

Contradictions in the Last Mile: Suicide, Culture, and E-Agriculture in Rural India

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Abstract

Despite its use to exemplify how the world is “flat,” India is in many ways “spiky.” Hyderabad is a prosperous hub of information–communication technology (ICT) while its impoverished agricultural hinterland is best known for dysfunctional agriculture and farmer suicide. Based on the belief that a lack of knowledge and skill lay at the root of agrarian distress, the “e-Sagu” project aimed to leverage the city’s scientific expertise and ICT capability to aid cotton farmers. The project fit with a national surge of “last mile” projects bringing ICT to the village, but it was unique in using ICT to connect farmers directly with agricultural scientists acting as advisors. Such projects fit the interests of many actors, which has led to an unrealistic national enthusiasm about their impacts. This article uses the first five years of the project as a lens to view the cultural nature of both indigenous agricultural knowledge and “scientific” agricultural advising. Unlike lay publics whose uptake of science is better known, with farmers the invention and

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adoption of agro-scientific knowledge is deeply embedded in daily productive activities and sociocultural interactions. E-Sagu eventually had to abandon its construction of agricultural science as objective and acultural, resorting to rural methods of persuasion. It also found that it could only survive by joining forces with companies promoting commodification of agricultural inputs, which was a cause of the agrarian distress it sought to alleviate.

Keywords

indigenous knowledge, Internet, information–communication technology, agriculture, commodification, suicide, cultures of science

Despite being a prime example of how the world is supposedly “flat” (Friedman 2005), India is in many ways better characterized as exceedingly “spiky.”¹ In terms of technology and economic opportunity, few spikes are as sharp as Hyderabad and its hinterland. “Cyberabad,” with its glamorous film industry, and renowned universities and prosperous Hi-Tec City, is a principal hub of India’s information–communication technology (ICT) sector (Grondeau 2007) and an exemplar of “postindustrial high-tech capitalism” (Sunder Rajan 2006). It is rapidly evolving, highly successful, and filled with enough opportunity to exert a reverse brain drain (Rai 2006). However, one need travel only fifty miles to rural areas like Warangal District (figure 1), where desperately poor farmers till fields with wooden plows as their kids sit in decrepit underfunded schools. Here, women’s literacy rates are among the lowest in the country (less than half of urban rates; Velkoff 1998) and upwardly mobile parents dream of their children getting out.

In Warangal, the main economic engine—agriculture—is in perpetual crisis: India’s “Achilles’ heel” (Sengupta 2006). The primary cash crop is cotton, but yields are among the world’s lowest, and growers in recent years have descended into a destructive spiral of escalating use of toxic insecticides, resistant cotton pests, and mounting debts. In 1998, matters came to a head in rural Warangal: After particularly severe bollworm attacks and poor harvests, several hundred farmers took their own lives (Stone 2002). The suicides were mostly small and marginal farmers (Reddy and Rao 1998) and they mostly did it by drinking insecticides. Arguments over the causes of the suicides were sometimes bitter (Stone 2005). Monsanto, hoping to market genetically modified seeds that killed bollworms, blamed the bollworms.² Vandana Shiva, the antiglobalization activist, blamed

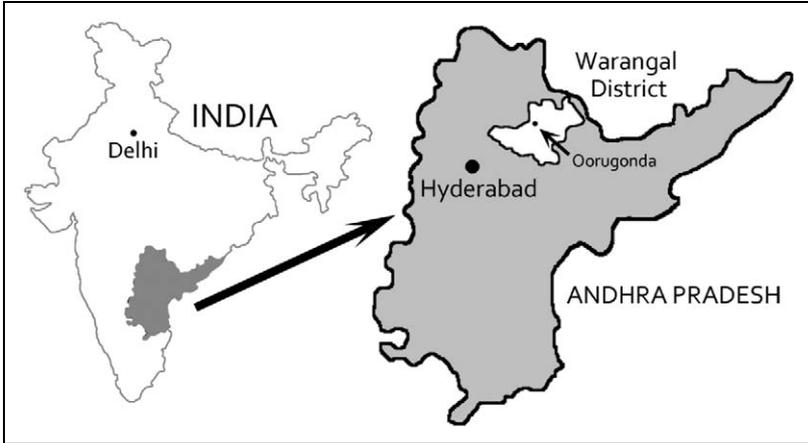


Figure 1. Map of India and Andhra Pradesh.

globalization (Shiva 2004; Shiva and Jafri 1998). Some government officials attempted to medicalize the problem by suggesting a wave of clinical depression, and a Hyderabad NGO started a program for suicidal farmers, intending “to calm them through anti-depressant drugs” (Mathew 2005).

An important and different perspective on the suicides was manifested a few years later by the appearance of an unusual facility in Oorugonda village (figure 1), in the part of Warangal with the highest commitment to cotton and the highest rate of suicide (Reddy and Rao 1998). Opening in Spring 2004, this small office, bristling with computer terminals and digital cameras, marked the beginning of e-Sagu (*sagu* meaning cultivation in Telugu), a project designed to aid cotton farmers by connecting them to agricultural experts in a university lab in Hyderabad’s Hi-Tec City. The idea for such an intervention had been gestating since 2002, when a professor of computer science named P. K. Reddy had envisioned a system in which “agricultural experts will get the recent status of the crop through [the] internet in the form of text and images, and they will generate appropriate advice which will be sent to the farmers through [the] internet . . .” (*Deccan Chronicle* 2002). Reddy and colleagues wrote that

[The] majority of the farming community is not getting upper bound yield, despite successful research on new agricultural practices, crop cultivars, crop cultivation and pest control techniques . . . The term upper bound yield refers to the yield that could be obtained using proper cultivation methods subject to

advances in agricultural technology at that time. The upper bound yield may change with progress in agricultural research. One of the reasons is that the appropriate and timely scientific advice about farming is not reaching the farmers (Reddy and Ankaiah 2005).

Explicitly identifying the farmers' lack of information as a cause of agrarian distress, the authors cited articles on farmer suicide. E-Sagu leaders have continued to espouse this view in the popular press (e.g., *Deccan Chronicle* 2006).

The premise that suicide may be linked to information deficits is not fanciful; indeed, distortions in the information environment have emerged as a key theme in recent anthropological research in Warangal (Stone 2002, 2007a). The question is if and how the delivery of external science could mitigate the problem. Projects to aid local agriculture by delivering external scientific expertise have a fascinating history, reflecting a range of historically contingent attitudes toward science and agricultural practice. In the United States, when the Country Life Commission advocated bringing modern agricultural science to farmers in 1909, it was reflecting an ascendant ideology of "scientific" (Fordist or Taylorist) production. However, in that case, the problem was getting the scientific advice to the farmers; the head of the commission advocated a far-fetched model in which plant doctors, breeders, and soil and spraying experts would "be established in the open country" to guide the farmers (Busch 2000; Marglin 1996). In contrast, e-Sagu was designed around—in fact, was inspired by—the availability of an excellent delivery mechanism: the use of advanced ICT to rescue cotton farmers seemed the perfect intervention for spiky Andhra Pradesh. In ICT circles, "the last mile" refers to the final leg connecting local customers to electronic communication; by 2004, there were various last mile projects delivering information to farmers on markets, monsoons, and new products (Das 2000), and iconic images of ICT reaching the farm were commonplace (figure 2). What distinguished e-Sagu was its plan to take connectivity the next step, linking the farmer not just to information on the Internet but to agricultural experts telling individual farmers how to farm. Its basic conception, which resonated richly across a range of stakeholders, was that farmers were foundering for lack of access to guidance from agricultural scientists; forging this connection was a *technical* challenge, to be solved by ICT.

From the beginning, signs indicated the project to be a major success. It did connect farmers to Hyderabad-based agricultural consultants, and it soon announced findings that it had improved productivity and saved client farmers

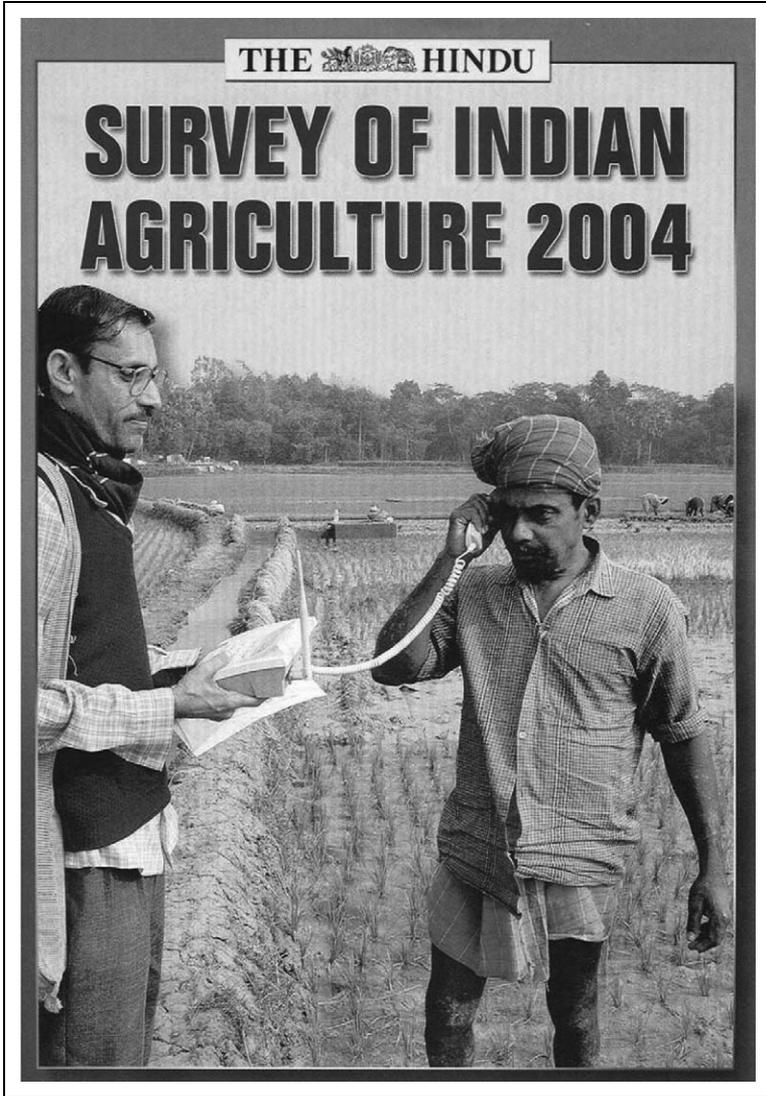


Figure 2. An example of information–communication technology (ICT) agriculture imagery dating to the time of e-Sagu’s opening. The caption reads: “Indian farmers need timely inputs and value-added dynamic information... The role of information and communications technology (ICT) to bring about “digital inclusion” is critical to broaden the knowledge-base of farmers” Printed with permission from THE HINDU, Chennai, India.

thousands of rupees per year. In short-order, it won the best CSI-Nihilent e-Governance Project Award; the “Fellows of Manthan Award” by Digital Empowerment Foundation; a diploma for excellence in the use of information technology in economic development by Stockholm Challenge; recognition as a global example from Taiwan’s Ministry of Economic Affairs; and recognition as one of the twenty “best technology users in India” by *Business Today* (*Business Today* 2006). It soon announced plans to spread to other villages, and to begin charging for its service.

Yet, on closer inspection, e-Sagu’s success story may have been more a reflection of what people wanted to hear than what was supported by evidence. As we see below, the evidence of positive impacts on farmers’ profits was dubious, and the project’s impact on cultivation practices may prove to be quite ironic. What the e-Sagu project does provide is an interesting case study in the intersection of knowledge, technology, and culture in agriculture. This is a timely area for examination because agriculture, having transformed from a form of production running largely on labor (Netting 1993) to one running mainly on imported material (fertilizer, pesticides, and machinery), is now rapidly evolving into a productive system running on information (Cash 2001, 431). This has brought a sea change toward increasingly research-intensive agricultural technology (Kenney 1986) and a growing commodification of agricultural information. Although the Country Life vision of a corps of rural advisors never materialized, by the late 1900s, U.S. farmers were becoming major consumers of data, consulting, and other information (Wolf 1998; Wolf and Zilberman 2001). Integration of these new information technologies into agriculture clearly brings about new structural relationships between farm operations and other actors and institutions in what have been called new “social relations of information capitalism” (Bousquet 2003). The particular issue at stake are the special obstacles encountered by “boundary organizations” (Guston 1999) in mediating agricultural science and agricultural practice. I show that conveying generic preexisting information to farmers—as other e-agriculture interventions had done—is a qualitatively different project than generating customized advice for farmers. Scholarship on boundary organizations has generally lumped the kinds of information being handled (e.g., Cash 2001), just as e-Sagu leaders saw the move from providing generic to customized information as an unproblematic improvement and logical progression. However, agricultural advising engages local decision making in a way that produces a richly social encounter on multiple levels. E-Sagu planners encountered this as soon the “agricultural scientists” being sought as advisors turned out to be a

heterogeneous population with deep sociopolitical clefs. E-Sagu's boundary activities then collided with the complex nature of agricultural decision making, which admixes environmental observation with social mechanisms for making collective sense of crops and for selecting sources of agricultural cues. Within four years, rather than transforming local agriculture, e-Sagu itself had been transformed as it struggled to recognize and manipulate the social drivers of agricultural performance.

Equally revealing of the new "social relations of information capitalism" were the partnerships e-Sagu was forced into in order to remain solvent. E-Sagu, originally conceived as a boon to suicidal small and marginal farmers, was eventually transformed into an agent of information commodification, partnered with vendors of commodified inputs that had been implicated in the farmers' plight.

Why this analysis of e-Sagu's impact so sharply contradicts the consensus on its triumphs is a productive question in itself. I show that the acclaim for the project reflects the wide roster of actors with vested interests in e-agriculture more than the empirical reality. The next section explores this set of interests as it establishes the context of the rise of e-agriculture in India.

The Popularity and Politics of E-Agriculture

India seemed to emerge as an ICT powerhouse just in time for the rescue of backcountry agriculture. Between 1991 and 2006, the Indian software industry grew from \$150 million to almost \$23.6 billion (Kuriyan and Ray 2007); in the early 2000s, when e-Sagu was conceived, ICT was growing at an annual rate of 37 percent (Carmel 2003; Harris and Rajora 2006). The conviction that ICT was a key to agricultural (and, more generally, rural) development arose in several Asian nations around this time (Harris and Rajora 2006), but nowhere did it have as much traction as in India. This was not only because of India's extraordinary "spikiness" but because e-agriculture fits the interests of a particularly wide set of actors in India, and those interests help explain its rise and positive reception. To the *press*, it offers stories of dhoti-clad farmers getting commodity prices at the Internet kiosk, irresistible to publications such as *Business World* (Kohli 1999), *Bloomberg News* (Sharma 2007), the *New York Times* (Waldman 2004), and the *Wall Street Journal* (2008). To *government officials*, it exemplifies enlightened and effective public policy (Grondeau 2007). In 2000, the Indian central government established a Working Group on Information Technology for Masses, and in 2003, announced a national mission to bring

IT applications to rural development and agriculture. The e-Sagu project was funded primarily by the government of India through a venture entitled Media Lab Asia. Several state governments also launched “last mile” programs (Kuriyan, Ray, and Toyama 2008). Andhra Pradesh was particularly aggressive in promoting such ICT projects in the early 2000s, led by its charismatic pro-globalization Chief Minister Chandrababu Naidu (*The Hindu* 2007); Naidu had already attempted to launch a statewide Geographic Information System (GIS) project to optimize the use of “every inch of land” in Andhra Pradesh (*Business Line* 2000). To *ICT corporations*, it provides an opportunity to burnish civic credentials and penetrate new markets. For instance, Microsoft, with much fanfare, gave an award to Delhi students who designed a farmer “Infostation” driven by Windows CE (Parthasarathy 2005); in 2006, they launched the “Digital-Green” project to disseminate agricultural information via digital video. These corporations are also interested in developing new channels for selling agricultural inputs (a consideration likely to dominate the future development of e-Sagu, as discussed in the final section). To the *ICT scientists* setting up the systems, it offers a highly fundable and publishable topic (e.g., Ratnam, Reddy, and Reddy 2005) along with professional kudos. To *academic institutions*, it offers invaluable press showing a development-conscious country the practical value of campus research. The International Institute for Information Technology (IIIT), which houses e-Sagu, has enjoyed glowing newspaper articles and TV spots; it has also produced its own self-congratulatory media, including a film in which the director of IIIT cites e-Sagu as an example of how the institution “benefits the common man” and a narrator claims it to have dramatically turned the Warangal landscape green through its “amazing impact” (IIIT 2005).³ To *academic business writers and free market enthusiasts*, it offers an exemplary case of profit-driven solutions to rural poverty. Farmer Internet kiosks provide the most striking example of the much-discussed “ICT4D” (ICT for Development), extolled by writers such as C. K. Prahalad (2004) as the means to “eradicate poverty through profits” by selling advanced technological services to those at the “Bottom of the Pyramid.” Finally, to some *nongovernmental organizations (NGOs)*, it offers a high-profile rural intervention. An agriculture-oriented Warangal NGO played a key role in designing e-Sagu and also performed its yearly evaluations (which were unfailingly positive). An interesting feature of such “last mile” interventions is that they appeal to both agricultural corporations and NGO’s with anticorporate orientations.



Figure 3. Web site display for ITC's e-Choupal project.

Given this convergence of disparate interests, it is not surprising that e-agriculture projects (and great enthusiasm for them) spread through India from the late 1990s on. Early initiatives, such as the National Virtual Academy for Rural Prosperity begun in Pondicherry in 1998, established “Experimental Information Village Projects” offering farmers weather reports and market prices (MSSRF 2007). In Gujarat, “telecentres” provided dairy farmers with information on cattle rearing; in both Maharashtra and Tamil Nadu, Internet kiosks offered scheduling and market information to sugarcane growers (Kohli 1999). In Madhya Pradesh, the Gyandoot-Dhar project provided villagers with access to agricultural commodity rates through cyber kiosks (Sreekumar 2007). The most ambitious e-agriculture project has been ITC’s “e-Choupal” project (figure 3; Harris and Rajora 2006). Featured prominently in the *New York Times* (Waldman 2004), this initiative had set up 6,500 Internet kiosks by 2008 called e-Choupals (choupal meaning gathering place in Hindi) that claimed to serve 40,000 villages while “empowering” four million farmers in nine states of India (ITC 2009).⁴

From the Gujarati telecentres and Gyandoot kiosks to the nationwide e-Choupals, the principal benefit of these “last mile” projects appears to have resulted from their delivery of market information that helps farmers reduce the power of intermediaries in the commodity chain. In evaluating the success of e-Choupals, Upton and Fuller (2003) concluded that its “effective methods of price discovery, honest trading, and information sharing” helped farmers escape the role of price-takers, while Prahallad (2004) noted that online access to the latest crop prices enabled farmers

to avoid the exploitation of local purchasing monopolies and increase incomes. Balaji et al. (2004, 41) too found that in Pondicherry “village knowledge centers,” *it was access to grain prices that mainly benefited farmers*. Broader impacts, such as opening economic opportunities to marginalized groups, have yet to materialize (Sreekumar 2007).

Expertise: Taking Connectivity to the Next Step

With no shortage of apparently promising e-agriculture projects, e-Sagu entered a crowded field when it opened its Oorugonda field office in 2004. E-Sagu’s founders distinguished their project by critiquing existing e-agricultural interventions for failing to provide scientific management and tailored advice:

[They] mostly move around marketing aspects, input supplies, price information, contract farming etc. They cover only selected aspects and little attention is paid in the provision of advices [*sic*] on all aspects personally to the farmers. In view of the shifting cropping pattern towards commercial and specialized crops, there is an increasing need for an integrated and scientific management of these crops and to ensure this, an intensive and personalized information flow to the farmers is essential. It is in this background, IIIT, Hyderabad, India has developed a model using ICTs for providing personalized information (Reddy et al. 2005b).

Reddy’s critique portrayed agricultural advising as the logical next step in “last mile connectivity.” Instead of eliminating intermediaries in the commodity chain, e-Sagu inserted a new player into primary production: the agricultural scientist. Before 2004, there had been only fledgling attempts at customized advice.⁵ E-Sagu recognized direct advising to be a different undertaking, but saw its challenges to be essentially technical and logistical, centered on the development of communication infrastructure and the hiring of a staff of agricultural scientists.

The communication infrastructure that e-Sagu pioneered in 2004 began with a field office in Oorugonda with three computers and a staff of local “coordinators,” each armed with a digital camera and a rudimentary knowledge of agronomy. The project recruited 1,051 local farmers to participate on a no-fee basis. Their cotton fields were visited weekly by coordinators who photographed and recorded agroecological details (figure 4). The images and information went onto CDs that were carried by a staffer by bus or train to the e-Sagu lab at IIIT in Hyderabad several times each week



Figure 4. Left: A coordinator at the Oorugonda office photographs a client farmer's cotton field. Right: The IIIT office in Hyderabad with three agricultural experts.

(bandwidth and phone connections did not allow direct Internet transmittal). At IIIT, there was a dedicated lab with ten networked computers managing the project with an Oracle-like database. The project's "agricultural experts" (discussed below) would view the field updates and then post advice on the e-Sagu Web site, which could be accessed by the coordinators and relayed to the farmers. Their advice included not only identification of specific problems and solutions (e.g., pest identifications and recommended sprays and fertilizers) but general management advice (e.g., on crop rotations). In this way, the farmer, according to the e-Sagu Web site (e-Sagu 2004), "cultivates like an agricultural scientist." The e-Sagu founder told me after the farmers became "habituated" to receiving advice they would probably be willing to pay for it.

This communication system seemed rational and impressive, but intervention into the arena of farmer skill represents a major departure in more important ways than these logistical considerations. Despite the superficial similarity of electronic mediation, advising on how to farm makes for a qualitatively different kind of interaction than what occurred on the e-Choupals and Internet kiosks. Those facilities served as simple conduits for independently generated information such as the current market price for cotton and the predicted arrival of the monsoon. Van der Meer et al. (2003) term this "dumb information," but the key is that it is generic information independent of the conduit—particularly market pricing, which accounts for the

most convincing evidence of “success” in these facilities. In the few cases where “last mile” projects had dabbled in actual advising, there had been problems: assessments of these projects found them to be performing poorly, plagued mostly by problems stemming from the burden of generating custom information. Even if the information were readily available, farmers complained that it came in unhelpful forms and often not even in their native language (Kuriyan and Toyama 2007, 4). However, the problems run deeper than the communication model and language use; I posit that these interventions foundered on the sociocultural dynamics of agricultural decision making, which we will see in the e-Sagu case.

The Sociocultural Nature of Agricultural Skill in Warangal

Despite the widespread belief in the need to tell Indian farmers how to farm, and in e-Sagu’s ability to do the telling, the dynamics of agricultural instruction are poorly understood. When institutionalized, such instruction is called agricultural extension, an enterprise that some see as in crisis across the world (Davidson and Ahmad 2003). While the persistent failures of extension are often attributed to management and incentive issues (e.g., poor training, inadequate operational funds, lack of relevant technology, top-down planning, centralized management, and absence of accountability), more broadly its epistemological foundations have been questioned because “it fails to adequately illuminate just ‘what happens out there’” (Davidson and Ahmad 2003). The uptake of scientific claims and advice by farmers differs in important ways from the uptake of science by lay publics with which “public understanding of science” (PUS) scholarship is primarily concerned. Farmers are not a lay public responding to science as performed by scientists; agricultural technology and knowledge are what farmers use, assess, and create daily in their profession. Farm management is what they *do*. In contrast, Jasanoff’s (2005) “civic epistemologies” (national patterns in ways of public assessment of scientific knowledge claims) concern scientific claims that the public may believe or doubt and technologies they may admire, fear, buy, or boycott, rather than prescriptions on how to ply one’s trade. Wynn’s (1996) analysis of sheep farmers’ response to scientific pronouncements on contamination concerns management of a unique catastrophe rather than basic instruction on sheep farming. In contrast, daily agricultural decision making poses a different set of problems for the penetration of outside scientific information and management

advice. I will note two issues of particular importance, the denial of which was at the heart of e-Sagu's model.

First is the dynamic nature of farm management and the complex matrix within which agricultural decisions have to be made. Paul Richards aptly characterizes farming as a "performance;" furthermore, it is an inherently sociocultural enterprise, often requiring intricate fits between agroecology and a range of local institutions (Lansing 1993; Richards 1989, 1993). Farmers do not simply acquire technical information on a seed or other technology; they must try to develop the ability to perform with a technology under changing conditions. This process is *agricultural skilling*, and since technologies and markets and ecology and land and labor and ideas change, it is necessarily an ongoing process (Stone 2007a)—a key difference from the "skill" that is central to the literature on industrial deskilling (Braverman 1974).

Second is the hybrid nature of the skilling process, which combines ideas from off-farm (often institutional) sources with those generated and manipulated by the local community. Agricultural skilling is also hybrid in being generated by the interplay of environmental and social learning. The influential model of Boyd and Richerson (1985) of cultural evolution separates the processes of environmental and social learning, but agricultural skill is rarely purely environmental or social. It is largely environmental learning when, for example, a farmer sprays a pesticide and observes its effect on a particular pest, but it is partly social as the choice of spray, timing and method of application, and expectations and interpretation of the results are all influenced by local farmers. It is largely social learning when a farmer takes cues from whatever most neighbors are doing, but this is partly environmental in that local consensus is expected to embody results of past environmental learning. It is clearly mixed environmental/social learning when a farmer heeds a neighbor's account of pesticide use or chooses to emulate a neighbor whose crop seems to be doing well. Reliance on the social mechanisms such as copying neighbors or the local majority ("conformist bias" in the literature of behavioral ecology; Henrich 2001) is an adaptive strategy, particularly in situations where environmental learning is difficult (McElreath 2004), and so farmers should be expected to prefer locally derived information. Agricultural skilling is thus a mostly local and sociocultural process, even though it may incorporate non-local technology and information (Brookfield 2001; Norgaard 1984; Scott 1998).⁶ What is often billed as diffusion of an innovation from outside is actually a process of indigenous adaptation or reinvention (Rogers 2003).

However, the agricultural skilling process is not immune to serious disruption, and the normally adaptive social components of learning may have maladaptive effects. A disturbing finding of longitudinal research on Warangal agriculture was agricultural *deskilling* in the cotton sector, evidenced in farmers' "indiscriminate and excessive" use of pesticides (Reddy and Rao 1998; Vandeman 1995). It was also reflected in seed fads: each village would have a new favorite seed every year, often a new seed on the market, with farmers following each other's lead with little knowledge of the properties of the seeds they were buying (Stone 2007a). The root of the problem was that the seed system lacked the consistency, recognizability, and reasonable pace of change needed for agricultural skilling to occur. The environmental component of skilling was disastrously impeded, leaving an unusual and maladaptive reliance on pure social learning. This was what was reflected in seed fads and in the misuse of pesticide and the general dysfunction underlying cotton farmer suicides. This was the situation that brought e-Sagu to town, offering "scientific" expertise ostensibly decoupled from the social dynamics of skilling. However, even before its encounter with the sociocultural complexities of agricultural decision making, e-Sagu had its encounter with agricultural science.

Negotiating Agricultural Advice

The "upper bound yield" that e-Sagu sought for Warangal farmers was understood to be obtainable by "using proper cultivation methods subject to advances in agricultural technology at that time," the result of "progress in agricultural research" (Reddy and Ankaiah 2005). In 2003, as leaders of e-Sagu began work on what they saw as the crux of the problem—the communication infrastructure—they delegated the seemingly more bureaucratic task of assembling the advising staff to two retired agricultural officials. The staff was to comprise "agricultural experts:"

Agricultural experts (AEs) are required to provide advice on factors that affect crops and their effect on crop productivity. An AE possesses advanced nontrivial knowledge about management of crops, and the expertise to recommend possible steps based on the current crop situation. As a result of intensive research, there is increasing knowledge regarding agriculture. Also, given a crop situation, we have a large pool of qualified agricultural scientists to provide appropriate advice to the farmers (Reddy and Ankaiah 2005).

Having animated the e-Sagu project from its inception, this vision of a ready pool of authorities on an essentialized “agricultural science” of smallholder production is an intriguing text in itself. In a general sense, it obviously neglected the well-known social/cultural components in the construction of scientific knowledge (e.g., Bloor 1991; Collins 1981; Knorr-Cetina 1981; Latour and Woolgar 1986). However, it also erased the political-economic drivers in agricultural research that strongly shaped what “knowledge” was available and who was available to provide it.

First consider that the “intensive research” cited by Reddy and Ankaiah has long been largely oriented mainly toward developing agricultural inputs—pesticides, genetically modified seeds, and so on—and evaluating their use—fertilizer response, pesticide dosages, and so on (Busch and Lacy 1983; Busch, Burkhardt, and Lacy 1991). Analyses of the drivers of this research show smallholder efficiency to be a low priority indeed (Binswanger and Ruttan 1978; Busch, Burkhardt, and Lacy 1991). For an illustration, one needs look no further than the fact that virtually all of the cotton growing in Warangal is from hybrid seed. The shift to hybrid crops is a widely known phenomenon of political biology, carving out a major niche for agricultural capital and entraining state agricultural research as a development arm of that capital (Kloppenborg 2004). The benefits of this technology to capital in the United States have been documented (Berlan and Lewontin 1986; Fitzgerald 1990), as have some of its deleterious impacts on farmer skilling (Fitzgerald 1993; Ziegenhorn 2000). However, impacts have been much worse for Indian cotton farmers, exacerbated by the tandem spread of unregulated cotton seed markets and hybrids which both contribute to deskilling in cotton agriculture (Stone n.d.).

The research priority on commodified inputs occurs not just in the private sector but also in Indian public agricultural research institutions that are ostensibly tasked with catering to the needs of India’s overwhelmingly smallholder farmers. Hybrid cotton was first developed at a public research station in Gujarat, and state institutions still develop the parent lines used in making hybrids, which find their way (legally or not) into the hands of commercial breeders. These hybrid seeds are also fertilizer-intensive, water-intensive, and most importantly, pesticide-intensive; most Indian cotton seed is *Gossypium hirsutum*, the New World species lacking natural resistance to many Asian insects and diseases (Kulkarni et al. 2009). Thus, reliance on insecticide spread with cultivation of commercial hybrid cotton, and Indian cotton farmers became classic victims of the “pesticide treadmill” as sprays killed off beneficial predator insects while pests have developed resistance. In short, the troubled agricultural decision-making system

that e-Sagu sought to correct with access to agricultural science was itself blowback from agricultural science.

However, with its enormous population of science-educated citizens, its thriving NGO sector, and its widely recognized problems in agricultural sustainability, India has a significant alternative agriculture movement. While most agricultural training and university programs take the heavy reliance on external inputs as a given and pay scant attention to alternative cultivation, other programs take these practices to be unsustainable and advocate alternative cultivation philosophies. Such programs are offered by international organizations such as Food and Agriculture Organization of the United Nations (FAO) and by private specialized schools and in some cases by public universities. The most common alternative cultivation regime is Integrated Pest Management (IPM), which combines minimal use of conventional pesticides with tactics such as early plowing, trap crops, bird perches, scouting, and neem oil (Mancini, Van Bruggen, and Jiggins 2007). IPM does not completely avoid commodified inputs (practitioners sometimes buy pheromone traps and parasitic wasps and may buy rather than make neem oil), but it sharply reduces input costs. A few programs also teach organic cultivation or NPM (non-pesticide management; Eyhorn, Ramakrishnan, and Mäder 2007). Graduates of these alternative agriculture programs find work with NGOs, companies selling IPM/organic supplies and consulting, or with organic cultivation projects.

Several alternative cotton cultivation programs have been run in Warangal District in the past decade, including an IPM program cosponsored by Novartis and a local NGO; an IPM field school sponsored by FAO; and organic/NPM ventures. These projects varied in their underlying philosophy and in how agricultural practices were presented to farmers. One NPM project, run by a partnership of Indian and Dutch firms, was entirely profit oriented, and it stressed to farmers the need for organic certification to obtain a price premium. However, some NGO-run programs may take on a messianic zeal. For instance, leaders of Modern Architects for Rural India (MARI, a major NGO active in environment and agriculture in Warangal District) exhorted farmers to shun pesticides in cotton farming not out of material interests but because of benefits to the environment and community. Participating farmers basically humored this rhetoric and made scant use of the techniques after the project's conclusion, remaining broadly skeptical of non-pesticide practices.

Agricultural advice, then, is variable in content and philosophy, and it is shaped by disparate groups who develop and pass on models of behavior—in other words, it is largely sociocultural. It is not surprising that e-Sagu,

with its construction of an apolitical, homogeneous “agricultural expertise,” would ignore these dynamics of the knowledge and practice. It did not, at least in the beginning, even take a position on the cultivation philosophy guiding its advising, and the two retired agricultural officials who hired AEs were left to devise their own hiring criteria. Of the six experts initially hired, one (the team leader) held a doctorate in plant pathology and the rest held masters degrees in entomology, plant pathology, or agricultural extension. None had significant experience in cultivation; the team leader was not from a cotton-growing area and had received no practical training in his education. These “experts” also varied in philosophy regarding inputs: one was fresh from work on the idealistic MARI organic cotton project and he tended to advise farmers to use alternatives to pesticides, while others were more committed to high-input industrial cultivation. Which AE was assigned to which farmer was normally random, but sometimes based on which AE “knew the most” about an issue in the farmer’s field. Farmers were not matched with AEs based on their own propensities regarding IPM or conventional farming: that would have required confronting the sociocultural nature of agricultural advice.

E-Sagu encountered complexities at the farmer end of its boundary function very quickly. From the outset, most client farmers in Oorugonda showed an indifference to e-Sagu advice that was inconsistent with their lacking only a conduit to gain access to the expertise they needed. While the coordinators had conveyed hundreds of field forms and digital images from the farms to the AEs, the farmers had showed a discouraging lack of interest in the advice. When I met with a group of the AEs near the end of its first season, they complained that the “farmers did not ask questions at all.” This chagrined the AEs, one of whom lamented that “If those farmers had cooperated we could have worked wonders.” In terms that echo the earlier account of the cultural nature of agricultural knowledge, a respected local crop breeder explained the farmers’ response to e-Sagu: “Most farmers are not interested, not because of deficits in the system as a whole but due to lack of faith in the persons giving advice. In general farmers receive advice only from those in whom they have faith and from the person who knew them and their village conditions.”⁷

By summer 2007, the dynamics of the AE corps had changed in many ways. Except for the team leader, the staff had completely turned over. There was another change as well: The presumption that agricultural experts were readily available, needing only an electronic conduit to the farmers, had been replaced by the realization that e-Sagu would actually have to train its own experts. Most of the “agricultural scientists” they

had assumed to be plentiful were either off doing research on inputs or had received academic training that left them poorly equipped to tell an actual farmer how to cultivate. In addition, the team leader had immersed himself in learning about cotton cultivation, reading scientific literature and learning from farmers and NGOs in the project areas. He had six newly hired advisors working under him; he was now in charge of hiring and he was busily training the recruits, aiming for greater consistency in advising.

E-Sagu was also increasingly coming to represent a single cultivation philosophy. Although keeping with the premise that agricultural expertise is generic and available (lacking only a delivery mechanism), it had developed a definite anti-pesticide orientation. In its first year, e-Sagu experts sometimes advised farmers to try nonchemical methods of combating pests (e.g., trap crops, pheromone traps, scouting, and encouragement of beneficial insects and birds), but more frequently they advised spraying the latest pesticides. Subsequent interviews and e-Sagu reports indicate a movement toward emphasizing IPM and Integrated Nutrient Management (INM). The project's in-house evaluation reports began to recognize IPM as a guiding philosophy, even taking adoption of IPM methods as a measure of the project's success (Rao et al. 2006).

A key factor in these changes was the team leader's increasing experience with cotton farmers and his growing conviction that the farmers' heavy pesticides use was their root problem. Since AEs were now receiving much of their training at e-Sagu, it was possible to harmonize the cultivation philosophy around the theme of reducing pesticide use, both through actual training of AEs and daily interactions among the staff. In 2008, one senior staff member told me that the farmers' chemical philosophy was "a Frankenstein that is destroying the environment." The problem was that it had not been shaped by the *farmers'* culture of agriculture; on the contrary, the e-Sagu philosophy had developed partly as a corrective to the farmers' penchant for spraying insecticides in their perennial war with pests; the e-Sagu staff was not only outside of the social nexus of agricultural decision making, but it had staked out a position that was unpopular among most farmers. Their advice developed little traction. In 2008, a senior staffer told me bluntly that farmers continue to demand chemicals to kill insects and that they generally regard e-Sagu's recommendations of IPM methods as "rubbish." Thus, after starting with a paradigm of perspective-free advice, e-Sagu came to endorse a specific approach to cotton farming—unfortunately, a perspective that was incompatible with entrenched local attitudes. Although there obviously were instances of AEs

diagnosing and recommending cures for agricultural problems,⁸ the larger picture was not so much one of an electronic pipeline delivering desirable information as one of a clash of cultures.

Shifting Definitions of Success

Learning how to manage a farm and advising others on running farms are complex processes with major sociocultural components and this account has shown how the beginnings of e-Sagu were more of an unproductive collision of these sociocultural components than a productive transfer of technical or skill. This account is clearly inconsistent with the widespread recognition of e-Sagu's success. Reports on and evaluations of "dumb information" interventions have shown some signs of positive impacts; as noted above, e-Sagu also claimed a record of glowing impact assessments that were lauded in the press (*Deccan Chronicle* 2005a). The empirical assessment clearly requires further attention.

Given the original conception of the project, the ultimate yardstick of success would be a reduced farmer suicide rate, but this is impossible to isolate. Many factors affect suicide rates; the disputes noted above barely scratch the surface (Stone 2007b). Even the suicide act itself is open to interpretation: it may be seen as an escape, a desperate move to obtain a cash payment for the family, or even as a communicative act (Kantor 2008). More to the point, the spatial and temporal dynamics of suicide among Indian farmers are very poorly understood; for instance, in the years following the well-publicized 1998 suicide spike in Warangal District there were smaller spikes in Guntur and Kurnool Districts, none of which can be clearly linked to local causes. Various developments also confound any attempt to isolate effects on suicide rates; for instance, e-Sagu began operating around the same time that a new Congress Party administration was elected to the state government claiming it would end farmer suicides.⁹ E-Sagu also coincided with the adoption of genetically modified cotton, which has been blamed by some for suicide among cotton farmers.¹⁰

A less ambiguous assay would come from the comparative assessments that e-Sagu commissioned. Reddy and Ankaiah (2005) assert that e-Sagu advice raised yields 30–50% between 2003 and 2004,¹¹ although offer no information on how the samples were selected. In 2005, an evaluation was conducted by Centre for Environmental Studies (CES), a small Warangal NGO that had helped get the project started in Oorugonda.¹² In this report, Reddy et al. (2005) also compare farmers' experiences in 2003 (data collected prospectively) and 2004 (the first year of e-Sagu). They found

that while participants in all three e-Sagu villages lowered fertilizer applications, two villages actually *increased* pesticide sprayings (although at lower costs, an oddity that goes unexplained); they also found two e-Sagu villages to have *lower* cotton yields in 2004. The authors admit that the analysis is problematic because it relies on farmer's recall of a whole year of inputs, and it compares two years in an environment where weather, pest attacks, and land cultivation patterns often vary sharply from year to year (Reddy et al. 2005a).

CES researchers also asked for farmers' perceptions of a range of issues, including how useful e-Sagu advice had been and how it had affected their inputs and yields. The perceptions of changes between the two years belie the report's own figures, as farmers claim that sprayings dropped and yields rose. Still, Reddy et al. (2005b) used the farmer perceptions to claim that e-Sagu clients saved an average of Rs. 3820 (\$95) per acre of cotton—a figure that has since been repeated in publications, presentations, Web sites (e-Sagu 2004), newspaper articles (*The Hindu* 2006), and flyers distributed to recruit farmers into the project. Total savings per farmer were claimed to be Rs. 11,240 (\$280).¹³ Reddy et al. (2005b) also compared e-Sagu farmers with a control group from non-project villages, in which the e-Sagu group had lower input costs and greater yields. Yet, the control group was randomly selected while the e-Sagu group was biased toward the prosperous, educated, and progressive farmers who would try such a service or be recruited by it; these farmers were also more than twice as likely to access newspapers, radio, and TV, and over ten times as likely to attend agricultural exhibitions and farmer training camps.¹⁴

In short, the empirical basis for e-Sagu's claims of positive impacts is highly dubious. The narrative of success appears to result instead from the appeal of e-agriculture in early millennium India, with its roster of vested interests. However, Oorugonda farmers were unimpressed and they dropped out in droves in the third year when e-Sagu instituted a fee (the funders had insisted on the project becoming self-supporting). The fee was small—an average of about under Rs. 500/year (around \$12.50) for a project claiming to provide Rs. 11,240 in economic benefit—yet less than a fifth of the clients agreed to pay for continued advice. The Oorugonda office closed after only two seasons. The farmers, an e-Sagu staffer lamented, had been “difficult to handle.”

However, e-Sagu itself did not fold; indeed, by 2007, it was operating in six new venues in Andhra Pradesh and there were hopes of going national. However, there had been two interesting and somewhat contradictory changes. First, the project had implicitly accepted that their advice would

not sell on its economic merits alone (their benefits analysis notwithstanding). E-Sagu therefore began to involve itself in the very sociocultural process of skilling it had denied in its conception of farmers merely needing a conduit to scientific guidance. New e-Sagu venues were chosen where the project had special powers of persuasion; for instance, one of the new venues was in the home village of the IIIT professor who founded e-Sagu. The Hyderabad staff began to visit fields themselves, to interact more with the farmers and develop rapport. They began to offer cooperative clients high praise and publicly award flower garlands. This development represents an interesting inversion of the more common pattern, documented in PUS literature, of lay citizens learning the languages and cultures of science to have the competence and credibility to influence medical/scientific institutions (Epstein 1995, 1996). In the case of e-Sagu, “agricultural experts” came to understand that agricultural decision making had a substantial sociocultural component that required them to adopt local practices to have local credibility.

The second change results from the decision by government funders that the academics’ job is developing technology and capacity, not retailing agricultural management; e-Sagu itself would have to concentrate on developing training modules and computer solutions and leave the running of advice centers to corporate or NGO partners. Given the continuing difficulties in getting farmers to pay for e-Sagu advice, this meant that field offices would need revenue-providing partners. For instance, the new e-Sagu center in Malkapur, Warangal District, is jointly operated with an Indian conglomerate that sells agricultural inputs, and its office doubles as a seed, fertilizer, and pesticide shop; it also offers loans (figure 5). The Andhra Pradesh state government has been trying to establish a network of village Internet centers, and the future of the e-Sagu experiment is likely to be some form of merger with this network. Eventually, there are expected to be dozens of field offices operated by partners, most of whom will aim to sell goods (such as pesticides) and services to farmers.

Conclusion

“Everything eventually morphs into the way the world is,” as an organic food executive assured Michael Pollan (2006, 152). The question, of course, is just how the world is, with its new “social relations of information capitalism.” This look at one of the world’s spikiest landscapes, and at an attempt to leverage that spikiness by saving suicidal farmers with advanced ICT, suggests two answers. The first concerns the complex and fraught relationship



Figure 5. E-Sagu staff in the Malkapur office. They are posing in the outer room which doubles as a pesticide shop. The office is also sponsored by a bank that makes agricultural loans.

between the farmer and the seemingly inexorable forces of commodification. After its first few years on generous government support, e-Sagu was increasingly involved in commodification of farm inputs, both in its partnering with input vendors and its increasingly serious attempts to get farmers to buy its advice as a commodity. The need to develop hybrid commercial and non-profit organizational forms to keep Last Mile projects afloat has emerged as a theme in India (Kaushik and Singh 2004). However, e-Sagu's emergence as an agent of commodification is ironic in this regard, given that its original target audience was the small and marginal farmers who dominated the suicide lists, who were thought to be the most bereft of technical information. These are also the farmers least able to buy agricultural inputs; in fact, debts to input vendors were the leading proximate cause of the suicides (Reddy and Rao 1998).¹⁵ In this, e-Sagu is hardly unique. In Kerala, Kuriyan and coworkers too found the Akshaya Project ran into a marked contradiction between the goals of profitability and development; rural ICT kiosks struggled to turn a profit, and kiosk operators catered to the middle-class customers. The rural poor, who were the intended beneficiaries of the kiosks, were rare users

(Karnani 2006; Kuriyan, Ray, and Toyama 2008). Echoes may even be found in the U.S. Country Life project noted above, which was propelled largely as mechanism to induce greater use of agricultural inputs.

But just as important, although probably less appreciated, is the lesson on the cultural nature of agricultural knowledge among the farmers and the “experts.” By assuming an external scientific source of agricultural skill, e-Sagu was unwittingly based on an extreme acultural model of external scientific expertise. However, agricultural skilling in rural India is in many ways a sociocultural process. This is not necessarily an impediment to successful cultivation, but it poses a fundamental problem to an external skilling system designed to bypass the skilling process and directly guide the farmer to cultivate “like an agricultural scientist.” E-Sagu’s own evolution reflects this reality of the sociocultural nature of agricultural skill. This is neatly encapsulated in the image of the e-Sagu “expert” publicly awarding a flower garland to a farmer who had followed their advice. The garlanding was entirely social, meant to encourage admiration of the e-Sagu client, and the reason this was happening in this particular village was social as well: this was the home village of the e-Sagu director, where the project felt it would have great acceptance. The experts, meanwhile—originally conceived as agents of an advanced agroscientific establishment lacking only a conduit to the last mile—actually had to be trained by the managers of the conduit, and trained into a particular philosophy that had evolved locally in the e-Sagu office.

Notes

1. Florida (2005) depicts “spikiness” using levels of nighttime light as a proxy for economic production. However, agriculture, India’s largest productive sector, is not indexed by light, nor is the spikiness that here refers to opportunity, access to resources, and health of the economy.
2. See the articles on their corporate Web site (e.g., *Times of India* 1999) and statements by Monsanto officials (Vidal 1999).
3. This institution has no connection with Indian Institutes of Technology (IIT), India’s famous network of national universities, a branch of which was opened in Hyderabad in 2008.
4. E-agriculture projects have continued to appear through the late 2000s; a recent one is the NetHotzone program begun in May 2008 at Gujarat agricultural fairs, which provided free Internet kiosks designed to help farmers get price information and to “bring about a sea change in agrarian economy” (*ThaiIndian News* 2008).
5. The Chennai-based n-logue project, which established fee-based Internet kiosks, claimed to offer “expert advice on better farming techniques and solutions to

crop and animal diseases” along with government documents, astrology, and weather and market information (n-logue 2007). However, n-logue users were largely on their own to get advice via e-mail and videoconferencing. Sponsored by agricultural inputs giant Nagarjuna Group (with backing from the World Bank), the iKisan initiative established village technical centers operated by agricultural graduates who mediated electronic resources for paying customers (Meera 2002; Meera, Jhamtani, and Rao 2004). These operators had access to agricultural databases they could use to look up material for farmers and, it was claimed, provide advice where appropriate.

6. Dove's (2000) account of the adoption and evolution of rubber cultivation by Indonesian smallholders demonstrates how agricultural skilling involves a complex negotiation of ecological constraints, economic demands, and social considerations. The “successful production of rubber knowledge” among Kantu farmers was an agricultural performance in which basic planting decisions were inextricable from scheduling, market involvement, land tenure, and gender relations. The Kantu case also underscores how innovation adoption is less passive than assumed; integrating an innovation into local practice can itself be highly innovative. For a contrasting view on hybridity in agricultural knowledge, see Gupta (1998).
7. Some of the farmers were blunter. In one village near the e-Sagu project, a key informant of mine is an educated and highly intelligent farmer reputed to be “scientific;” yet, he said he would have no interest in e-Sagu advice because agricultural experts “all just say whatever they want” (Telugu: *everikivachinathu varu cheppinaru*) and routinely disagree with each other.
8. A diagnosis by one of its staff led to e-Sagu being embroiled in controversy in its first year. In 2004, there was an unusual mid-season of outbreak grey mildew, a fungal disease that is normally a minor problem only late in the season. It was diagnosed incorrectly by local and state agronomists, but correctly by the team leader at e-Sagu, who eventually went to the press when he was unable to convince any officials to endorse the correct treatment. This led to hostility between e-Sagu and officials. This mildew outbreak was also seized by anti-biotechnology groups, who blamed it on the new Bt cotton seeds. This claim was repeated in headlines, even though a government study found the disease to affect Bt and conventional cottons alike (Sharma 2005). Thus, by being right, e-Sagu managed to alienate both the green NGO sector and the agronomic establishment.
9. Less than a year later, the chief minister conceded that there had been 1,289 farmer suicides since he took office, 679 of which were “genuine” (*Deccan Chronicle* 2005b).
10. Those blaming suicide on GM cotton include Vandana Shiva (2008) and Prince Charles (Lean 2008), although the empirical basis for the claim is dubious (Gruère, Mehta-Bhatt, and Sengupta 2008).

11. The cotton season often straddles two calendar years: seeds are typically planted in late June and may be harvested as late as March. To make the discussion less cumbersome, I refer to cotton seasons by the year the crop was planted.
12. Disclosure: I have collaborated with this NGO in two surveys of Warangal farming.
13. No measure of dispersion is provided, although this is probably more important to the farmer than the mean (Stone 2007a).
14. This is hardly the only study to have been unable to clearly isolate impacts of agricultural extension. Since it is unrealistic to have random treatment and control groups for farm management, participants are invariably a biased group. For example, Sulaiman et al. (2005b) studied a Tamil Nadu on-farm extension project, in which the self-selected or invited client farmers were significantly larger and wealthier than non-clients.
15. This irony is not lost on the thoughtful scientists who started the project; the founder of the project pointed it out wistfully to me in 2008.

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