of jobs created would be the costs required, and the economic value created. Those questions are taken up in Chapter 14, as part of an evaluation of business models. In the next chapter, we consider the indirect effects of the rural ICT initiatives, including employment effects, which can include job growth through reducing the costs of starting and running other small businesses. Here we offer some qualitative discussion of the nature of the employment impacts of the rural ICT initiatives themselves.

In the case of ITC e-choupals, the direct employment impacts are negligible, since the e-choupal is operated by a well-off farmer. In all the other initiatives studied, however, there was a strong likelihood that the operator was someone with a reasonable level of education, but without attractive local employment opportunities. In the case of women kiosk operators, there might be no alternative occupation. Women would often have good educational qualifications, designed to improve their status and marriageability, rather than to enhance their earning power. In such cases, occupations such as running an ICT kiosk offered an acceptable occupation that could use their human capital effectively.

In the case of many male kiosk operators, the social constraints were obviously less stringent, but even so, our field interviews suggested that young men were often required by family obligations to stay in their rural homes or nearby small towns, rather

than seek employment in more distant cities. In such cases, also, kiosk operation represented an attractive employment possibility. Often, these operators (women as well as men) were quite entrepreneurial, and expanded their businesses to non-IT-enabled activities.

In addition to reducing wastage of human capital, the rural ICT kiosks we observed also played a role in substantially increasing human capital through training and learning by doing. While the report by Dossani *et al* (2005) is quite critical of the level and magnitude of these impacts so far, we saw several cases where the kiosk operators had mastered skills that they would otherwise never have even attempted. In the cases of Drishtee and TARAhaat, and the initiatives surveyed by Dossani *et al*, operator selection and training was a major hurdle, but through repeat visits and interviews over time, we also observed substantial learning by the headquarters organizations and their field staff. The significance of the nature of the jobs created, apart from sheer numbers, therefore, should not be underestimated. Successfully running an ICT kiosk in an entrepreneurial franchise situation requires a mix of technical and business skills that can be transferred to other jobs as well. This may raise the social value of the employment created here vis-à-vis more traditional kinds of jobs.

An additional facet of indirect employment creation may come from the educational impacts of using rural ICT kiosks for delivering specific and targeted educational services. Even those who have been through enough of the Indian educational system to earn a high school diploma have significant skill gaps that hinder their employability. These kinds of constraints show up in shortages (manifested in high turnover) in areas such as IT-enabled services, and in rising wages for a range of jobs in

that sector. Even jobs in other service sectors, such as travel and tourism, can require skills that are not imparted by the traditional educational system. While rural ICT kiosks cannot become full-service educational facilities, and even meeting a small subset of the unfulfilled demand in rural India will tax their capabilities, the examples of Drishtee and TARAhaat in successfully offering instruction in basic computing skills and in conversational English indicate the possibilities. The special role of ICTs and the kiosks here may be in providing access to instructional materials and programs that could otherwise not be provided economically to students in rural areas.

A final aspect of employment impacts through rural ICT kiosks may come about through improved job matching. The transaction costs for obtaining jobs in India are extremely high, and the Internet and IT in general provide efficiencies in advertising jobs by employers, searching by job seekers, and initial screening of applications. The costs for job seekers in villages and small towns have been particularly high, and the ability to overcome distance barriers through convenient Internet access has been a significant benefit, according to some of the organizations implementing rural ICT kiosks in India. To the extent that these improvements in job matching reduce the number of unfilled vacancies, their impact on employment is still relatively small, and it represents a static efficiency benefit, rather than a factor that influences long-run employment growth. Nevertheless, it is worth noting as a positive by-product of rural ICT access.

12. Rural Development

We have already discussed several of the components of rural development, and the potential role that existing ICT initiatives might play in supporting such development. Clearly ICTs cannot alone solve enormous and long-standing problems of poverty and deficits in physical and social infrastructure that contribute to the lack of economic well-being. At the same time, the low cost of hardware, and the growing availability of relevant applications make the use of ICTs economically realistic even for developing countries. In fact, in some cases, ICT-based solutions can allow leapfrogging by poor communities, and provide greater marginal value than where relatively strong development has already taken place. For example, TARAhaat seemed to have greater and easier success in Bundelkhand in southern Uttar Pradesh, where the lack of infrastructure was acute, than in Bathinda in Punjab, where ICTs competed with some of the best rural infrastructure in rural India, in terms of roads, telephone communications (particularly wireless phones in recent years) and market institutions.[55]

Health, education, agriculture and market functioning have been discussed in previous chapters as areas where rural ICT initiatives have had some impact, and have the potential to contribute more to development. Interestingly, the experiments so far have helped to uncover supply constraints as well as the nature of demand for information services in rural areas. The telecommunication infrastructure on the supply side, and the and access to land records on the demand side stand out as two examples of constraints that can be relaxed with a combination of institutional reform and

[55] A caveat here is that the Bundelkhand effort was better funded, allowing VSAT connectivity, whereas the Bathinda initiative tried to use dial-up connectivity, without success – as noted in an earlier chapter, the fixed-line rural telephone infrastructure proved to much worse than expected.

technological innovation, once the problems are identifies. The nature of governance with respect to providing public goods such as maintenance of land records is discussed in the next chapter. Clearly, ICTs cannot directly solve problems created by defective policies or government failure, including underinvestment in physical infrastructure such as roads, power, and water, but they can help to change the underlying institutional causes of these problems.

The direct developmental benefits of rural ICTs can be summarized as falling into two classes. First, ICTs can help to reduce transaction costs, and thereby enable more and better quality economic transactions to take place. This includes not only consumption, but also investment-related transactions. In doing so, there can be gains in static efficiency as well as growth. Of course, it is difficult to quantify such impacts, in the absence of controlled experiments. One has to rely on specific examples involving localized improvements in health, education, crop selling price and so on, to document the benefits of access to timelier, higher quality and low cost information than has been the norm in rural India.

One area where ICTs may be particularly important in the future is with respect to rural credit markets. While postal savings accounts and rural branches of nationalized banks have been able to soak up rural savings, there has not been an effective mechanism for lending for productive investment to the majority of the rural population. Rural credit cooperatives and cooperative banks have achieved some success here, but they have been subject to inefficiencies and moral hazard.[56] Nationalized banks are better regulated, but they suffer from high operating costs and poor internal organizational incentives. As a

[56] See, for example, Bhoir (2004) for a news report on these problems of rural cooperative banks.

result, they have been limited in their effective lending to small farmers, or those without land. The experience of kiosk operators illustrated these problems. Many complained of difficulties and delays in obtaining loans from nationalized banks, even when these loans were part of government poverty-alleviation schemes, and had implicit or explicit backing from the district-level authorities, or were fully collateralized. These problems also exist in urban areas, but are more acute in rural India. Nationalized banks are simply not organized in a manner that supports efficient small business lending.

Of course, microfinance institutions have proliferated to fill the gap for small lenders. Their main advantages are in their lower transaction costs and more efficient incentive provision. Nevertheless, in many cases, it is not clear if these advantages are sufficient to achieve financial sustainability – some continuing subsidy may be involved in many current microfinance operations. The constraints on microfinance are reflected in the relatively small amount of lending that takes place in this manner. Some of the problem has to do with organizational design, which may be addressed in various ways.[57] However, another issue is simply that transaction and operating costs are still relatively high within microfinance institutions, especially when scaling up is attempted. For example, Nancy Barry, President Women's World Banking (WWB), USA, states that "You need to recognize the transaction costs are high in microfinance… [and] focus on cutting transaction costs in microfinance through new technology and channels" (Barry, 2004). It is in addressing these issues that ICTs can play an important role, and perhaps relax a major constraint to rural development. Implementing specialized IT-based rural

[57] See for example, Godquin (2004) and Nair (2005), for different aspects of organizational design, as well as further references. The literature on microfinance is, of course, very large, and cannot be fully addressed here.

financial services requires efficient, profit-oriented banks such as ICICI Bank, and filed partners such as microfinance institutions and rural ICT initiatives.

The second possible developmental benefit of rural ICTs pertains to the reduction of operating costs for productive activities. We have highlighted the possible gains in agriculture in Chapter 10. However, the nature of ICTs as a "general purpose technology" (GPT) makes them their potential impacts much broader.[58] Modern models of growth emphasize the importance of innovation (for adding to the stock of knowledge, which in turn raises productivity of physical inputs), rather than ICTs *per se*. The concept of GPTs, introduced by Bresnahan and Trajtenberg (1995), provides a somewhat special role for ICTs, as an example of a GPT. GPTs have three key characteristics: pervasiveness, technological dynamism and innovational complementarities. Helpman and Trajtenberg (1998a, 1998b) model GPT-led growth, in which sustained growth comes from the periodic, exogenous introduction of new GPTs. In these models, any GPT has similar abstract effects.

One can say a little more about how well ICTs fit the characteristics of GPTs. Pervasiveness seems to be a natural property of ICTs. In the developing country context, doubts about achieving pervasiveness are centered on issues of cost and access. Technological dynamism refers to the potential for sustained innovation that come with new GPTs, and is illustrated by the dramatic fall in computing costs over the last two decades. The complementarities of GPTs are vertical complementarities, because GPTs spur innovation and lower manufacturing costs in downstream sectors, with positive feedback effects to the GPT itself. Thus vertical complementarities are related to the

[58] The following discussion draws on Singh (2003). A further idea developed in that paper is that ICTs are an especially powerful type of GPT, because they provide an extra boost to innovation.

older idea of linkages, with the downstream impact being a forward linkage, and the feedback being a backward linkage.[59] There are also horizontal complementarities, since the downstream sectors may face a coordination problem in expanding sufficiently to encourage the improvement of the GPT (thus creating positive feedback).

The linkage idea is an important one for understanding the broader impact of ICTs.[60] To the extent that rural ICTs as made available in kiosks or similar centers can provide access to a range of digital services for other small businesses, they may reduce operating costs and make other businesses feasible and sustainable. We have discussed various IT-enabled services in the context of market efficiency, including photography, word processing, printing and publishing, accounting, communications, search for market information, and so on. Not all such digital services can be outsourced to a kiosk, but a wide variety of them can, and one can envisage some kiosks as developing into "business centers." Of course, this has already happened in some cases with rural and urban Public Call Offices (PCOs). The indirect employment effects in this case are likely to be greater than the direct employment impacts of introducing rural ICTs through the franchised kiosk model.

Aside from direct economic impacts, one possible effect of introducing rural ICTs can be in expectations. In earlier chapters we noted feelings of empowerment expressed by kiosk operators in field interviews. This was also true of the well-off farmers who operate ITC e-choupals. They were respected in their villages, but not when they went to

[59] See Basu (1997) and Ray (1998) for references and further discussion. Singh (2006) provides an analysis of linkages in the context of India, with a focus on the services sector.

[60] The concept of agricultural linkages is stressed in the presentation of the Jagriti e-Sewa model. See http://www.jagriti.com/faq.html. Kumar (2000) provides some evidence of forward linkages in the urban informal IT sector itself, where the provision of IT maintenance, data entry and customization services for domestic users are developing. He estimates the jobs created in this way at over half a million.

the *mandi* to sell their crops. The ITC procurement process, and the methods of selection and training, all increased feelings of self-worth and tangibly improved the treatment of the farmers outside the village. In economic models, expectations can play an important role in determining the equilibrium level of economic activity (e.g., Ciccone and Matsuyama, 1996): optimism can lead to a higher equilibrium. This idea is applied to the case of rural IT kiosks in Singh (2004a). The evidence for the importance of expectations in India is discussed next.

In the context of India's software exports, Kapur (2002) makes a case for the importance of expectations on development. Theoretically, expectations, can have a positive or negative role in determining the nature of equilibrium where complementarities matter. The argument of Kapur (2002), that India's success in software exports has increased the confidence of Indians, can be couched in terms of a positive shift in expectations, helping to overcome a potential coordination failure. More broadly, Kapur gives the effect of IT's success on attitudes in India pride of place among the sector's impacts: "the success of IT, more than any other change, has helped legitimize capitalism in a country whose intellectuals have long harbored suspicion of markets and the private sector." (p. 103). He goes on to discuss changes in attitudes to entrepreneurship, business culture, and reputational effects, which can include both horizontal and vertical impacts on expectations of entrepreneurs and customers in other knowledge-based sectors. Thus, in Kapur's view, these 'indirect' effects may be quite pervasive, more so than the technology itself. It is perhaps not too much of a stretch to extend this argument to rural India. In fact, our fieldwork in various parts of India suggested that village residents (especially younger, more educated ones) were quite

aware of the success of India's IT industry. They understood at a general level that computer (and also English language) skills increased the possibility of obtaining "good" jobs, and they were eager to have the means to participate in these new opportunities.

In addition to tangible changes in status and treatment, feelings of empowerment also reflect the powerful symbolism of using modern technology. There is also a possible demonstration effect for users of ICT services. In particular, village children may be encouraged to realize possibilities for education and careers that they would otherwise not consider.[61] Of course, there is a long way to go in realizing such intangible benefits, and seeing them translate into real economic improvements. Dossani *et al* (2005) and Parthasarathy *et al* (2005), as well as other studies, emphasize the limited nature of some of the kiosk initiatives, with low awareness among the surrounding populations. However, that kind of assessment may change rapidly as experiments improve in their functioning and achieve a firmer financial footing. Certainly, the positive expressions that we heard in field interviews with kiosk operators seemed genuine, even as those making them acknowledged problems and difficulties in these ventures.

It has also been suggested that rural IT kiosks can have a substantial, ultimately positive effect on village politics.[62] Kiosk operation is seen as an avenue for the younger generation in villages, with their superior education and connections, to remain there, and establish, first symbolic and then substantive leadership roles. Most kiosk operators are relatively young and well-educated, and might well have moved to urban areas for suitable employment in the absence of this opportunity. Evidence from a sample of n-Logue kiosks (Kendall and Singh, 2006) bears out the positive impacts of age – older

[61] Again, this is somewhat speculative, but is a reasonable hypothesis that can be tested through surveys.
[62] I am grateful to Gautam Mukherjee for this insight.

kiosk operators do better in terms of revenues, though education does not seem to matter once other factors are controlled for.[63]

A final issue with respect to rural development has to do with equality of access. It is well known that India is socially fragmented, especially in rural areas. Surveys of rural ICT initiatives in India note that the location of kiosks is important for determining the nature of access. In this respect, initiatives that are more substantially commercially-driven, such as that of ITC, may not provide as broad benefits as other efforts. ITC e-choupals are located in the houses of well-off, high status farmers, and certain groups may not be permitted entry into these premises.[64] In this case, the range of services offered, being centered on agricultural outputs and procurement, will also tend to not cater to the entire population, especially the poorest. In the case of other initiatives, these factors are less important, and organizations setting up kiosks (where not pure NGOs themselves) often partnered with NGOs, women's self help groups, and government to include a cross-section of the population among their kiosk operators. While many kiosks are located in public commercial spaces, this is obviously more costly than using household space. Locating the kiosk in an exterior room or veranda of the operator's house was often a compromise solution. In some cases, local government premises, also publicly accessible, were made available to the kiosk operator.

While all thee details of access and their implications are important to understand, it is worth emphasizing that the developmental benefits of ICTs are worth capturing, even if they are initially skewed toward the relatively better off in rural areas. It is fair to say

[63] We conjecture that training and selection of operators smooth out any possible impact of prior education differences on performance.

[64] Econometric analysis by Kendall and Singh (2006) for a sample of n-Logue kiosks suggests that caste can matter for performance, controlling for other operator characteristics such as gender, age and education.

that, except for the very richest and largest farmers, rural incomes are quite low, and economic activity that raises rural productivity will ultimately have broader benefits. One can also repeat the point that ICTs are not a panacea for rural India and for the poor. They will not automatically solve all the problems faced by the rural poor. However, not being a miraculous cure cannot be an argument against ICTs. In fact, even though the most severe problems of poverty require effective government policies and implementation, ICTs may facilitate a move in this direction: this is the subject of the next chapter.

13. Governance and Policy Reform

ICTs have a dual role to play in the case of governance and administrative reform. First, the use of ICTs for improving internal government processes is important, through its potential to increase the efficiency of these processes. For example, the costs can be lowered, and accuracy improved, of data entry for tasks such as the preparation of electoral rolls and lists of welfare eligibility. Second, and perhaps more importantly (because it can hasten the first change), transparency, accountability and responsiveness can all be enhanced by using ICTs to alter the citizen-government interface. This second avenue is particularly relevant in rural areas, where government is both extremely important and also stretched very thin: effective access to government services can be difficult and costly for the average rural citizen.

In traditional situations, rural citizens have to expend high levels of time and money to gather information or to submit it to government agencies. They can be subject to predatory activities of touts when they travel to the towns where government offices are located. Urban citizens may face similar problems, but benefit from greater proximity, more effective social networks, and lower social distance (i.e., in class, education, etc.). Rural ICT kiosks have the potential to bypass the severe problems faced by rural citizens, by making information exchange possible without physical proximity.[65] The costs for citizens can be as low as 10 to 20% of traditional means of interaction. Here, using ICTs to 'computerize' back-end government processes is a necessary complement to the use of ICTs to improve the exchange of information between

[65] Of course, intermediaries may not be eliminated, but simply adapt – they may become more efficient and fewer in number. For example, the computerization of railway reservations in India has had this effect. Many examples of intermediation being revamped, but not eliminated, with the introduction of the Internet also exist in developed countries.

government and the rural masses, and ultimately to improve the responsiveness of government to its rural citizens. In this respect, also, rural ICT kiosks have a potentially important role to play in increasing the capacity of nascent rural local governments to the point where they, and hence rural decentralization, can be truly effective.

Given the enormous scale of unsatisfied citizen/end-user demand in rural areas, it is unsurprising that many rural ICT initiatives have stressed e-governance as an essential component.[66] These include Gyandoot, Rural e-Seva, and Drishtee, as well as other, more localized efforts. In addition, efforts such as TARAhaat began with high hopes of providing e-governance services to users of their kiosks. There are several types of e-governance services that are particularly valued in rural India. Foremost among them is access to land records and certificates of ownership. The situation in most Indian villages is that land records are maintained by the lowest rung of revenue officials, known as *patwaris*. This position goes back at least to the Mughal era, and the local *patwari*, who is responsible for a cluster of villages, wields considerable power. In theory, there are hierarchical checks on the misuse of this power, but in practice, *patwaris* typically collect large bribes for providing access to land records, essential whenever any sale or lease transaction, or inheritance is involved. Interviewees at rural ICT kiosks emphasized the value of having low-cost access to digitized land records that bypassed the *patwari*.

A second type of e-governance services pertains to all other kinds of access to routine information, including forms and regulations, and the ability to submit these forms, for qualifying for Below Poverty Line (BPL) status or pensions, participating in

[66] Our field interviews with rural residents repeatedly confirmed this observation: government was at once an important influence on people's lives, and simultaneously not equipped to interface with constituents. See Kaushik (2004) for further discussion of rural e-governance issues, based on his field surveys.

other welfare schemes, obtaining driver's licenses and birth certificates, and so on. To the extent that rural ICT kiosks can provide online access to these forms, and submit them efficiently for citizens, there is the possibility of a substantial reduction in transaction costs for these routine citizen-government interactions.

A third category of e-governance services involves more discretionary interactions. A broad cross-section of complaints and queries can be digitized and efficiently handled by IT, reducing travel, processing, and other transaction costs. For example, Gyandoot created 37 different complaint categories in its initial operations – this model was also adopted by Drishtee in its startup. While certificates and licenses should be fairly routine, requiring minimal judgment and action on the part of government officials, complaints are more likely to involve internal conflicts and resistance within government organizations. They are also more complex in terms of the internal information exchange and data retrieval that has to take place to assess and address complaints. Hence, without some internal process re-engineering, digital collection and delivery of complaints may be of limited value. One possible benefit, however, is that such complaints, when collected digitally outside the government machinery, can be documented and tracked much more effectively than would happen with traditional means of interaction.

One can also include the payment of utility bills in e-governance services, since utilities are typically government-owned in the Indian context. Aside from the potential to save in monetary and time costs of travel by using electronic payment, there is an additional non-trivial benefit to improving this process, even if physical presence is required. This is because in India even bill payment can be subject to hold-up by corrupt

government employees. In this case, new mechanisms for financial collection and tracking have to be developed. On the other hand, unlike in the case of complaint redressal, there is no extra pressure on government employees to perform additional work. They merely lose an avenue for collecting illegal income.

The example of Drishtee illustrates some of the difficulties with implementing rural e-governance services. While their initial efforts in Sirsa (Haryana), showed considerable ingenuity and promise (Kaushik and Singh, 2004), they petered out for several reasons (Parthasarathy *et al*, 2005). Essentially, the initial success of handling applications and complaints depended on the interest and pressure of the Deputy Commissioner (DC), and the fact that the volume was manageable. However, the lower cost of interacting with the government increased the demand from citizens, strained the managerial capabilities of the DC, and increased the workload for employees. Naturally, resistance built up within the government's district-level staff, and with a change in the DC, the back-end response further deteriorated. Citizens became disappointed, and reduced their use of the ICT kiosks, leading to a downward spiral in the reputation of the new channel. The problem was compounded by the thin human resources of Drishtee, and the limitations of the kiosk operators, who were being asked to play a demanding role in a complex interplay of institutional forces. Drishtee, caught up in the basics of day-to-day operations, was not able to compile and document complaints in a manner that would have at least provided some information to citizens and senior government officials. The potential for creating transparency and benchmarking mechanisms that could have been realized with digital collection of complaints was not realized, since it was beyond Drishtee's capabilities at the time.

Other initiatives present a range of outcomes with respect to e-governance. At one extreme, TARAhaat, after beginning with a promise of e-governance services, based on promises from the government officials concerned, found itself left high and dry, and totally abandoned any attempt to partner with the government in this respect, focusing instead on education and other kinds of offerings in its information centers. In many other cases, however, there has been greater success, with the state or local government creating the required databases and providing access to the requisite information and interaction possibilities for citizens coming through kiosks. Many of the details of these efforts can be found in Parthasarathy *et al* (2005) and Dossani *et al* (2005). In all these cases, the process of trying to improve the effectiveness of rural government has met with resistance from government employees who face two costs: reduced bribe income, and greater scrutiny of performance. Since this is a natural outcome, however, problems in this respect should not be used as an argument against the use of ICTs for improving governance institutions and outcomes.

Instead, a case can be made that a combined use of ICTs for improving internal functioning and citizen access represents the single most important possibility for changing the nature of governance in India.[67] Unlike developed nations, where government functions relatively effectively, or some developing countries, where government is worse than ineffective, being chiefly a predator, India's governance institutions have enough positive attributes so that relatively small and feasible changes

[67] Shah (2006) provides an analytical framework and several case studies (railway reservations, financial trading, fraud control, tax administration, and agricultural price measurement), highlighting the importance of IT systems for improving the quality of governance, as well as the difficulties in successful implementation. The case for IT that he makes is essentially the one outlined in the current chapter. Among the roadblocks that he identifies are lack of skills for implementation, and difficulties when implementation cuts across internal departmental boundaries in government. In the latter case, significant reorganization is necessary, compounding the complexity of, and resistance to implementation.

can have positive impacts. In this context, the gradual strengthening of rural local government institutions presents an opportunity for the deployment of rural ICTs. Several initiatives (e.g., Akshaya) involved rural local governments in essential ways in the design and implementation of the initiatives. In other cases, (e.g., Drishtee), the service provider has sought to partner with local governments for maintaining local government records through ICT kiosks. Even without formal, high-level partnerships, in numerous cases, individual local government officials have seen the kiosks as mechanisms for improving their functioning and voter satisfaction.

In understanding the possibilities for alignment between rural ICT initiatives and local governments, it is important to realize that state governments have often been reluctant to devolve power, resources and authority to local governments. Local officials must therefore work hard to establish their credibility with their constituents, in competition with state-level politicians. Thus, they try to help their constituents get complaints to higher levels resolved, or qualify for receiving welfare payments. Rural ICT kiosks can be one mechanism for increasing the effectiveness of local governments, by providing communication and tracking mechanisms for citizens interacting with more distant government offices. Note that state governments may still have a supportive role, by providing financing and infrastructure for back-end e-governance efforts. This has been the case in Kerala and, to some extent Andhra Pradesh, where the centralizing impulses of the state government have been overcome to some degree.

If the transparency and accountability of government can be increased, partly through the use of ICTs, there is also the possibility that the quality of government policies will improve along with implementation. However, it is not possible to rely on

that channel for policy reform. If rural ICTs are to make a difference to the populations they aim to serve, several specific policies can be designed and implemented to support this direction. Dossani *et al* (2005) outline policy interventions with respect to the telecommunications infrastructure. The ongoing failure to provide low cost telecommunications to rural populations represents a policy failure rather than current technological constraints.[68] Problems with the setting of interconnection charges are long standing, and the way in which Universal Service Obligations (USO) have been designed and implemented also has left much to be desired. Dossani et al provide some specific suggestions with respect to using USO funds and deploying specific new wireless technologies for spreading rural access to ICTs, including voice and data communications.

Other aspects of micro-level policy reform have to do with the scope and legality of ICT kiosk operations. If kiosk operators are to provide an interface with the government, financial institutions and agribusinesses, their status and qualifications need to be established and clarified. Often, there are restrictions on who can carry out what kinds of transactions and services. In the Indian case, these restrictions are often archaic, or are unintended consequences of other legislation or policies. If rural ICT initiatives are to be successful, this aspect of institutional and legal reform may require the concerted effort of the different organizations involved. In the case of large businesses such as ITC, they are able to negotiate changes with the relevant government – for example, the key to their soy-choupal operations in Madhya Pradesh was obtaining an exception to the *mandi*

[68] See, for example, Jhunjhunwala (2000), Jhunjhunwala and Ramamurthi (2004), Chowdary (2004), and Singh (2003a) for discussions of the telecommunications policy aspects of providing rural ICTs in India – regulations can increase the cost and complexity of accessing the network for smaller rural providers.

monopoly over trade in that commodity. Some of these reforms may be desirable in any case, but establishing concrete benefits to identifiable groups can help to make the case for them stronger and more likely to succeed. This is also important for preventing negation of such agreements when governments change at the state level.

14. Business Models and Entrepreneurship

If India is to get anywhere near 500,000 rural ICT kiosks (the potential estimated by n-Logue), there has to be a clear economic model for expansion to that scale. One also has to have an estimate of the economic costs and benefits of these ventures, to see if the goal makes sense from that perspective. It is certainly likely that there are social benefits beyond those that are captured in the explicit costs and benefits, but one should not make a case for subsidization lightly. It is much better if the rural ICT model can be financially self-sustaining. There are two extreme views on this possibility. On the one hand, many field researchers, possibly reacting to initial, glowing journalistic accounts that neglected the economic calculus entirely, are very cautious, or even skeptical about the potential for financial sustainability. At the other extreme, one of the most detailed and influential case studies of the possibilities of rural markets in developing countries, including, but going well beyond ICT kiosks, has the heady title of *The Fortune at the Bottom of the Pyramid* (Prahalad, 2005). The reality no doubt is somewhere in between, with real opportunities and challenges that must be carefully understood.

The first premise for identifying sustainable models of rural ICT provision is the importance of economic incentives. These must be ironclad at the bottom rung of any hierarchy of effort to deliver such services. Ashok Jhunjhunwala, of IIT Madras, and the inspiration behind n-Logue, has emphasized the role of small-scale local entrepreneurship at the core of the required business model, and this perspective will be obvious to economists, who think in terms of self-interest and incentives.[69] This

[69] One early and cogent analysis of economic sustainability is that of Best and Maclay (2002). Our perspective differs from theirs in details and emphasis, but many of the central points highlighted in more recent fieldwork can be found in this piece.

emphasis does not exclude non-pecuniary motives from the calculations of individuals involved in these projects, but social service will not by itself provide a sustainable effort at any significant scale. NGOs may play important roles in organizing and supporting rural ICT efforts, especially in areas such as increasing awareness, training, and community participation. However, if they are involved in operations funded through external sources, they may achieve significant success, but it will not be scalable. This point applies to many of the initiatives surveyed in various studies referenced here.

The role of the government is also a delicate one. There is a possible argument for government financing or subsidization of the required telecommunications infrastructure, and one must not rule out this option. However, falling costs of providing even fiber optic cable and wireless infrastructure mean that direct subsidies may be unnecessary. This also avoids enmeshing the government in technology choices, where it has no particular expertise or knowledge. Instead, the main role that the government can play is in ensuring that it digitizes its internal operations, and provides access to its own databases as needed for e-governance, and ensuring that the policy framework and specific rules and regulations do not unnecessarily hinder what is rather a new form of rural entrepreneurship. In this context, we observed in fieldwork that government sponsorship that was too overt often misled villagers and kiosk operators. The former often expected improvements in service or specific benefits that were not immediately attainable, and the latter sometimes expected working conditions and rewards commensurate with government employees, particularly with respect to salaries. In

several cases, the expectations of kiosk operators that they would be bailed out were very explicit.[70]

It is not difficult to see that rural ICT kiosks run like the typical government department in India would be disasters. However harsh it is in practice, the pressure to perform must be an intrinsic part of the business model for kiosk operators. There are variations possible in the nature of payments and revenue sharing, ranging from fixed payments to the parent organization, with the operator keeping all marginal revenue, to various levels and degrees of revenue sharing. These contracts often have to be fine tuned, to provide economic sustainability for kiosk operators, but this is something that can be done at the ground level. There is nothing that requires that contracts have to be immutable over time or across locations. Certainly, the more uniformity the better for management, since accounting and evaluation is simplified, but ground realities can vary greatly and dictate variation.

In some cases, kiosks do not work out, even with adjustment in contract terms. There are several possible responses: shutting down the kiosk, changing operators, and providing new inputs in the form of additional service capabilities or training. The initiatives we studied followed this path, trying the salvaging operation first, but admitting mistakes and winding up where necessary. It is absolutely essential for the viability of the model that those who start up the kiosks have the option of cutting and running, even if this is not a step to be taken lightly. Clearly, these are difficult situations, in a society where exit is viewed as failure, and the government views everyone as

[70] In our fieldwork, we found that this problem of inappropriate expectations was compounded in one case by lack of clarity, and even deception, on the part of the implementing organization, or its field employees. Thus, it was arguable that the kiosk operators had themselves been misled in the early going. In general, we found that reputational concerns provided a reasonable check on this kind of behavior by the organizations involved.

involved in a collective enterprise of informal social insurance.[71] For entrepreneurs, the possibility that initial capital may be lost, or that reputation may be damaged, has to be accepted. This is a challenging problem in rural India, especially when the individuals being recruited do not come from middle class families with asset cushions.

To some extent, the difficulty of allowing failure puts increased pressure on selection and training of kiosk operators. TARAhaat, for example, after running into difficulties in delivering on its promises to its first operators, who came under severe financial strains, shifted away from villages and farm entrepreneurs toward solidly middle class business families in small towns as sources for running their centers. Drishtee and n-Logue both responded to problems by improving the training of kiosk operators. As a review of the range of potential services discussed in previous chapters will emphasize, the entrepreneurial task of a kiosk operator is not easy, and the importance of careful training and continued skill upgrading cannot be overestimated.

One area that emerged as critical, from our fieldwork and that of others, was the importance of marketing and the roll-out of services. Very early experiments often succeeded because of considerable publicity from development organizations, or the media, but in order to build sustainable businesses, there was a need to draw in people for a range of services at the ICT kiosks. Attitudes, awareness and social norms all play an important role in adoption of new ways of doing things. In some cases, the initiatives studied followed the principle of "build it and they will come", or relied on traditional means of advertising, such as flyers, announcements in the local temple, or demonstration "camps" to which villagers were invited. Just like many of the casualties of the dot.com

[71] For example, this attitude is expressed in legislation and court interpretations that do not allow firms to fire workers, or even in requiring firms to hire the children of employees.

bust in the West, the kiosk operators and the higher-level organizations underestimated the switching costs involved for populations unused to digital technology, and the need to invest resources in building familiarity and acceptance. Even in 2004, some kiosks that had been operational for some time had failed to achieve much in the way of general awareness in the surrounding population. In other cases, general awareness did not translate into comfort in carrying out certain activities over the Internet. The competence of the kiosk operators and the quality of services offered (especially for areas such as health) also required time to be established: credibility and reputation are far from instantaneous achievements.

Organizations have also underestimated the importance of providing a complete solution, including strong maintenance efforts as well as connectivity, training, marketing support and a broad enough range of services. One of the developments over the last few years, however, has been significant learning along these dimensions, but the difficulty of operating in rural environments with weak infrastructures continues to slow down all rural ICT efforts. On the other hand, this should not be surprising, since the problems are ones of lack of development in the first place. Interestingly, the fastest roll-out has been by ITC, which had the resources and commitment to provide complete solutions, including solar panels and VSAT connections. By focusing on economically significant services (crop procurement) they were also able to avoid the need to develop the broad range of service offerings that is otherwise necessary to generate adequate revenue. In the case of other initiatives, such as n-Logue, the road has been harder, but as service capabilities have improved, the package offered to kiosk operators continues to become more robust. Organizations such as Drishtee have learned from their own experiences and

those of others, to similarly improve their packages. Having a regional focus has helped every one of these efforts.

Returning to the issue of incentives, it is important to recognize that much of the effort comes at the level of an operating territory, which may cover a geographic area that can be covered in a day's drive. Maintenance, trouble-shooting, training and support services all need to be delivered at this level to several dozen kiosks. In this case, more effective incentives can be provided by franchising such territories to "local service providers" (LSPs). Here again, the primary motive has to be commercial, though some franchisees may have a larger component of social concern than the kiosk operator who is making a livelihood and career. For example, some n-Logue LSPs are retired individuals who have made enough money to live comfortably and risk some of it for a social goal. In any case, they and their employees cannot have access to bail-out funds, just as much as the kiosk entrepreneurs are restricted in this way.

At the top of the organizational pyramid, the main franchisor (e.g., n-Logue or Drishtee) must typically be organized as a profit-making corporation, again to protect incentives. Only measurable financial objectives can be used to assess the performance of employees, even if they do get a warm glow from doing something more socially rewarding than "selling soap."

Turning to the economic aspects of the emerging business model, while there is a tremendous amount of variation in costs and revenue, one can offer some illustrative figures by way of calculations. From the typical single-computer kiosk-owner's perspective, the total capital cost may be from Rs. 50,000 to 75,000, with the lower figure becoming more common as hardware prices fall (though some of this fall can be used to

upgrade equipment and therefore services). If a computer lasts for 5 years, using an intermediate figure of Rs. 60,000, this works out to Rs. 1,000 per month in straight line depreciation for the equipment. Assuming a loan for the same period at 10% per annum simple interest, the monthly cost would be Rs, 500 per month in interest. Assuming operating costs of Rs. 2,000 per month (including franchise payments, which would go toward meeting back-end infrastructure costs), and gross revenue of Rs. 5,000 per month, the kiosk operator makes a net amount of Rs. 1,500 per month as a return to his or her capital and labor. How one allocates this return to labor and capital is somewhat arbitrary, since the opportunity cost of labor may be very low in many such cases. If one assigns Rs. 250 as a monthly return on capital, this works out to Rs. 3,000 a year, or a 5% net return on equity. This leaves Rs. 1,250 as the monthly return to labor.

None of these figures are surprising or spectacular. Despite the small numbers involved in the returns to labor and capital, they are still not easy to achieve. However, they are certainly feasible, and illustrate the soundness of the business model at the kiosk level. The next level of the organization is more challenging. If the monthly cost of capital and labor for the LSP level is of the order of Rs, 50,000 (which could represent 5 employees at an average salary of Rs. 8,000 a month, and Rs, 10,000 a month in interest and depreciation on Rs. 400,000 of capital employed for central infrastructure), the LSP would need to manage 50 kiosks just to break even. This calculation does not even include any payments to the top level for its services, equipment and technology.

These illustrative calculations are similar to ones used by the actual initiatives that are attempting to scale up without continued injections of financial support from government or foundations. They suggest that the model is not a path to quick riches. On

the other hand, they provide some validation of the approach that is being taken. Starting with such calculations, one might be able to estimate the level and nature of governmental infrastructure subsidies that would enable successful implementation and scaling without distorting or destroying incentives. This is the kind of hard-headed analysis that is required and indicates direction that must be taken next in these initiatives. Empirical analysis of existing kiosks can also provide insights into what works well, and the various factors that influence the success of rural ICT kiosks.[72]

[72] Kendall and Singh (2006) used data from n-Logue kiosks to provide one of the first econometric studies of rural ICT kiosks in India. Best and Maclay (2002) and Caspary and O'Connor (2003) examine the issue of commercial sustainability from a cross-country perspective.

15. Conclusions

This monograph has surveyed several initiatives to provide ICT-based services in rural India. We have provided an overview of the economic impacts of IT, and gone on to examine demand side and supply side issues of successful implementation. In particular, we have suggested that there is a broad range of services that can be provided to a cross-section of rural households, even at relatively low levels of income. This creates challenges for implementation by posing choices for organizations, but also opportunities for creating niches. We have also provided a framework in terms of the supply side value chain, and used this to discuss the implementation of rural IT-based initiatives by several organizations. We have examined several specific impacts of ICTs, on health, education, agriculture and overall market efficiency and rural development.

All the organizations discussed in the paper face common issues of implementation, but differ in terms of how they have been handled. There are differences in scale, connectivity technologies, services offered, revenue models, organizational structures, and so on. Clearly, focused efforts with substantial financial and organizational backing have a good chance of success. However, even startups that have put together the required competencies and resources through partnerships and slow organization building appear to have room in this market.

There appears to be enough evidence now that it is close to commercially feasible to use IT to deliver services to rural populations either at costs that are lower than previous delivery methods, or in ways that make it possible to achieve delivery where none was earlier cost effective or feasible. Initially, the static savings from reductions in transaction costs may be of the order of a few percent of value added. However, the

benefits from enabling new transactions may be an order of magnitude greater (Singh, 2004a).

Just a few years ago, one of the visionaries in this area offered a cautionary assessment of initiatives for rural IT in India (Keniston, 2002). Recent fieldwork indicates that numerous difficulties remain in implementation. However, the falling cost of hardware, new software, and most of all, perhaps, significant organizational learning in the intervening period all suggest a somewhat more optimistic view today. That is the final message of this analysis. In the long run, bringing rich information to the population of rural India, whether in the form of education, market prices, market opportunities, or knowledge that improves productivity, health and well-being, can only have positive impacts on the material well being of the rural masses.

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