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Assessing Network Applications for Economic Development

Sustainable Access in Rural India (SARI) Project

Pilot Phase Assessment – Madurai District, Tamil Nadu, India

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Executive Summary

Client

The following PAE has been prepared for the Information Technologies Group within the Center for International Development (CID) at Harvard University and the Media Laboratory at MIT.

PAE Team's Objectives

- Create a survey instrument to assess the impact of technology intervention in rural India
- Advise on potential applications for village-level Internet terminals

The aim of the Sustainable Access in Rural India (SARI) project is to improve the lives of individuals in poor rural communities by leveraging information and communications technologies to facilitate economic development. Ultimately, the project's success will be measured by its social and economic impact and viability, which depends critically on the appropriateness of applications provided to end-users.

Our conclusions and recommendations concerning applications are as follows:

A **price application** that posts the daily price fluctuations of certain goods in order to promote competition among sellers and improve the economic decision making of villagers and traders may not increase efficiency or further economic development; its effectiveness depends critically on geographic scope and a focus on goods whose prices exhibit sufficient price volatility and differentiation. We recommend a central web site-based price application, with independent kiosk operators responsible for inputting price information from villages in which markets exist.

A **spot labor market application** that aggregates supply and demand of jobs for clusters of villages holds much promise—there are potential benefits from coordinating labor markets in the area studied. The relatively constant need for work coupled with unmet demand suggests that there is a significant willingness to pay for a service that matches supply and demand for labor in a timely and accountable way. We recommend a bulletin-board type labor market application that connects small numbers of nearby villages.

An **agriculture application** that addresses the basic knowledge needs of farmers, providing weather forecasts and information on farming techniques must include tailored content, given the diversity of crops grown and methods employed throughout the region. We recommend a local content creation mechanism, facilitating farmer access to agricultural expertise via simple voice or text communications, or a more robust web-based application.

Deficiencies in the current state-provided healthcare infrastructure may limit the initial impact of IT within local Public Health Centers (PHCs). Instead, we suggest a **health care application** that delivers information and services to villagers directly through community centers.

Based on villager awareness levels and needs, we recommend a **government services application** that would enable villagers to access information on relevant government programs and initiate online requests for necessary government documents.

While applications to facilitate **education** (particularly adult learning) may be useful, there appear to be significant implementation barriers at the school level.

The motivation for these proposed applications stems from several regional attributes, inferred from local economic data and extensive interviews with villagers, school representatives, health workers and NGO staff members:

- Many if not most villages exhibit segregation along religious and/or caste lines.
- While some data is readily available and disseminated (e.g., prices of heavily traded goods), other potentially critical pieces of information are not easily accessible to villagers (e.g., livestock prices, agricultural advice, government programs).
- A majority of all economic activity either directly or indirectly involves agriculture, and much of a typical villager's social activity relates to agriculture.
- A majority of laborers are without a regular source of employment—unemployment is extremely cyclical, reaching high levels during the agricultural off-season.

Introduction

Technology and Development

The potential link between knowledge and economic growth leads proponents of IT for the developing world to argue that improved access to quality information can deliver tangible benefits to even the poorest of the world's poor. Yet despite their promise, Information and Communication Technologies (ICTs) are only slowly taking hold in developing countries, relative to the pace of their Western counterparts. Wilson and Rodriguez observe a significant disparity between sets of countries: "The evidence shows a gap between rich and poor countries' access to ICT that is staggering. While the average OECD country has about eleven times the per capita income of a South Asian country, it possesses 40 times as many computers, 146 times the mobile phones, and 1036 times the Internet hosts."¹

Coupled with an extreme sense of urgency, this divergence has sometimes led to ill-planned, indiscriminate adoptions of technology in different areas. As Grace et al. note, "technological change moves so quickly that it often surpasses substantive analysis, leading to an over-reliance on anecdotal evidence as justification for ICT projects. This in turn can lead to poorly designed programs and haphazard implementation schemes that do not account for local conditions, resulting in projects which fail to meet their objectives or may even harm the welfare of supposed beneficiaries."²

Purpose of this Report

One of the several aims of the Sustainable Access in Rural India (SARI) project is to avoid this potential pitfall by providing an analytically sound justification for IT intervention in poor rural villages. Written under the supervision of the Media Laboratory at Massachusetts Institute of Technology and the Center for International Development at Harvard University, the following report attempts to support this aim by introducing context-specific surveys and incorporating field research into the choice and design of applications and services.

¹ Wilson, Ernest J. Are Poor Countries Losing the Information Revolution? (InfoDev Working Paper, May, 2000)

² Grace, et al. Information and Communication Technologies and Broad-Based Development: A Partial Review of the Evidence (Draft, Feb. 14, 2001).

Organization of this Report

- Section II (Background) describes the circumstances of the SARI project, detailing its objectives, organization and choice of technology
- Section III (Problem Definition) explicitly characterizes the problem addressed by this report, namely the issue of choosing and designing initial applications to be provided with Internet connectivity
- Section IV (Survey Design & Objectives) explains the rationale for and method of local data collection
- Section V (Specific Applications Sections) leverages preliminary data to assess the value of suggested applications and to raise potential implementation issues
- Section VI (General Implementation Issues) addresses several concerns common to the implementation of any application

Background: The SARI Project and Pilot Phase

About SARI

The rationale for the Sustainable Access in Rural India (SARI) project is to demonstrate rigorously, rather than anecdotally, the efficacy and sustainability of Information and Communications Technologies (ICTs) in a rural poor setting. By providing Internet connectivity coupled with useful and innovative applications and local content, SARI seeks to enhance the lives of individuals in these disadvantaged communities by improving information flows and facilitating social and economic development.

Sponsored jointly by the Media Lab at Massachusetts Institute of Technology, the Center for International Development (CID) at Harvard University, the Indian Institute of Technology, Chennai and the Internet Business Capital Corporation (IBCC), SARI will provide Internet access to approximately one thousand rural villages in two locations: the Madurai District in the South of India and Hazaribagh District in the North.

SARI intends to leverage the network effects from establishing connectivity among a wide range of users. By creating viable business models premised on the aggregation of demand in dispersed rural areas, the project will be able to validate its sustainability, and encourage similar initiatives worldwide.

About the Pilot Phase

On a more modest scale, the pilot phase of SARI entails the creation of approximately 50 new connections in villages in the Madurai District of Tamil Nadu.



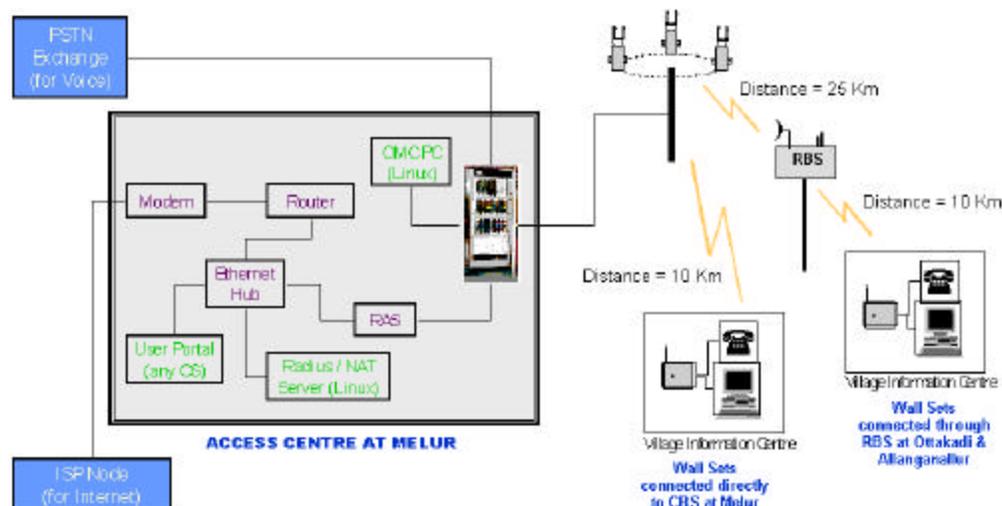
Of the 13 development blocks that comprise Madurai, villages in 7 have been targeted for the pilot phase. Approximately half of the land in the selected areas is dry land—the other half is irrigated. Selected villages lie roughly within a 30-km radius to the northeast of Madurai City. All 50 villages have relatively good infrastructure, with roads leading to the larger cities. Electricity is available in most villages, though not wholly reliable, and there is limited telephone access in each village, typically beset with managerial and/or technical difficulties.

Technology

The process of providing simultaneous telephone and Internet access to the villages has begun as of February 2001, led by n-Logue, a local ISP. Internet services will be provided through an ISP license and will be enabled by leasing bandwidth from BSNL³ in Madurai.

Voice will be provided by operating a Rural Group DID-EPABX (Direct Inward Dialing EPABX) in the area. This feature will be enabled by leasing E1 (2.048 Mbps) lines from BSNL. In the first stage, a DIU (DECT Interface Unit) will be installed in Melur taluk,⁴ which will cover the areas in and around Melur and Ottakadi. A Relay Base Station (RBS) will be installed in Alanganallur to provide services there. Eventually, a second DIU will be installed in Alanganallur. All voice calls will be handed over at the local exchange. In the first phase, 50 connections will be provided along with handsets and PCs.

A kiosk will be set up to service the needs of the people in each village chosen. Separate connections may be provided to schools, colleges, primary health centers, etc.



Source: Sustainable Access in Rural India: Voice and Internet Services in Madurai District. <<http://www.tenet.res.in/rural/sari.html>>

³ Bharat Sanchar Nigam Ltd., formerly the Department of Telecommunications. ISP and Voice provider in the area.

⁴ A division of the revenue district. There are 7 taluks in Tamil Nadu.

Local Support

The DHAN (Development of Humane Action) Foundation, a Madurai-based NGO, is the acting liaison between the villages and implementing organizations/research institutions and will help both in introducing the new technology into villages and in training personnel to manage the various Internet connections. Given the deep trust DHAN has fostered among these villages, its local expertise and relationship building capacity, it will be critical both in facilitating implementation and in identifying potential issues.

Defining the Problem

The stated mission of the SARI project is to “improve quality of life among the rural poor by enabling and creating new opportunities in education, health, economic development and community through the appropriate use of ICTs.”⁵

Fulfillment of this mission depends critically on the provision of widespread Internet access along with useful and relevant applications. Based primarily on fieldwork conducted in rural Madurai, the intent of this report is to begin to resolve questions of *application choice and design*. Given Internet connectivity, we ask:

Which applications would enhance social and economic development and be most valuable to the rural poor? Cultivating interest, awareness and willingness to pay for Internet services is important for sustainability and entails careful consideration of villager needs and capabilities. However, appropriate and effective introduction of the technology into local life and culture is just as important when considering social and economic development. Combining our field research with analysis of previous technology implementations in developing countries and data concerning commodity price fluctuations, health care statistics, literacy levels, etc. we identify and provide justifications for six applications that focus on Prices, Labor, Agriculture, Health Care, Government and Education.

What factors influence the design and implementation of these applications? This report describes how various applications and supporting processes might function to improve the distribution of information both among rural villagers and between villages and urban areas. Given prevailing economic and social frameworks, we pose operational concerns and solutions as well as specify incentive structures for technology users.

⁵ SARI Concept Paper, October 2000.

Survey Design and Objectives

In addressing application choice and implementation, the role of the PAE team within the SARI project has been:

- To create a comprehensive and appropriate survey instrument with which to measure the economic and social impact of any technology intervention undertaken by the SARI project
- To evaluate candidate information applications based on their potential to aid social and economic development in the region

To accomplish these tasks, we created the survey instruments (attached in Appendix II) and collected preliminary data from households, schools, health clinics and markets detailing information needs, demographic characteristics and communication patterns and profiles of the target population.

The data from the future administration of the survey will serve two functions:

- To create an economic baseline for the purpose of gauging the effectiveness of the SARI technology intervention, and
- To inform design decisions on local applications and content

Creating an Economic Baseline

The household survey will be used to determine the socio-economic baseline of the pilot communities. It aims to capture some key initial information from a large-scale, random sample that will help us track the effects of IT on economic and social indicators as the survey is repeated at different periods. The Information Technologies Group at CID plans to administer 100 to 200 surveys prior to the introduction of IT infrastructure and applications into the communities. Such survey analysis requires a sample of 400 to 800 people, based on a family size of 4. The total population of Madurai District is 3.5 million, of which 2 million are in the rural areas.

To control for external factors that may influence socio-economic indicators but are *unrelated* to IT intervention, the survey will be administered periodically. For example, the fact that this is an election year in India is an exogenous factor that will influence the well being of the communities, as incumbent politicians invest disproportionately to gain votes. Similarly, the analysis will control for unexpected variants such as the weather (droughts and floods) that might affect agricultural yields.

Analyzing the present socio-economic dynamics of the target populations will also help us to understand where the most prevalent market inefficiencies exist, and will inform the choice and design of applications. ⁶

Each section of the survey aims to gather specific information about the socio-economic situation of households, test hypotheses about the potential impact of IT in these communities, and evaluate those impacts over time (see below).

Informing Application Design

The second objective of the survey and analysis is to provide *a large scale, comprehensive needs assessment of villages being considered for the pilot project in order to guide the design of applications and the choice of information services distributed over the network.*

A *systematic* approach to needs assessment can facilitate design, pricing and content decisions. A comprehensive survey can:

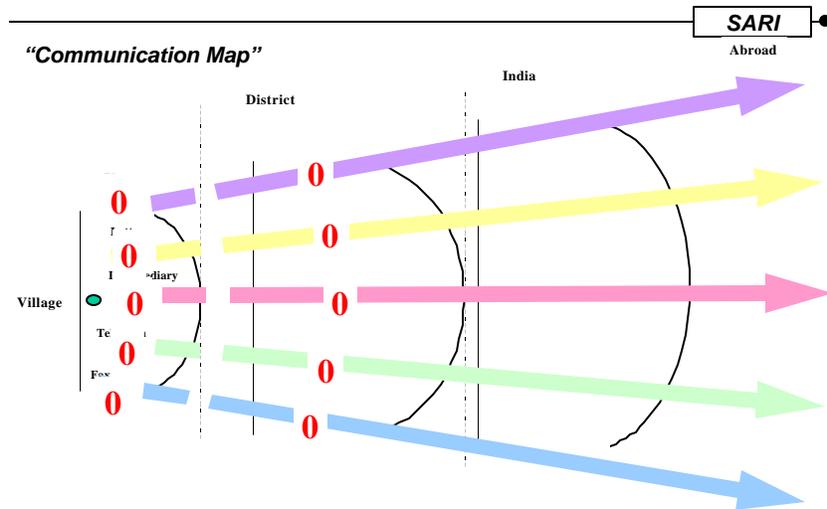
- Avoid decision-making based on merely anecdotal evidence and impressions about the region and its needs.
- Create a better understanding of the differences in needs across regions and villages.
- Detect regional trends in information use.

An Example:

From the survey data, we expect to broadly understand the information and communication profiles of the villagers in the area just north of Madurai City. From this data we can create a *map* of the communications that take place from a particular village and the frequency with which particular modalities are used to conduct these communications. As we aggregate this data, we create a rich picture of the current communications taking place in that village.

⁶ The next section will explain how the survey instrument will also help us understand the design of the applications.

Figure 1 shows a communication map that illustrates a particular village’s communication profile.



The communication map simply describes the number of people who use a particular communication tool to communicate to the block level, the district level, outside of the district but within India, and abroad.

From this analysis, we can learn about::

Area of learning

Cost Reduction / 'Willingness to Pay'

Purpose of communication

Type of communication

Design principles

- High rates of international phone calls suggest high willingness to pay for international communication and an opportunity to significantly reduce communication costs.
- High rates of telegram and fax use to a particular region may suggest high urgency communications for specific purposes.
- Urgency affects design
- Low rates of letter writing may predict difficulty of written communication and highlight the need for voice communications provided over the network.

Survey Rationale

As described, the purposes of the survey instruments are:

- To create a baseline of social and economic indicators to conduct a long-term evaluation of technology interventions undertaken by the SARI project
- To collect systematic data for a large scale needs assessment to guide the design of applications

Toward this end, we have devised four basic survey instruments with which to collect data:

Household Survey – designed to collect demographic and economic data, communication profiles and information needs assessments from villagers to whom information services might be offered.

Community Survey – designed to collect village level data on available infrastructures, ethnic and social proportions within a village, community dynamics and potential information needs.

Organization Survey(s) – designed to deliver capacity assessments, design requirements and information needs assessments of schools, health clinics, Internet cafes and other relevant organizations.

Market Survey – designed to track price fluctuations of key commodities in local markets over time. The purpose of this survey is not only to inform the design of potential price dissemination applications but also to test, over the long run, price convergence across markets as price information is more broadly disseminated. The law of one price indicates that as markets become more efficient, prices should converge across them.

Analysis of Applications

Analysis

In analyzing potential network applications for use in the Madurai Pilot Phase, we evaluated several criteria in order to:

- *Determine whether a candidate application would be beneficial for social and economic development in the region*
- *Recommend models of implementation that maximize the efficacy of applications*

Methodology

In order to draw conclusions about the impact and implementation of candidate applications, we employed several research methodologies including:

- *Literature and program review.* We surveyed the literature concerning wireless in local loop technologies, the implementation of networked information systems in developing countries, other pilot projects involving networked information kiosks in developing countries, Madurai specific demographic data, studies detailing economic and social development in rural Madurai, Indian telecommunication regulations and legal frameworks, and Tamil Nadu specific literature outlining government networking programs and recent telecommunications and ICT initiatives in the area.
- *Fieldwork.* We traveled to Madurai for a two-week fieldwork exercise to interview villagers and workers within different NGOs, schools, health clinics, hospitals and Internet cafes.
- *Data analysis.* We collected data to test the results of our fieldwork. For example, in order to analyze the price application, we tracked daily price volatility and differentials of heavily traded commodities in Madurai District over the last two years.
- *Initial survey results.* In addition to focus groups and pre-tests, we administered the full household survey to a limited number of initial respondents. Our recommendations reflect the outcome of those survey results. However, the sample size available after two weeks of fieldwork was not large enough to return valid statistical results. Our purpose in constructing the surveys is to create analysis tools requested by our client for use in more robust future analysis and program evaluation.

Structure of Recommendations

Our recommendations attempt to evaluate candidate applications' impact on social and economic development, their potential financial sustainability (as indicated by the demand for such services and the

willingness of villagers to pay for services) and implementation and design strategies that can maximize their efficacy.

We begin our analysis by defining the application, stating the summary of our conclusions and defining the assumptions of each model. Next, we summarize the results of our fieldwork, present a potential model of the application's design, and discuss operational specifics of implementation (both technical and social). Finally, we conclude by describing potential limitations to our model.

Price Application

Definition

A price application would post the daily prices⁷ and fluctuations⁸ of certain goods in order to promote competition among sellers and improve the economic decision making of villagers and traders. Competition should equalize prices across markets, reduce search and distribution costs for traders and villagers and ensure that they get the best available price.

Conclusion

Based on data collected during our fieldwork, a price-based application localized around the Madurai District alone will not significantly aid economic or social development efforts.

In principle, price-based information services can create efficiency, equalize prices across different markets and regions and improve living standards. If prices are transmitted efficiently and if market access exists, information inefficiencies can be overcome, and villagers and traders can take advantage of competition and improve their living standards. However, in the Madurai District, market access is limited, the geographic scope of price arbitrage is too large, transportation costs are prohibitive, informal communication channels transmit prices fairly well now and only certain product prices fluctuate daily. These constraints will prevent a localized price application in Madurai from having a significant impact on development.

An expansion of the geographic scope of the price application, however, such that market access was higher and distribution costs were not prohibitive, could help improve efficiency and living standards.

Furthermore, access to price information must be equitable in order to avoid promoting elitism and a widening of income disparities in the region. If access to price information is limited to large farmers or traders or if the price of information services is prohibitive, there is a real danger that price information could improve returns for those with access at the expense of those without. Creation of a useful price application depends on:

⁷ The exchange rate as of January 2001 stood at 46 Indian rupees to the dollar.

⁸ The price application could post daily prices and the fluctuations of those prices over time. Daily prices would give the most basic information about where to maximize revenues. However, fluctuation data could also teach villagers which are the best crops to grow at different times during the year and when to sell crops during the year.

- *Choosing a geographic scope of information distribution that is sufficiently large.* In order for the application to be successful, the region in which prices are disseminated must have a fair degree of access to different markets. In addition, we should observe price differentials within that region that demonstrate the existence of market inefficiencies.
- *Choosing the right products for price dissemination.* Candidate products for a successful price application are those whose prices differ across suppliers and whose prices fluctuate at least marginally.
- *Creating incentives to post and use information.* Without the proper incentives in place, it is unlikely that sellers will post price information or that traders and villagers will pay to view that information. Any price application must be designed such that incentives to use the system are maximized.
- *Creating equitable access to the information.* Unless access is equitably distributed, a price application could further inequality and income disparities. Therefore, an important facet of a successful price application is universal access.
- *Recognizing and addressing currently existing social divisions, power relationships and communication norms.* In order to ensure that technology interventions are appropriate and effective, any SARI implementation must meaningfully consider the current structure of social organization and life in these villages.

Assumptions

Assumptions critical to this hypothesis are:

- Prices vary across different markets
- Prices fluctuate at rates that make them exploitable
- Market choice exists – i.e. that there is competition among different markets and that farmers have access to several markets where they can buy and sell goods
- Farmers are rational price takers
- Price information is poorly transmitted now

Results of Fieldwork: Creating a successful price application for Madurai District

During the course of our interviews in the field and our discussions with the DHAN Foundation, we came to several important preliminary conclusions about the applicability of price information in aiding social and economic development in rural India and about design principles critical to success in Madurai District. We have divided these findings from fieldwork into supporting characteristics and challenges.

Findings that support a Price Application

Information may equalize price by controlling larger regional price variation. During our fieldwork, we discovered that local price variation was small and that limited market access makes price variations difficult to exploit. However, we also discovered that arbitrage does occur at a larger regional scale. Some respondents described situations in which traders from the north came to buy cheap agricultural goods in the south for distribution at a profit in the north. The existence of arbitrage may indicate the viability of price applications implemented at larger regional scale. However, despite the potential efficiency gains a price application may offer, certain physical realities still exist; and it is entirely possible that traders provide valuable economic services (e.g., transportation) and derive reasonable rents as a result. Thus, regardless of application design, the transportation intermediary will still be a necessary component of the process.

Evidence of greater price variations and the existence of arbitrage opportunities at larger regional scale indicate that a price application may exhibit strong network externalities. The more regions and markets that input prices, the more valuable the information is to those with access. If only a few market's prices are listed, the efficacy of the application is reduced, especially when the geographic scope of true price variations is large.

Information may aid decision making if market opportunities are not limited. Although our research revealed certain limitations to the applicability of price information to sustainable development at the local level, our experience is limited to the region just north of Madurai City. In localities where access to markets is greater, price information may be useful to villagers for securing lower prices for inputs and consumer goods and higher prices on what they produce.

Information may empower those with storage facilities – storage may improve the effectiveness of price information. An important discovery made during our research was the importance of storage facilities in enabling farmers to take advantage of price fluctuations. Several farmers recounted stories of situations in which delays in agricultural production harmed crops or agricultural products. In addition, we heard of several instances in which farmers stored rice or grains in order to wait and sell their products at a higher price. When combined with data that suggests that prices fluctuate seasonally and that daily volatility is limited, these observations may demonstrate that in order to exploit price fluctuations for greater economic return, farmers may have to store grains for longer than a few days. In this case, storage facilities may buttress information services aimed at delivering price information that helps farmers maximize their profit or minimize the costs of household expenditures.

Prices of less frequently traded items (livestock) are poorly communicated. Prices of livestock are generally harder to determine and vary geographically as well as seasonally. In addition, transactions involving

livestock employ more barter-related trading mechanisms that have less stable price inputs. Due to its high price differential, volatility and inefficient price communication mechanisms, livestock is a prime candidate good for price dissemination.

Benefits vary geographically. Typically, different localities have varying access to markets and information. In different regions, the effectiveness of the price application will vary accordingly. This variation is another reason to conduct comprehensive survey analysis in regions where the project will be implemented.

Challenges to a Price Application

Market access is limited. A critical assumption of the appropriateness of a price application is that there is access to markets that will allow villagers to exploit variations in price. However, our fieldwork in N. Madurai revealed a distinct lack of such market access. In fact, the only market available to these villages is the Melur market. Agricultural goods are aggregated among several villagers and taken there. In some cases, if prices are not reasonable there, goods are carried a bit further to the Madurai market. However, these cases are rare. There are no other accessible markets nearby between which villagers can choose. As such, price information may be less relevant at the individual village level in Madurai.

Informal communication transmits prices now. Typically, market price information is transmitted by villagers who went to market the day before. Price information is then transmitted among villagers through informal communication channels. These informal communications currently transmit price information for most heavily traded goods (especially those whose price fluctuate less). As such, a localized price application (which only transmits local prices) is less valuable for individual villagers than originally expected.

Prices typically fluctuate seasonally. Our interviews revealed that prices of most consumer goods and agricultural inputs exhibit little daily price volatility, but vary seasonally. This lack of volatility again demonstrates the potential limits of a pricing application that delivers daily changes in price. However, the initial results also highlight the importance of the more comprehensive survey of market prices. To understand the comprehensive picture of how prices move in these markets requires time series data across several products. Some products exhibit high price volatility while others do not. In order to choose the right products for price dissemination, the products' price volatility and differential across accessible markets must be examined. The section titled "Choosing the right products for price distribution" summarizes a detailed analysis examining the volatility and differential for relevant products.

Subsistence farmers have difficulty exploiting price variation. Our fieldwork results found that some farmers saw themselves as subsistence level workers who do not make economic decisions based on profit

seeking strategies. This perception does not in and of itself implicate price applications either positively or negatively. Additional information could enable farmers to become profit seekers, and some farmers did seem to make profit maximizing economic decisions based on price.

Is price dissemination a realistic development strategy?

While certain challenges to the price application exist, examples of successful price dissemination using ICTs can be found in India. One such example involves the use of cell phones in fishing markets near Kerala in south India.

The Fisherman of Kerala – Example of a successful price application⁹

The use of mobile phones to disseminate price information to fishermen in India's southern state of Kerala improves fishing profits and makes distribution systems more efficient – demonstrating the power of a well designed price dissemination system. Individual farmers reported getting prices four times higher using mobile phones than using traditional selling techniques (12,000 rupees. vs 3,000 rupees), a significant improvement for a 28 billion rupee (\$600M) industry.

In Kerala, there are 17 landing spots around the Cochin area where fishing boats can sell their daily catch. Fish prices fluctuate daily and vary across these spots and across sellers in the same spot. Before BPL and Escotel introduced mobile phones to these markets, fisherman guessed at where the best prices were. Today, they call ahead, discover prices before choosing a landing spot and improve their profits by maximizing the prices they receive for fish.

When the fishing is good, mobile phones allow boat captains to call in their friends from less lucrative areas. Carrier boats, which take the catch to shore while the mother boat continues fishing, are now summoned only when there is something to deliver, conserving expensive fuel.

The challenge of equitable information dissemination. Typically, only larger fishing boats can pay for mobile phone access and smaller boats may be pushed back in the selling queue or disadvantaged (in terms of efficiency) by the more competitive economics of the larger boats who have access to price information. A price application must be designed with equitable distribution in mind in order to avoid perpetuating inequality.

Price access does not eliminate incentives for distributors and middlemen. The fish markets' middlemen – agents, handlers, traders and so on – are not squeezed out by the technology: They, too use mobile phones to find the best deals and maximize their return.

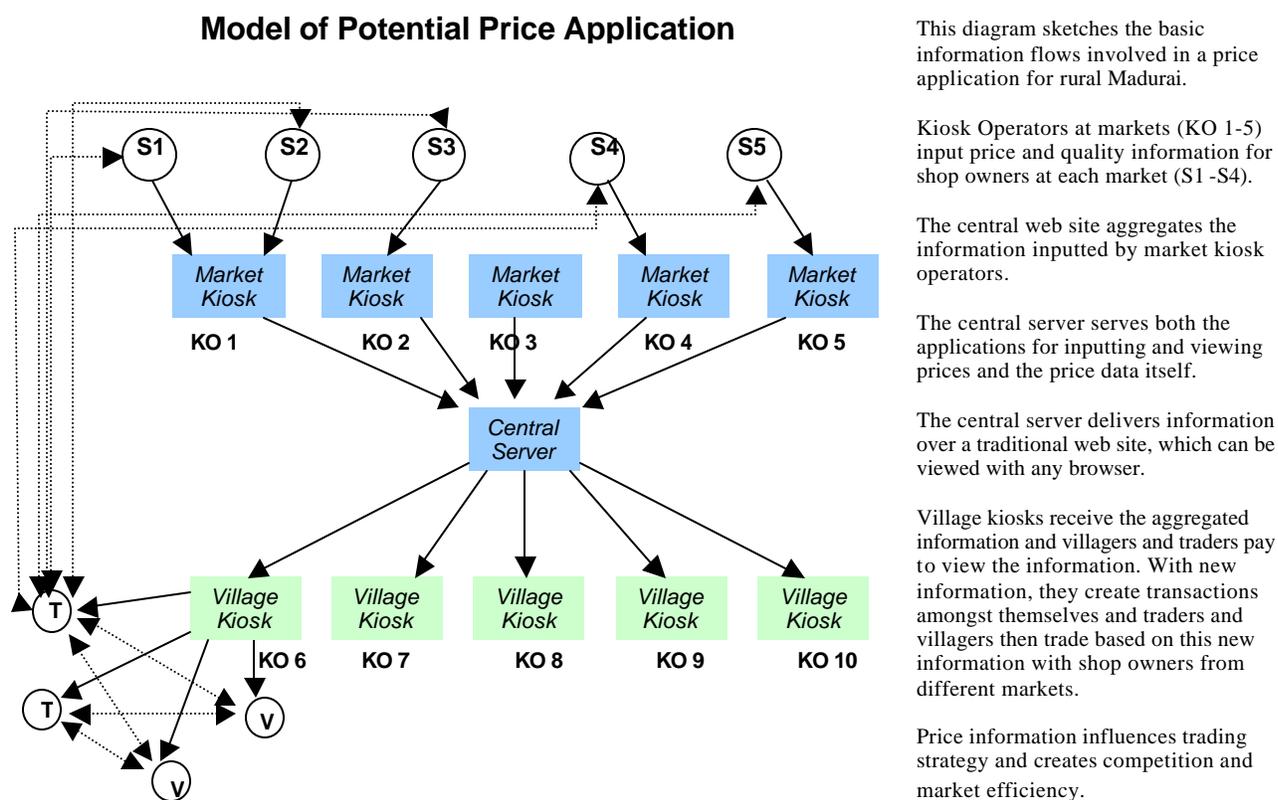
Description of application

We can envision a price application functioning over the wireless local loop such that prices are disseminated from market inputs to village kiosks on a daily basis. The price application would be web based, with kiosk operators responsible for inputting price information from areas in which markets exist. The information, both bid prices for agricultural outputs like rice and ask prices for commodities like milk, could be inputted by traders and shop owners.

⁹ The information in the example comes from The Economist, March 3, 2000 <www.economist.com>

Villagers, in turn should pay for access to the web site at their local village kiosk. Access to the kiosk entails access to the price application and any other application that exists. An hourly use rate, such as the one charged by current cyber café operators, would entitle a villager to use any application on the system. By our estimates the hourly use rates of cyber cafes in Madurai range from 50 rupees (US\$ 1.1) /hour to 100 rupees (US\$ 2.2) /hour.

Figure 2



Creating incentives to maintain and use a functioning price application

The success of a price application requires incentives for kiosk operators to input and maintain data at the kiosk and for villagers to pay for and use the information to make economic decisions. In order for the system to be useful, several key incentives must be addressed.

Incentives for sellers to communicate regular price information to the kiosk operators. As the amount and scope of the price data itself is critical to the success of a robust price application, the burden on sellers to participate in the system should be reduced as much as possible. There should be no cost to sellers to post price information in order to maximize the amount of data available. Sellers have a natural incentive to

input prices because the network provides free advertising about the quality and price of their products and helps them reach new customers. In addition, when combined with the kiosk operator's incentive to collect information, data collection should proceed fairly efficiently. We considered a model where sellers paid to participate in order to capture the advertising benefits of the system. However, minimizing the barriers to data collection is critical to achieving a data set that creates value to those making economic decisions based on price.

In addition, displaying prices over the web creates incentives for sellers to charge competitive prices, improving market efficiency.

Incentives for the kiosk operators at market to input prices to the system. Kiosk operators have an incentive to input prices in order to attract customers to their kiosks. The more comprehensive the price data, the greater the benefits for villagers and traders. However, a distinction should be made between the incentives of the kiosk operator at market and the kiosk operator in the village. The village kiosk operator's incentive to post local price data is relatively large as they will attract the majority of 'customers' who pay to view the information. However, the kiosk operator at market may have less access to potential customers and may be relied on to input price information. In order to address this lack of a strong incentive to input data, we propose a revenue sharing scheme between the market and village kiosk operators. Transferring some of the rents collected at the village level to the market kiosk operators may create greater incentives to input data.

Incentives for the kiosk operator in the village to sell access to the system. Hopefully, the incentives for the village kiosk operator are the easiest to conceptualize. The village kiosk operator has an incentive to sell access to the system to sustain their business. They also have an incentive to ensure that price data is comprehensive and timely. Their willingness to *share* revenues with the market kiosk operator (to ensure comprehensive and timely data) should be further investigated.

Incentives for villagers to pay for and use price information. The incentive for villagers to use the system depends on the benefits of the price application for their economic well being. If the price application successfully creates market efficiencies and raises living standards by improving incomes, villagers may be willing to pay a percentage of their income for access to the information. Finally, informal communication may reduce aggregate demand for kiosk services. If, after one person in a village has seen the posted prices, they communicate with others about them, the appropriateness of pay-per-use services may be compromised. This potential incentive dilemma is discussed under the "Limitations and issues to consider" section at the end of this chapter.

Incentives for traders to support and participate in the system. It is critical to ensure the involvement of traders within any price scheme. Their role in the distribution of economic products is essential to any scale efficiencies gained by villagers aggregating their grain production. During the early phases of any technology intervention by the SARI Project, the aim should not be to remove traders from the process, but to structure a system that creates incentives for them to contribute. This model creates incentives for traders in that competitive prices improve their returns as well as villager's returns. However, a perverse incentive to hoard information does exist. If villagers remained unaware of prices, traders could maximize their benefit from price competition and pass little to none of the benefits on to villagers.

A key concern in this regard is the distribution of returns between villagers and traders. At one extreme, traders could capture all of the value created by efficiency gains leaving villagers with little return. At the other extreme, traders could be cut out of the process entirely (although this scenario is unlikely considering the need to aggregate distribution services). This subject is addressed in depth in the section titled "Disintermediation / Reintermediation."

Choosing the right products for price dissemination

Choosing the right products for price dissemination can ultimately determine the success or failure of the price application. If the products are chosen correctly, chances of successful implementation increase.

There are three major criteria for deciding which product prices to disseminate. First, the product must be *commonly traded* in the area. Commonly traded goods will achieve the greatest impact for economic development. Second, the price should exhibit reasonable *volatility*. If prices vary on a daily or weekly basis, then price information can enable villagers and traders to sell products at the profit maximizing time. Finally, prices must differ across markets and regions. Large *price differentials* across markets reveal inefficiencies that can be corrected with efficient price dissemination. Knowing prices in different markets, villagers can seek the best price and thus create incentives for sellers to equalize their prices and generate economic efficiency.

We analyzed the volatility and price differentials for products commonly traded in north Madurai. The following table lists commonly traded goods, their expected daily price volatility and differential between competing markets. A successful price application must report prices of goods that exhibit high volatility and can expect the highest return for economic development from those goods whose price differential is high.

Data used to support conclusions in this table include extensive interviews conducted during the two week field study in Madurai and daily commodity price data from several sources reported over the last two years in Indian markets. The price data is reproduced in its entirety in Appendix III.

Table 1

Good	Expected Price Volatility	Expected Price Differential
Milk ¹⁰		
Rice		
Sugarcane		
Coconut		
Ground Nut		
Vegetables		
Feed		
Livestock		

 High
 Medium
 Low

Note: We use standard deviations over the various time series as one measure of the variation (i.e., price volatility) in a given data set. We calculated the percentage change in standard deviations between sets of data to calculate price volatility (exact calculations are in Appendix III). *Low* refers to price volatility between 0-10%, *Medium* between 11%-16% and *High* as higher than 17%. Calculated coefficients of variation and the assessed volatility for various commodities (which inform Table 1) are displayed in Table A2 at the beginning of Appendix III.

Operational Specifics

Based on our fieldwork, we have identified several design specifications critical to social acceptance of the application and efficient adaptation to existing communication modes.

Kiosk operators responsible for inputting prices must be independent. It is important for kiosk operators to be independent of sellers and act to maximize the benefits of the kiosk for its users. Prior linkages

¹⁰ Milk price volatility and differential is primarily limited by government regulations that set the price of milk in Tamil Nadu. Milk price setting reduces volatility and creates parity across seller prices.

to sellers or to groups within the village community could prove to reduce the efficacy or fairness of the price application by promoting certain sellers, distorting price information or discriminating by prioritizing access.

Standardized price and quality measures must be established. It is crucial that there is one format shared by the group of villages using the system to make sure that, for example, rice of quality A has a common definition.

Livestock price listings must post buyers and sellers because it is not a fluid market. It may be efficient to create a market for livestock instead of listing prices. As prices for livestock seem to vary greatly and change often, posting one average price may be less useful than creating a market that posts buyers and sellers and connects the two to create more efficient distribution of livestock. For these types of goods, villagers and traders may be willing to go to a different market for a significant difference in price.

Limitations and issues to consider

Equity. Equitable access to services should be a key consideration during the implementation of any application over the SARI network. However, the impact of a price application on income distribution highlights a particular need to carefully implement an accessible system. Unequal distribution of price information could disadvantage the poor as they are most likely to be the first excluded by either the prohibitive cost of price data or any potential discrimination by kiosk operators against the scheduled caste (although the likelihood of such discrimination cannot be determined by our fieldwork.)

Informal communication may reduce willingness to pay and impact financial sustainability.

Our fieldwork discovered a system of informal communication in rural villages that transmits price information. Although the accuracy of such communication has not been validated, the existence of such communication could create disincentives to paying for price information at the kiosk. Conceivably, villagers could obtain price information from the kiosk and informally communicate those prices to their villages, reducing demand for kiosk information services. Considering the kiosk operator's ability to appropriate value is important to the financial sustainability of the franchise model.

Labor Market Application

Definition

A labor application would aggregate the supply and demand of jobs in a cluster of villages. It would involve a database-driven Web site regularly updated by kiosk operators with job opportunities in the local area.

Conclusion

Preliminary analysis points to a labor application as one of the most beneficial uses of IT in North Madurai's rural areas.

There is a need for coordinating labor markets in North Madurai. Most villagers in this agricultural community rely on casual labor and are constantly looking for work. Coupled with an unmet demand for work, particularly during the dry season, this constant need suggests that there is a significant willingness to pay for a service that matches the demand for and supply of labor in a timely and accountable way.

A labor application would improve labor markets by aggregating information about opportunities in nearby villages. This application would overcome the distance limitation of finding work based on how far Kotths¹¹ or individual workers can travel. Such an application would best leverage the potential of the Internet by aiding coordination and reducing transaction costs associated with finding work.

Initial Hypotheses

The initial assumptions that drive this application are that:

- Labor markets do not work effectively due to lack of information sharing between employers and potential employees, and time inconsistencies in their searches.
- Coordinated information could expand job opportunities¹² and increase the productivity of economic endeavors (small farms getting harvested on time, faster development of construction projects, etc.)
- Finding employment is one of the major activities in the day-to-day lives of villagers, and casual labor is appropriate for the economic and social activities in this area.

¹¹ Kotths coordinate work opportunities for a group of villagers which pay them a fee in return. System will be explained more thoroughly later in the paper.

Results of Fieldwork

There is an unmet demand for work in N. Madurai. Preliminary research shows the inefficiencies that exist in the market: employers sometimes cannot find workers and their crops fail, while workers often sacrifice a day's wage because they cannot find work in a consistent manner. During survey pre-tests, 100% of those interviewed said they would work more if they could find work, especially during the dry season.

Laborers in Tamil Nadu have very little power to influence wage levels, and remain for the most part, unorganized. During the CPM's (Communist party) term in power starting in 1967, a series of comprehensive land reforms were implemented that aimed at formalizing labor relations, regulating wages and institutionalizing collective bargaining of agricultural workers. The legislative reform reduced the concentration of land, but was unable to eradicate unfair labor practices.¹³ Data collected from fieldwork in the Palghat region points to nominal wage rates that are twice as high as in the neighboring state of Tamil Nadu, where forms of 'unfree' labor are still common, and minimum wage laws are rarely respected.¹⁴ Rural workers in Tamil Nadu remain unorganized, without the ability to pressure or influence employers.

Casual work is more prevalent in rural Tamil Nadu than regular work. Usually, daily wages for regular work are lower than for casual work, increasing landless laborers' preference for casual employment.¹⁵ This tendency highlights the potential demand for an application to reduce the transaction costs of searching for casual employment. Currently some poor households prefer regular work despite lower wages because they can get wage advances which functions as credit.¹⁶ The increased availability of low interest credit in these communities may increase demand for casual work.

Villagers in rural areas have devised formal mechanisms to find casual work. Most villagers are members of Labor Gangs that perform group chores for primarily agricultural employers. Each gang is headed by a gang leader (Kotth). The Kotth's role is to find jobs for gang members through his connections with local farmers, periodically travelling to nearby villages to find out about job opportunities. In return for his services, gang members pay the Kotths a fee.

The Kotth's main role is to aggregate labor supply and demand, and serve as the information locus for these opportunities. Kotths maintain relationships with a few employers that can assure employment for the gang at

¹² New job opportunities are created for a given community by expanding the geographic area where searches are performed, once traveling is not required to close a contract.

¹³ Heller, Patrick, From class struggle to class compromise: Redistribution and growth in a South Indian state, pg. 645

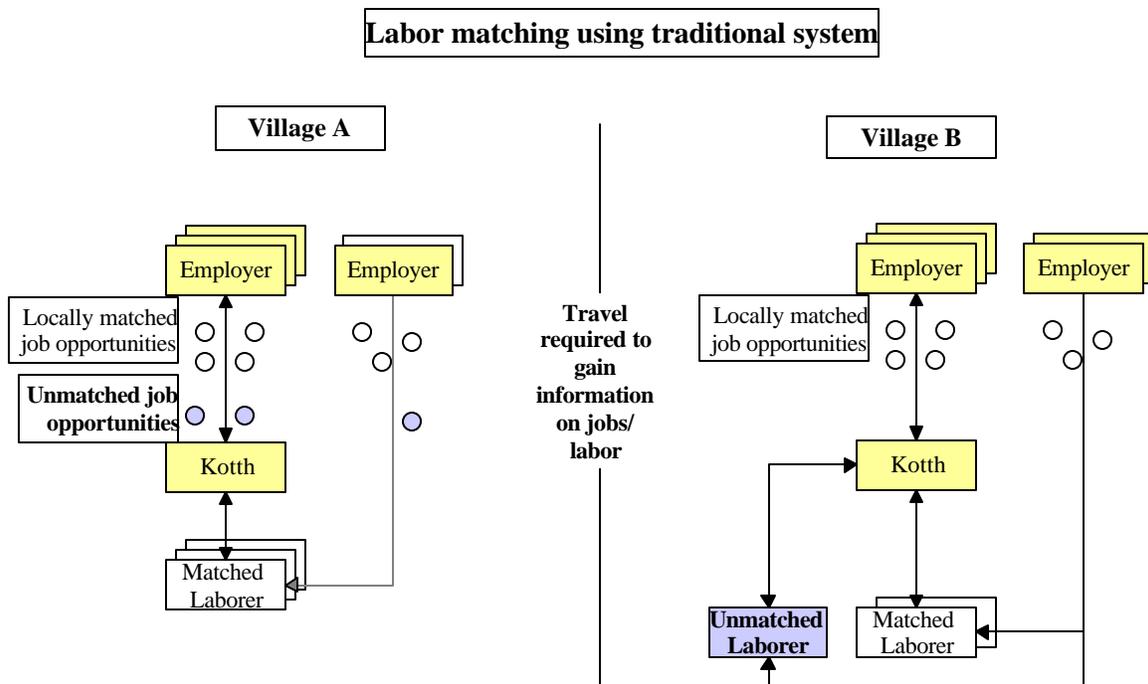
¹⁴ Ramachandran, V.K., 1990, Wage Labour and Unfreedom in Agriculture: An Indian Case Study, Oxford: Clarendon Press

¹⁵ Sarmistha, Pal, Casual and regular contracts: Workers' self-selection in the rural labour markets in India. Pg. 99-116

¹⁶ Landless peasants have a hard time getting credit, which usually requires collateral or involves exorbitant interest rates.

certain times of the year. During the agricultural season, the gang usually works together (depending on the size) and moves from employer to employer as a group. This arrangement works well particularly in the agricultural season, a period of 3 months determined by the monsoon rains (October, December and March), where most “koolies” (seasonal workers) are employed consistently—replanting, weeding and harvesting in respective months. During the other months, and particularly during the dry season (April-September), finding employment options becomes more difficult, leading to high unemployment and underemployment.¹⁷

Figure 3 Currently, matching labor with employers happens primarily at a local level (where laborers get jobs through Kotths or directly through employers), and is constrained by how far they have to travel to reach these opportunities. The status quo leads to inefficient allocation of jobs since it is constrained by the reach of personal relationships (Kotths and employers) or geographical limits (meeting in the village market), leaving unmatched job opportunities and unmatched laborers (in blue).



¹⁷ Mathiot, Elizabeth, “Defeating Poverty and Hunger: Grassroots Action in South India”, Hunger Notes, pg. 8.

In larger cities, job matching is dependent on a physical market (where employers and laborers meet) which increases costs and forces laborers into a wage taker position. In larger cities such as Madurai or Melur, where coordination through labor gangs becomes more difficult, there are various common locations where laborers can convene in the morning to look for work. People looking for laborers also know they can go to these places to find day laborers with the appropriate skills. The problem is that at the various locations there are mismatches between the supply and demand for laborers with certain skills. Although employers and laborers have traveled a great distance to market, labor participants are unable to match available skills with current needs efficiently. Were it known on a particular day that there was no demand for laborers with a certain skill set, workers could save themselves the time and cost of traveling into the city for that day.

An Internet-enabled application through which laborers in rural areas can learn if their skills will be needed can help to eliminate the time and costs of traveling as far as 20 km to reach the city, and limit traveling to where opportunities exist.

In agriculture jobs, wages differ on the type of activity and intensity of work. The agricultural season (characterized by monsoon rains) runs from August to January, of which 3 months require intensive work. The most rigorous chore involves transplanting, followed by harvesting, weeding and removing sirlings. Wages vary from 2000 rupees (US\$ 46) / month for transplanting, to 1,000 rupees (US\$ 23) / month for removing sirlings. Older members of the communities, especially women, work in the latter chores and sometimes get paid in kind rather than money (bags of rice, animal feed, etc.). Job types are also distributed by caste and gender. An application that intermediates the first encounter between laborers and employers may help downplay the impact of caste in job distributions.

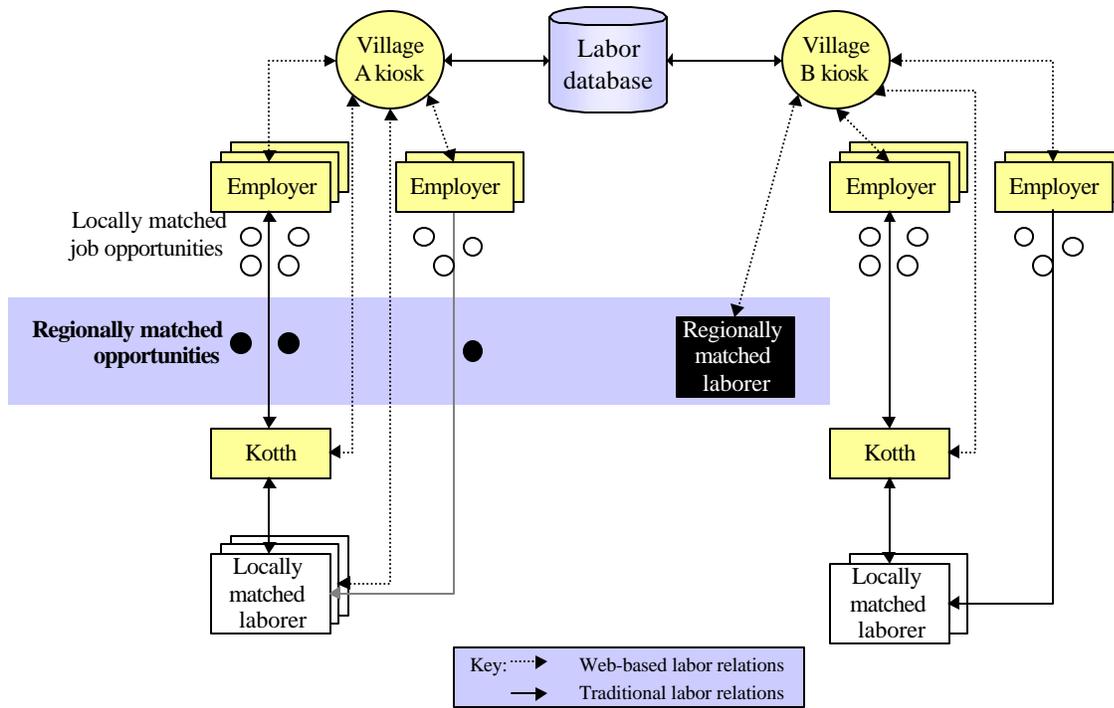
Description of Application: Design and Implementation

The labor application could work as a centralized bulletin board that is updated through e-mails, voice messages or phone calls at each village kiosk. Each Kiosk Operator (KO) would have access to an interactive database-driven Web page that could be simultaneously accessed by all the networked villages and their respective KOs.

The market inefficiencies seen in Figure 3 could be overcome with a centralized *Labor Database* that is able to match local job opportunities with laborers. As seen in Figure 4 below, currently unmatched local opportunities could be more easily matched with laborers at a regional level, intermediated by the *Village Kiosk*.

Figure 4

Labor matching using Web-based system and traditional system



The database would include the following data in separate fields to facilitate queries and searches. The database should include codes for type of job, required skills, location, etc. that are extensive enough to classify the distinctions in each village cluster, but simple enough to remain user friendly. For example:

Table 2

Fields	Codes
Name_Employer	
Type of Employer	LO: Land owner (3 acres) CC: Construction company MC: Micro Credit Federation
Type of Job	
Date of Job Entry	
Date/s for_Job	
Location	VL: Vallalapatti ME: Melur MA: Madurai
Number of people required	
Length of job_Hours	
Length of job_Days	
Wage	

Skills Required	WE: Weaving HA: Harvesting MA: Masonry... etc RW: Read/write Tamil
Transportation provided	Y/N
Kotth contact for this job	
Contact Info	

Other Labor Application Requirements

- The application should allow employers to post the types of laborers that they need for the day, while registered laborers (through Kotths or individually) would be able to sign up for work over the Internet before they travel into the city. Both recruiters and laborers would have an incentive to post and match their needs as early as possible. This prior matching would allow laborers to plan their week/ month of work, reducing the transaction costs involved in searching for work continuously.
- Employers without access to Kotths can post more elaborate (or long term) jobs required in the cities by providing the kiosk operator with details about the job (such as type of job, number of people and skills required, pay, conformation contact, transportation, etc.).
- New employers posting opportunities directly through the KOs need to be assigned to a Koth who would ensure the employer is trustworthy, and that job opportunities do exist.
- Incorporating the personal reputation of the Kotths into the system will create incentives for laborers and employers to fulfill their labor contracts (i.e., posting jobs that exist and showing up for engagements). If renegeing on contracts becomes a problem, more formal enforcement could be provided at the Panchayat level. However, given the size of these villages, the reputation consequences transmitted through word of mouth should be effective in enforcing contracts. Any official enforcement (such as a credit rating type system where unreliable workers are labeled) at the outset could lead to potential abuse of power.
- The labor database would be most useful for large jobs (requiring a lot of people) or specialized tasks, requiring a specific skill set.

Operational Specifics

The labor network should connect only a small number of nearby villages.

- The proposed application would connect a group of nearby villages (approximately 10 to 15) covering one or two Panchayat clusters, each with at least one central kiosk available to the villagers.

- Confining the application to a cluster of nearby villages initially would suffice to expand current labor opportunities since most villagers are unlikely to travel further for daily work, and a larger reach would make coordination and enforcement more difficult.

The Kotths should still be involved in this process and use the ability to connect with other villages as a tool to improve services to their gangs.

- Kotths have knowledge about the gang members, their skills and interests, as well as the inside knowledge of work opportunities available.
- An effective system will still require coordination among Kotths so that there is an enforceable prioritization of who can take jobs posted e.g., by proximity to the task, qualifications of workers or contact with potential employer. An equitable and enforceable system by which all Kotths coordinate how jobs get matched with workers is necessary for the success of this application.
- Gang members would still pay Kotths a percentage of the salaries received for the job. This method would give Kotths an incentive to collectively bargain with employers about wages. This type of bargaining (resembling informal unions) would help create long-term relations with employees and coordination that can be leveraged for other purposes (training, technology and information transfer among employers, etc.). Currently, the lack of organization allows exploitation of workers and unfair labor practices (such as debt bondage and little respect for minimum wage regulations).
- Ideally, with time the Kotths' role would evolve to one of system coordinator and recruiter of new jobs, leaving the job selection and distribution to individual workers as they become accustomed to the technology. Kotths could become promoters of the system since the only way for it to be effective is if large numbers of employers and workers use it.

Limitations and issues to consider

Maintaining social interaction is imperative. Face to face meetings within interdependent groups such as the Labor Gangs are important to build community, share experiences and learn about different opportunities. IT interventions should be designed not to make these institutions obsolete, but to leverage their expertise. In this way, gangs could still function as a group for agricultural chores, training or collective bargaining purposes.

Incorporating the role of Kotths in managing a labor application. While their role will most likely change, Kotths will still be required to maintain accountability (from employers and employees), and gather

information about skills, reliability, quality of working conditions, etc, to enhance the availability of information necessary for labor market participants to make decisions.

Discriminatory practices may limit use of an application. Currently personal characteristics influence wage considerations (for example, family landholding, caste occupations, credit worthiness, amount of non-leisure time available). Often the asset-poor, landless households belong to the lowest caste in the village, who can devote the whole of their non-leisure time to the labor market, and who are often left with the lower paying jobs. This link between caste and type of employment in rural India¹⁸ may limit the use of a more anonymous job matching application.

Perverse incentive to hoard information. Part of the Kothths' current value lies in the proprietary information and contacts they can maintain with employers. It will be a challenge to have Kothths initially share their information about job opportunities, putting it into the database. The fee given to Kothths when their posted jobs get taken will be an incentive, but they need to be further encouraged so that there is an initial volume that promotes the application's use.

Future research necessary. To successfully implement a labor application, further research is needed in some key areas:

- Understanding the relationship between Kothths, employers and laborers, to know whether appropriate levels of trust and accountability can be transferred to an electronic system.
- Understanding the mobility of peasants in rural areas, and current transportation opportunities to decide a realistic scope for the labor database.
- More research is required on the actual unmet supply of employment opportunities due to coordination problems. Current research relies on anecdotal data.
- Need to calculate the costs saved through better coordination of labor markets (search costs, wages forgone) to appropriately price access to this database and commissions to Kothths and KOs.

¹⁸ Sarmistha, Pal, Casual and regular contracts: Workers' self-selection in the rural labour markets in India. For example, traditionally Gowdas in Aurlpalle are engaged in toddy tapping, Kurma in sheep-grazing, Padmasale in weaving, Wadla in carpentry, etc.

Agriculture Application

Definition

An agriculture application would post region specific weather information and contingency based agricultural assistance information (such as water management, weed management, pest control, crop rotation etc.) and establish electronic communication between villagers and Agricultural Extension Officers (AEOs), whose job it is to advise and assist farmers in rural India.

Conclusion

A majority of all economic activity in the region deals directly or indirectly with agriculture and much of villagers' social activity relates to agriculture. As such, any IT solution must address agricultural content. Agricultural information and collaboration could improve planting decisions, yields, pest control and thus living standards.

Assumptions

This hypothesis was reached based on several assumptions:

- Agriculture is a large part of income and life in Madurai District
- Agricultural activities are weather dependent
- Accessible information can aid farming techniques
- AEOs cannot reach all farmers who need their services
- Demand for agricultural information exists

Results of Fieldwork: Creating a successful agriculture application for Madurai District

During the course of our interviews in the field and our discussions with the DHAN Foundation, we came to several preliminary conclusions about the applicability of agricultural and weather information in aiding social and economic development in rural areas and about design principles critical to success in Madurai District. We have divided these findings into application characteristics and design implications.

Findings that support an agriculture application

Lack of knowledge currently prevents optimal farming, demand exists. Interviews revealed significant demand for agricultural and weather information. Many respondents indicated that they could benefit from such information and several described specific scenarios in which they lost crops or profit due to early rain or drought. Pests were also described as a problem and one that villagers were not well equipped to deal with; partly due to the cost of fertilizer (and pesticides) and partly due to a lack of knowledge about control of pests that target specific types of plants.

Access to Agricultural Extension Officers is limited and sporadic. Agricultural Extension Officers are government officials at the district level who are responsible for aiding farmers with agricultural needs. AEOs are currently the only official mean to obtain information about farming technique or crop maximization. However, our research revealed that access to AEOs is sporadic and limited, (especially for scheduled castes and for certain ethnic minorities) as AEOs can only devote a certain amount of time to each village. This lack of access and inequality in distribution of information may represent an opportunity for IT to improve the equity of information dissemination.

Aggregating sales is critical. Much of the efficiency in distribution currently comes from aggregating agricultural goods and transporting them in bulk. This aggregation process involves a “middle man” type distributor who collects, transports and sells the aggregated crops of many farmers for a fee. They usually own the vehicle for transport and are well connected in the community. IT could help organize this process.

Localities differ in crops and methods. Great diversity of crops and farming methods exists across villages (even those in close proximity to each other). The diversity of crops and methods was astounding and shows a need to comprehensively survey the region and to record the geographic distribution of crops. This information will influence the design of applications that deliver agricultural information as different crops and methods require different treatment.

Design implications for maximizing IT impact

IT can provide region specific, timely information – weather and weather influenced farming techniques. The diversity of crops and methods in north Madurai requires heterogeneous information delivered across different villages. This type of information service could either be built on input from the survey or could be designed to employ collaborative filtering to align frequent requests with a steady stream of relevant information delivered to particular regions or villages.

IT improves equity of access. The description of access to AEOs above demonstrates the inequity of current information dissemination. IT may be able to address the limited time and reach of AEOs by universally distributing constant streams of information at or near zero marginal cost.

Direct implications for sustainability and willingness to pay. As most livelihoods in this region are dependent on agriculture, agricultural information will contribute to the sustainability of information services provided by SARI. The willingness to pay for information will to a large extent be driven by the potential improvements to agricultural efficiency.

Collaboration / communication – shared experience facilitates local content creation. We hypothesized that local content creation is an important step in generating village interest in using the technology. As such, one such application could be a ThinkCycle¹⁹ type application that recounts particular villager's experiences using certain types of seeds, fertilizers or pest control methods in certain climactic conditions or in specific combinations. These experiences could be catalogued and queried through a system of collaborative filtering that delivers locally relevant information to farmers in response to specific queries. As such, the information provided would be locally relevant and specific to the requests being made. In addition, collaborative filtering would add an element of data aggregation to better serve specific queries from particular regions.

Description of Application

An agriculture application must address three basic knowledge needs for farmers in Madurai District.

- **Weather information.** Updates on local weather conditions and future weather predictions. Information should be specific to the locality and include detailed information necessary for farming such as humidity readings and estimates of particulates in the air.
- **Contingency based agricultural assistance information.** Information on farming techniques based on soil, weather and pest threat conditions. This information should aid farmers with planting, land preparation, pest control, fertilization, irrigation and crop choices.

¹⁹ ThinkCycle is a collaborative problem solving tool, designed at the MIT Media Laboratory, for use over the Internet. <<http://www.thinkcycle.org>>

- **Access to Agricultural Extension Officers.** One of the primary benefits of an agriculture application could be to improve the equity of access to agricultural extension officers who currently find it hard to visit all villages and farmers.

An agriculture application could be successfully implemented over a simple web site that provides access to weather and contingency farming techniques.

Weather information. Weather information specific to Madurai District could be provided through existing weather reporting centers. For example, <http://www.weather.com> provides detailed information about weather specific to Madurai District. Hourly weather updates are available for the region and long term forecasts describe predicted weather 10 to 15 days into the future. Weather information includes cloud coverage, wind speeds, expected temperatures, satellite imagery, UV index results, average humidity and chance of precipitation. This level of detail in weather information surpasses currently available weather reports and can aid farming decisions.

Contingency based agricultural assistance information. Contingency farming information can also be accessed through existing sites. For example, the International Rice Institute's Troprice site at <http://www.cgiar.org/irri/Troprice/Default.htm> provides detailed farming advice for specific contingencies and farming conditions. The site provides information and training concerning land preparation, rice varieties, crop establishment, water management, nutrient and weed management, insect and disease management and farming economics. Access to this site could improve villagers' knowledge about contingency farming techniques which, in turn, may enhance crop yields, prevent mishaps and improve living standards.

However, in order to adequately address farming techniques relevant to the Madurai region, information must be tailored to the localities involved. The Troprice site encourages collaborative development of region specific farming information. Through coordination with Agricultural Extension Officers and local farming NGOs, relevant collaboration with Troprice could produce Madurai specific farming information accessible through the SARI network.

Information should be provided in a region specific format, where information provided to a locality addresses local agricultural concerns. Content should, in part, be created locally. Local content creation can ensure the appropriateness of the content provided and improve awareness and interest in the service. Several potential local collaborators exist.

Access to Agricultural Extension Officers. Access to agricultural extension officers could be facilitated through simple communication tools using voice or text communication applications. Alternatively, a more robust system of local content production could be constructed to resemble the ThinkCycle application developed at the MIT Media Lab. The ThinkCycle application promotes cooperative problem solving through a dynamic community produced and moderated bulletin board that relates to specific farming problems encountered by local villagers. Agricultural extension officers who would guide the discussion and provide answers to questions raised by farmers could moderate this application. The asynchronous and cumulative nature of this type of application could increase access to agricultural extension officers and develop 'libraries' of problem solving information exchanges that could be catalogued and stored for reference.

Operational specifics

Incentives for local content creation should be maximized. Creating local content will greatly enhance the applicability and appropriateness of an agriculture application. Resources that directly implicate Madurai District are obviously more useful for farmers there. Toward this end, incentives to produce Madurai specific content must be established. As incentives to consume information are greater than those to produce and input information (relevant stories or experiences of villagers into the area), design of an agriculture application must include built-in incentives to post farmer experiences and lessons learned. For example, access to parts of the web site could be restricted until a user has contributed an experience. However, creating such incentives could drive potential users away. These issues highlight the need for further consideration of incentive structures.

ThinkCycle type applications exhibit network externalities – creating awareness and a contributory environment is critical. The more people who contribute to a ThinkCycle type application, the greater the value for other users. As more potential problems or solutions are posted, the value of access to the site increases. As such, awareness building and creation of a contributory culture through incentives or group training forums should be part of the implementation of a ThinkCycle agriculture application. Training and awareness are discussed in Section VII General Implementation Issues.

Limitations and issues to consider

IT cannot solve AEO selectivity. Although IT can increase the capacity of AEOs to reach more people, it cannot prevent conscious selectivity on the part of the AEOs. If they choose to service a particular

area or caste more often or more comprehensively, the impact of increasing potential contact with AEOs may not benefit everyone.

Incentives to consume information are greater than those to produce it. Although agricultural information may be valuable, the incentives for a farmer to share their experiences with others are quite low. As described, creating awareness about the application and a culture of collaboration are critical to success.

Potential Collaborators

Below is a partial list of potential collaborators we discovered during the research and fieldwork phases of our analysis:

Collaborator	Contact Information
AgVentures	Preeti Ramanathan penathan@yahoo.com
IndiaAgroNet	http://www.indiaagronet.com
Ramasubramanian	Samanvaya Plot #26, 1st St., Bank Colony Madhavaram, Chennai - 51 044-5550781 samanvaya@vsnl.com
TropRice	http://www.cgiar.org/irri/Troprice/Default.htm m.bell@cgiar.org
AgroIndia	http://www.agroindia.org
Infoagrar	http://www.infoagrar.ch/index.htm
Intl Center for Research in Agro Forestry Online	http://www.icraf.cgiar.org/ ICRAF Southeast Asian Regional Programme Jl. Cifor, Situgede, Sindangbarang P.O. Box 161, Bogor 16001, INDONESIA Phone: 62-251-625-415; Fax: 62-251-625-416 E-mail: icraf-indonesia@cgiar.org Website : http://www.cgiar.org/ICRAF/sea/
Intl Fund for Agricultural Development	http://www.ifad.org/ Via del Serafico, 107 - 00142 Rome, Italy Tel: 39-0654591 - fax 065043463 -

Health Care Application

Definition

A health application would aggregate user-friendly content on issues of health care and wellness, and be made available to villagers through the IT kiosk. Content should allow villagers to inquire about symptoms, common diseases and treatments, resources and subsidies available to them by the government, and general wellness and sanitation information.

Conclusion

Deficiencies in the current government-provided healthcare infrastructure may limit the initial impact of IT in Public Health Centers (PHCs). While PHCs would benefit from communication and information tools, we found that there are structural and compliance issues in the present provision of rural health care in N. Madurai that would make leveraging IT tools difficult for these facilities. Rather, our preliminary research found that instead of targeting the weak infrastructure in place, health care information and services should be made available to villagers directly through community centers, allowing them to take control of their health needs, and de-mystifying medical practice.

Assumptions

Enhancing the functioning of health services through information and efficiency gains in treatment and logistics through IT is one of the most cited examples of how technology can help rural settings. The ability to send information and symptoms of a patient in remote areas through the Internet and receive treatment options by qualified doctors in urban centers is an idealized example of the potential uses of IT. IT could facilitate remote consultation (regionally, nationally and internationally), sharing of medical techniques, disease monitoring and online medical records. However, this type of communication assumes the intermediation of local medical practitioners that have access to medicine, resources and training to treat patients. A comprehensive IT solution managed through PHCs would assume:

- An established health system that villagers commonly visit for health concerns
- Doctors and health practitioners that have the incentive to provide the best service to patients

- Health practitioner sentiment that additional information and resources would be useful to treat local villagers

The research conducted in N. Madurai concluded that these assumptions do not hold, and a health care content application should not be administered through PHCs. However, healthcare information provided directly to villagers would be useful to combating more common day-to-day ailments, preventive care and wellness guidelines to improve the standard of life of villagers.

Results of Fieldwork: Creating a health care application targeted to villagers

India has a socialized medical system, whereby health care services are administered to low-income citizens at no cost.

- In the rural areas, villagers have access to a Public Health Center (PHC) available at the Panchayat level, which translates to one center for 5 to 7 villages. There are also smaller Village Health Centers (VHC), which are more prevalent in smaller villages and are responsible for monitoring vaccinations and births.
- The quality and extent of services is poor, forcing even the poorest villagers to seek private health care.²⁰ PHC's services are usually limited to pain relief, child delivery and inoculations. Most of the cases that fall outside these services are referred to city public hospitals in Melur and Madurai. A lack of infrastructure and personnel means that all non-basic cases are referred to these city hospitals.
- Doctors are usually available at the PHCs only until noon, and nurses are often traveling to nearby villages for vaccinations or to give elementary first aid training. Doctors usually have private practices in the cities where they live, which in conjunction with poor monitoring and low wages, creates PHCs that are closed most of the day or poorly attended.
- Nurses and doctors do not currently use many reference materials, as they have little incentive to handle complicated cases with which they are not familiar.

These observations led us to conclude that empowering PHCs and formal health providers with information and communication tools may not be the most effective way of improving health care in a community. Similarly, while being able to contact city hospitals effectively during emergencies could help in the delivery of timely care, coordination and incentive problems prevent simple communication enhancements from

²⁰ Interviews with the health ministry in Andhra Pradesh by the ITG at Harvard indicate that almost 75% of rural poor go to private practitioners for ambulatory care.

significantly altering the quality and/or speed at which services would be provided to patients. Currently, villages have access to public or private telephones, yet they are rarely used to make health arrangements. Patients are simply referred to city hospitals, and have to incur the necessary travel costs.

Although PHCs may not be the best forum for health based IT services, there is, however, an important role for health content in IT kiosks, or community centers.

Description and implementation of application

Specialized training for health care providers. While the government provides training to nurses in rural areas, these sessions inevitably remove nurses from their posts and cause the government to incur large transportation and lodging costs. Providing specialized training through IT at the local level could decrease these costs for the government while increasing the quality and frequency of training. Given the need for timely training on epidemics or seasonal diseases, being able to quickly disseminate information to rural PHCs and VHCs through the village center would be useful.

Provide health care information to villagers. Providing health information to local villagers in a user friendly way can empower local villagers to look after some of their health needs, and de-mystify medical treatment. Due to the lack of quality services at government providers, most villagers consult inexperienced and/or expensive “quacks,” doctors’ assistants or private doctors for their health needs. Health education is most important in improving public health, and should emphasize maternal and child health, nutrition, alcoholism, birth control and oral re-hydration therapy for diarrhea.²¹

Provide information about sanitation and community health practices. Telecenters could also provide information about public health care (vaccinations, epidemics, water quality control, etc.) and preventive health practices that could be distributed at the Panchayat level, which has more accountability to the villagers than the health providers who work under a top-down, socialized health structure. The health ministry could use these IT kiosks to communicate regional health initiatives, seasonal epidemics and sanitation tips to be announced at the monthly Panchayat meetings.

Disseminating public health knowledge to villagers should not be limited to telecenters, but could also be announced through radio or television, which are both widely used.

²¹ Mathiot, Elizabeth, “Defeating Poverty and Hunger: Grassroots Action in South India”, Hunger Notes, pg. 16

Implementation

A health application would require specialized content, and professional monitoring. It would be difficult to make such an application financially sustainable since it could be easily transmitted from person to person (as with the price application). The positive externalities of health information would make this endeavor attractive for local or international NGOs or government agencies and for the SARI project as a whole.

Government Services Application

Definition

The initial version of a government application would enable villagers to access information on relevant government programs and initiate online requests for necessary government documents.

Conclusion

Information and Communication Technologies can significantly enhance citizens' relationship with government, improving both service delivery and awareness, and contributing to increased enforcement of representative accountability.

Assumptions

The notion that government plays an essential role in rural communities motivates the concept and design of government-specific applications and content. Our working assumption has been that the manner in which villagers interact with government is highly inefficient. Consequently, the objective of a government application would be to facilitate the flow of information and to simplify transactions between institutions and individuals.

Results of Fieldwork

Most citizen interaction with government takes place at the local level. Villagers rely on the government for various services, grants and benefits, documentation and other information. Villagers interact extensively with multiple levels of government; interviews revealed that many have escalated issues of service provision (e.g., drainage, drinking water) to government agencies as high as the District Collector level. Most often however, interaction will occur at the lower municipal (taluk) level where requests for government documents (birth certificate, marriage license, land record, death certificate, etc.) take place.

Currently the process undertaken by villagers to secure various government documents is time consuming and costly. While documentation is necessary to receive benefits or to settle disputes, its procurement involves large time and monetary costs. In addition to the cost of the document itself, local officials often require bribes of up to 250Rs to initiate a request.²² Moreover, obtaining documents entails a lengthy application process—villagers must travel into the city (sometimes making multiple trips) to acquire and

²² Based on interviews conducted with villagers in rural Madurai, (January 23-27, 2001)

to complete forms—whose opportunity cost is often reflected in lost wages. Finally, the process is uncertain; villagers cannot check the status of a request at any stage.

Villagers have little knowledge of government schemes in their area, and little ability to access such information. Apart from the procedure of obtaining documentation, preliminary work also indicates that, within the villages, there are depressed levels of awareness regarding government involvement. Villagers are often not aware of various government schemes and potential benefits available to them. The difficulty in accessing even very basic government information contributes to this lack of awareness within the villages. Consequently, representatives can falsely claim credit for programs for which they have no responsibility, or avoid blame when villages do not receive funding.

Description of Application

From a citizen's perspective, an effective government application would likely be web-based, and involve a single URL from which varying levels of government could easily be accessed. This type of portal site would avoid the confusion caused by a multitude of disparate agency sites, and diminish information redundancies.

As with other applications, one might envision a spectrum of functionality. At one end, the application would only allow the user to access and to view public data. In and of itself, this function could be of substantial benefit to villagers:

Accessing government program information. Fieldwork suggests that there is villager demand for, but little availability of information on local government schemes. Studies elsewhere in India also provide support for this claim. In Pondicherry (approximately 250 km north of Madurai), “in an area with around 20,000 inhabitants, it was demonstrated that rural villagers have a demand for information that is relevant and useful to them. On top of the list of info requirements were government programs and entitlements for social welfare.”²³ Thus, it appears that given relevant information, villagers would indeed use a government application; this use in turn could strengthen the accountability of local government officials as the cost to villagers of becoming well-informed decreases.

At the other end of the spectrum, the application would also provide the user with more robust interaction and transaction capabilities:

²³ The Use of Information and Communications Technology (ICT) in Learning and Distance Education, pg. 18. Intelecon Research, January 24, 2000

Downloading electronic forms. Online accessibility of government forms and status tracking can streamline the document procurement process, significantly reducing the time and effort involved for villagers in securing documents. A system currently operational in Andhra Pradesh for example, allows citizens to pay their taxes and other bills and to obtain documents online. Early evidence suggests more than simply a positive user experience—the application may over time have a profound impact on how citizens perceive and interact with the government.²⁴

Implementing a Government Application

Implying a phased implementation strategy, Jay Nussabum, head of Oracle's service industries business advises in regard to e-government services, "Start small, scale fast, deliver value."²⁵ While each may prove valuable, an application with e-commerce functionality may take longer to implement than one with only publish capabilities. Implementing the latter (while planning for the former in subsequent iterations) will provide immediate benefits to villagers, who currently demonstrate an unfilled need for information.

In addition to application scope and timing, implementation of a government application must consider:

Equity. Fundamental to a well-formulated government is its universal accessibility. As a direct consequence, more so even than others, a government application must be available to all citizens. The need for such access demonstrates the importance of the application's local language interface and ease of navigation.

Local government focus. Fieldwork suggests that local government should be the focus of the application. It appears that villagers generally interact with government at the municipal level. Thus, in this setting, central government content would likely be less relevant or useful. This local focus implies that an effective government application requires each locality to provide tailored content and service provision, offered via an easy to understand, intuitive interface.

Data obtained from future survey results will further each of these aims by helping to determine specific requirements, such as the exact costs of obtaining documents, as well as the general overall nature of citizens' interaction with different organizations and levels of government. Specific villager feedback on what they need from the government, what information they find useful, and how they currently access and become aware of information and services will be vital to the application's design.

²⁴ "Brick by Brick", Hindu Business Line, October 4, 2000.

<http://www.indiaserver.com/businessline/2000/10/04/stories/240439yb.htm>

²⁵ "Brick by Brick", Hindu Business Line, October 4, 2000.

<http://www.indiaserver.com/businessline/2000/10/04/stories/240439yb.htm>

A Government Application in the context of an owner-operator model. The use of a government application is not inconsistent with incentives in the owner-operator model of providing Internet connectivity to rural villages. Increasing numbers of villagers seeking government-specific information and services may drive demand for Internet access. For example, citizens seeking to communicate online with various levels of government may require an e-mail account. After using e-mail for a time, citizens may become amenable to other Internet services and content. Consequently, owner-operators would be incentivized to offer as much government content as possible in order to attract a larger number of users to their pay-per-use kiosks; moreover, given their knowledge of the local population, operators may be able to advise on decisions of local content provision, or to create such content themselves. In the Pondicherry example, villagers were able to build a local database that included information on government assistance programs for low-income households.²⁶

²⁶ The Use of Information and Communications Technology (ICT) in Learning and Distance Education, pg. 18. Intelcon Research, January 24, 2000

Education Application

The primacy of education (broadly defined to include both academic and vocational instruction) as an enabler of economic development necessitates the consideration of education-related IT applications. Through various online learning modules with tailored content, villagers may be able to learn a new trade, develop computer and Internet proficiency, or simply enhance their basic literacy.

The assumption then is that using IT to facilitate learning can itself increase the demand for education through explicit demonstration of its benefits via higher wage jobs and increased opportunities.

Early impressions underscore the promise of IT-enabled adult education. Informal discussions with individuals revealed that there exists reluctance on the part of some to attend public literacy courses due to the stigma involved. Additionally, individuals expressed a willingness within several of the villages to partake of training to fill the growing number of data entry roles becoming available in the cities.

Schools may be less enthusiastic. While individual demand seems to exist, at the organizational level there may be less motivation to implement IT-reforms. Based on very limited interaction, some school officials exhibited little enthusiasm to introduce electronic learning tools and applications, instead citing more basic educational resource priorities.

Future Research Questions

Given a lack of wide discussion on education issues, it is difficult to assert robust implications at this time. While Internet connectivity may foster equality of access to education, it is possible that demand for IT-related education services may be regarded by villagers as a luxury item, more so than more critical price and agricultural applications. Thus, questions for future work include: Can an education application have an immediate positive impact on the lives of villagers? What current barriers to implementation exist?

Future surveys conducted at the household and organizational level will determine the demand, if any, for IT-enabled educational services and the capacity of schools to maintain a technology intervention. Narrowly formulated and opened ended questions to individuals and institutions will attempt to provide detailed measures of both the consumer willingness to pay for and organizational willingness to implement educational applications.

General Implementation Issues

In order to successfully implement any IT intervention in North Madurai, several general implementation issues must be evaluated and addressed. Regardless of the specific application, any technology intervention must create an appropriate environment in which to introduce technology and must ultimately take steps to prepare the community to accept and use the technology to its potential. The first step in such a process is to design *appropriate* applications that not only consider local needs and capacities but also address the social norms that exist today in Madurai. The design of appropriate technologies has been discussed as part of each potential application we analyzed. This section addresses general implementation issues that every application will encounter.

The overall success of the SARI Project will depend, to a great extent, on whether the project design is financially sustainable, whether users are trained and aware of these new technologies, whether access to the kiosks is equitably distributed, whether local language considerations are addressed and finally whether the support of those actors who may be disintermediated by ICTs is secured.

Franchise model

Centrally located village kiosks represent the SARI project's chosen means of providing Internet access and applications to the rural poor. Traditionally, these telecenters have been the primary vehicle used by developing countries to introduce ICTs to disadvantaged and/or remote areas.²⁷ Under the SARI model, kiosk owner-operators will be entitled to a share of the revenues they generate through fee-based services, primarily pay-per-use access to the Internet.

Supply-driven vs. Demand-driven models. Many telecenters have been initiated from a supply-side standpoint. NGO or international donor funded ventures aspire to create long-term demand by offering a comprehensive set of tools and training, with little initial emphasis on sustainability.²⁸ Consequently, supply-driven models are subject to a host of problems.²⁹

²⁷ Barton, Clifton and Marshall Bear. Information and Communication Technologies: Are they the Key to Viable Business Development Services for Micro and Small Enterprises? pg. 18, March 1999.

²⁸ Initial Lessons Learned About Private Sector Participation in Telecentre Development. National Telephone Cooperative Association, 12.

²⁹ The Use of Information and Communications Technology (ICT) in Learning and Distance Education, pg. 22. INTELECON Research, January 24, 2000

- Unresponsiveness to local input and content suggestions
- Untenable pricing strategies
- Lack of significant market research before implementation
- Over-reliance on uncompensated staff, leading to high turnover

In contrast, the SARI project favors the demand-driven model, an approach that rewards the owner-operator with revenue shares in return assuming start-up and ongoing operational risks and responsibilities. In providing this profit motive, the demand-driven model has “proven to be highly responsive to community needs, particularly in basic service provision.”³⁰

While the demand-side approach appears to excel at providing basic access services to local populations however, it often fails to provide adequate ICT training.³¹ In the context of the SARI project, the issue of training, what it entails and how it is administered is a key consideration for ICT implementation.

Role of kiosk owner / operator. The role of owner-operator is central to the success of the SARI project. An owner’s incentive to attract users and to generate pay-per-use fees governs his behavior with respect to kiosk operation; it is implicit in the design of many if not all of the above applications. Profit seeking tendencies motivate the kiosk operator to display relevant local content, to ensure data quality, and to develop relationships with users and intermediaries. These same tendencies however may also include negative consequences: the kiosk operator’s ability to control access and information as well as monitor use, innocuous in some settings, may be harmful where incentives are incorrectly structured or where regulatory mechanisms are not in place.

Training & Awareness

Need. In order to prepare rural communities to accept and use IT to its full potential, training and awareness building must be conducted either prior to or during technology implementation. In our discussions with villagers in the pilot project sites, we heard several people tell us that ‘if I knew what the technology could do, I would tell you what I would do with it.’ In general, there is a lack of understanding about the purpose and usefulness of IT by rural villagers. Although they are intrigued by the concept and are at least familiar with computers through their children who may have used them in schools, there is little understanding of how to use new communication technologies. In order to build a critical mass of users (which empowers the network

³⁰ Initial Lessons Learned About Private Sector Participation in Telecentre Development. National Telephone Cooperative Association, Pg. 13.

³¹ Ibid.

externalities described in the price and labor applications), these communities must be aware of the technology and interested in and capable of using it.

Characteristics of potential training and awareness building programs. In order to fully develop training and awareness building programs, the input of local NGOs like the DHAN Foundation is critical. However, a few important characteristics of these programs can be identified prior to program design:

- Awareness building must fully describe the *purpose* of technology interventions in communities
- The potential benefits from technology use should be emphasized
- The role of kiosk operators should be clarified
- The user interface itself must be introduced through hands on use, experimentation and training
- Local content must be solicited
- Awareness building should leverage popular issues, topics or people to promote interest

Implementation. Implementation of training and awareness programs in rural communities should be led by organizations who have built a culture of trust with villagers, who have knowledge about the area, a deep understanding of the people, the society and cultural norms and finally, who have the authority within the community to lead innovative social or cultural change.

In the case of villages north of Madurai, the DHAN Foundation is best positioned to lead this initiative (although entrepreneurship should also be encouraged). They not only exhibit all of the qualities mentioned above but are also deeply committed to advancing the living standards and well being of villagers in Madurai. They are intimately connected to the villages and are respected by the villagers as a result of their community banking and water management initiatives in the area.

Equitable access is one consideration that the DHAN Foundation must be aware of if they decide to lead training and awareness building efforts. While DHAN is well connected and respected in Madurai, they have an established constituency in the area through their Kalanjiam community banking programs. It is critical that DHAN implement training initiatives universally by consciously interacting with villagers outside their constituency. These inclusive efforts would not only address the issue of equitable access, but could also help DHAN build relationships and grow their constituency. During our interactions with the DHAN Foundation, we were convinced that they are willing and able to accomplish this 'broad constituency' approach to SARI implementation.

In addition to the DHAN Foundation, universities and other non-governmental organizations should be involved in training efforts. Departments of computer science and electrical engineering at IIT Madras (Chennai) are well equipped to describe and demonstrate technologies. However, the efforts of sociology and rural management departments at MK University and others in Madurai could also be useful in conveying a non-technical perspective about the role of technology in rural communities.

Equity of Access

As mentioned throughout the document, SARI's success is partly reliant on understanding the social norms that dictate interactions among villagers, which will subsequently guide the interaction between these technologies and its users. While implementation requires that incumbent social dynamics to be accepted, it must also provide equitable access to the benefits of these technologies to all members of the community regardless of gender, caste, education-level, etc. Following is a surface-level analysis of some of the dynamics that need to be addressed in choosing a kiosk operator and molding the user experience to ensure equitable access to IT services.

Gender dynamics. Tamil Nadu, as is the case with many of the southern states, is relatively more progressive than the north of India regarding gender. Women are often seen in political posts, professional roles and positions of power. In addition, in rural areas, necessity brings more equality in gender roles. However, there are entrenched gender roles that may inhibit an ideal use of IT in village kiosks. For example, if the Kiosk Operator (KO) is male and needs to intermediate most applications, he may prevent women from using the kiosk to find out about health issues (such as birth control, vaginal infections, STDs, etc.) or inhibit them from looking at jobs that are not typically considered "appropriate" for females. Studies suggest that women are usually excluded from regular labor contracts,³² making them even more likely to participate in the casual market (although many times their participation is restricted to specific jobs). Higher literacy rates among males (69.7%) compared to females (41.7%) in rural areas of Madurai District may also increase the need for females to use intermediaries.³³

Privacy. Similarly, both men and women may be intimidated or reluctant to share information about themselves with a fellow villager or KO. In Ghana, for example, payphone booths were originally installed without doors, eliciting strong privacy concerns among users. Given competitive market businesses in Ghana, and a cultural propensity toward multipartner romantic liaisons (especially among traders), the need for

³² Sarmistha, Pal, Casual and regular contracts: Workers' self-selection in the rural labour markets in India, *The Journal of Development Studies*, London, Oct 1996, Volume 3, Issue 1, Pg. 99-116

³³ Liou, Michael, Seetharam, Deva, Alexander, Elizabeth; *Empowering People with the Internet: A Report on the Madurai Study*

privacy was great. Once private booths were installed, the use of public payphones rose dramatically.³⁴ While this might not be the behavior we are trying to promulgate, privacy is important in expanding the use of ICTs in public places, and helping villagers transcend gender or caste barriers. Privacy may also be an important factor in accessing health information, using the services to contact family abroad, and conducting private communications.

Caste System. India's caste system consists of hundreds of strata, but within each village people are often among a limited number of caste levels. In the last 30 years, the government has initiated various programs to weaken caste divisions and is implementing a series of re-distributive programs³⁵ that require 'caste blind' admittance to public schools and health facilities. Many villages have moved away from having castes segregated geographically in different parts of the village. People trying to file as lower caste to receive government benefits is an example of the diminishing influence of castes in the society. However, caste divisions still exist and discrimination against scheduled castes (at the lowest levels) is present in the formal and informal authority given by villagers. Caste also plays a part in labor markets, creating a dividing line between tiers of farm servants.³⁶

Several implementation strategies can help alleviate these potential equity issues.

- **User-friendly interface.** While the KO needs to be able to serve as an intermediary to all the applications and be able to enter information, such as prices, job postings, questions, etc., most applications should have a user friendly interface that allows users to access them privately.
- **Frequent workshops.** KOs should be encouraged to hold frequent workshops with villagers interested in learning how to use the different applications.
- **Voice applications.** Even simple voice applications (voice over IP) may encourage illiterates to visit the kiosk.
- **Women as KO or assistants.** As much as possible, women should be included in the administration of kiosks, even if in secondary jobs, to encourage other women to learn the technology, and to help women customers feel more at ease.

³⁴ Richardson, Don, Rural Telecommunication Services and Stakeholder Participation: Bridging the Gap Between Telecommunication Experts and Communication for Development Practitioners, <http://www.fao.org/docrep/x0295e/x0295e04.htm>

³⁵ In 1959, Prime Minister Jawaharlal Nehru dismissed the Communist Ministry and imposed President's rule, a first in India. The Ministry had however already set into motion a series of redistributive programs that were to dominate the state's politics for the next decade and a half.

³⁶ Binswanger, H., 1993, 'Wealth, Weather Risk and the Composition and Profitability of Agricultural Investments', *Economic Journal*, pp.56-78. Binswanger, H. and M. Rosenzweig (eds.), 1989, *Contractual Arrangements, Employment and Wages in Rural Labour Markets in Asia*, New Haven, CT: Yale University Press.

- **Accessible location.** The kiosk should be in an accessible and familiar place to the community. Some options include the post office (which usually manages phone calls for the villagers), bank or public booth in a central location.

Language

Briefly stated, creating applications accessible in Tamil, the primary local language of Madurai District, is imperative for encouraging the use of SARI technologies. A Tamil keyboard has recently been produced by the Computer Science and Engineering department at IIT Madras. This keyboard should be a standard option for village and market kiosks.

During our fieldwork, we saw a need for speech based user interfaces to improve the accessibility of the network for illiterates and to create efficiency during use by enabling voice based communication application. Voice based applications could be developed to transmit voice from one user to another. This type of interface does not require speech recognition technologies. However, if queries or requests to the servers themselves are to be provided through voice interface, speech recognition is essential.

It should be noted that in our discussions with Professors Pandu Rangan, PhD and Chandra Sekhar, PhD of the Computer Science department at IIT Madras, it was clear that reliable voice recognition in Tamil is not currently available and is quite difficult (although possible) to achieve.

Disintermediation vs. Re-intermediation

As demonstrated in previous sections, ICTs have the potential to significantly enhance the lives of the rural poor by providing easier access to a broad range of critical information. Much of this advancement however, may come at the expense of intermediaries who currently benefit from the deficiencies inherent in labor and goods markets. These beneficiaries—notably goods traders and labor gang leaders—hold substantial leverage in negotiations with villagers over the sale of crops or distribution of jobs. A consequence of inefficient processes, this power tends to create entrenched interests against the use of technology to disseminate information.

Yet regardless of the efficiency or inefficiency of processes, traders and Koths do provide valuable economic services by assuming transportation responsibilities or matching labor supply and demand (the extent to which they exploit villagers is a separate question). Thus, the by-product of technology intervention should not be disintermediation *per se*, but re-intermediation—intermediary roles, though redefined, will still be required, both for operational reasons (e.g., crops will still require transport to market), and practical

concerns (i.e., securing buy-in of all affected groups to ensure technology acceptance and implementation). While even this relaxed notion of re-intermediation can conflict with well-established interests, it recognizes the need for such economic agents.

Appendix I: Fieldwork Guide

Based on experiences in Madurai, we have created a brief guide to fieldwork that contains guidelines for fieldwork and survey administration in poor rural areas of developing countries. We have included specific examples of conditions in Madurai as well as more general notes on survey creation and administration. We intend this to guide future SARI teams continuing evaluations in the region or for anyone conducting fieldwork in poor rural areas outside the United States.

On Local NGO Contacts

- A local NGO contact is essential to conducting fieldwork efficiently in rural India. Unless resources are available for long term independent research, local NGOs are indispensable in the process of gaining access to rural villagers, creating trust among potential respondents, making contact with relevant parties in the area and arranging transportation, translation and other local services. Without the DHAN Foundation, access to rural areas and respondents would not have been possible.
- Local NGOs have established local constituencies. Awareness of this local standing is important when conducting fieldwork through a local NGO. The programs administered by the DHAN Foundation, for example, have created a local constituency of several thousand villagers who are involved in their water management and community banking programs. The existence of NGO constituencies has both positive and negative ramifications for fieldwork.
- Local NGO constituencies create a need for the NGO to assert its role in decision-making and value creation within the project. Justifiably, NGOs are concerned with potential consequences of intervention in the local area. As a project like SARI can seriously impact villagers and local societies, local NGOs are rightfully concerned about the appropriateness of technology interventions and survey methods, and desire to have a commanding role in implementation. However, it is important to explicitly negotiate the scope of decision-making. As an example, the geographic scope of the SARI Project extends beyond the Madurai area and has many local collaborators. As such, it is important that roles are negotiated in advance.
- Local NGO constituencies may bias sampling and skew implementation. As local NGOs have established informants in their regions, it is important to strive to access a sample that

is representative of the area population instead of limiting respondents to NGO constituents. If the NGO is responsible for any part of implementation, it is critical that implementation is conducted in such a way as to ensure access to programs for those who are not NGO constituents.

On Survey Writing

- In order to be comprehensive and efficient, any survey work should be strategized in advance. In particular, we found it helpful to layer our survey efforts according to the scope and substance of our questioning. For example, for particular information that we required, we found that it was inefficient to use a household survey to ask the same questions about the community to every respondent in that community; doing so would have yielded a series of time-consuming and redundant answers. Therefore, we instead created a separate community questionnaire designed to give us a broad picture of the community, the state of roads, the availability of telephony, the number of people living there and other general community data that can be asked of one or two village leaders. Although it is important to attempt to eliminate bias in these questionnaires, as there are fewer respondents, the data here is quite factual and therefore less vulnerable to subjectivity.
- As we were pre-testing our survey, we discovered that questions must be asked from the respondent's social and cultural perspective. The ensuing revisions were essential in obtaining valid results from our work. The chance of miscommunication with respondents is quite high considering the cultural and social differences in communication style and substance. Revising the survey through iterative discussion and pre-testing ensured that the terminology used would be easily understood and elicit meaningful answers. For example, during pre-testing we realized that "feed" was not a specific enough term, given that there are at least 4 different types, some of which are bought and others of which are paid for 'in kind.' Such a distinction was difficult to discern from Cambridge, and required open-ended discussions with villagers. Similarly, the part of our household survey that attempts to create a 'communications map' of villagers in particular areas was originally constructed as a separate survey section asking questions like "How often do you use the telephone, fax, letter" etc and "for what purpose." We created several questions like this to get a picture of communication modalities that exist now. However, it was difficult for villagers to think about their communication patterns in such an abstract way. In fact, they were better able to reconstruct their communication profiles when we asked them questions about their

communications embedded in sections of the survey that addressed the people in their lives. For instance, as villagers were explaining their family structure, we asked related questions about whether they communicate with various members, how often and through what modality. Creating context around the questions that matches the respondent's mental models was key to successful survey creation.

- Surveys can be intrusive and detailed. It is critical that the survey and survey administrators respect the respondents and that the survey is written appropriately. For example, detailed data about household income and expenditures can be quite personal. Each question must be written with care. In particular, it is essential that every piece of data being retrieved is justifiable. There were some more intrusive versions of the survey that we scaled back in order to be respectful of villager privacy. With each revision, we asked of each individual question: "Is this data critical to our findings?" This simple test (rigorously applied) helped us reduce unnecessary intrusion and create an appropriate survey. In addition, we held several focus groups and team meetings with the DHAN Foundation to discuss the appropriateness of the survey and to revise the content.
- The survey **MUST** have detailed instructions to the interviewer to ensure consistent survey administration and to clear up any possible discrepancies in the survey or how to administer it. We found that it is not necessarily clear how and in what order to ask questions without explicit and detailed instruction sets.
- Accurate and reliable translation is critical. In order to collect valid results, translation during pre-tests and the proper translation of the final document and responses must be ensured. In order to accurately understand responses and to properly revise the survey during pre tests, it is essential to have translators who not only speak Tamil and English fluently, but who understand how to conduct professional translation. Even those who are fluent in both languages may not translate well if they do not communicate all speech to the pre testers or if they subjectively report what is being said based on their interpretation of what is important. Professional translators translate verbatim. Striving for professional translation should be the goal.

On Survey Administration

- Typically, survey administration became problematic when speaking with more than one or two respondents at once; while different opinions are valuable, we found that multiple respondents often tended to argue and/or influence one another's answers. In addition,

interviews with multiple respondents were prone to tangential conversation, lengthening survey administration time.

- We observed men and women to respond to the survey in distinct ways. Aside from the issue of having different levels of knowledge on various survey subjects, women in general were much more forthcoming with their answers. In contrast, many of the men we spoke with were somewhat more wary of our intentions, and were consequently more reluctant to answer our questions, particularly those concerning income and livelihood. As a result it may be necessary to control for gender-bias in a large-scale survey.
- Our presence in the villages around Melur attracted an inordinate amount of attention. Curiosity drew dozens of villagers to our interview sites, and was likely a significant distraction to respondents. In retrospect, we would have chosen to be less conspicuous in our entrance and appearance (although probably difficult to accomplish in practical terms).
- Collecting accurate data from rural area surveys requires detailed census-type information at the village level. As in our case, such sampling issues pose a significant concern, and underscore the need to develop local individual and organizational contacts.

On Choosing and Training Administration Personnel

- Training local interviewers to administer the survey is critical—it is especially important that interviewers understand the rationale behind each question in order for them to be able to pursue answers appropriately.
- Explicit survey scripts help to ensure consistency of administration and to prevent biasing respondent answers. Thus, interviewers must allow respondents to complete the entire survey by following the written script and asking every question; we found a tendency among survey administrators familiar with the local community to assume knowledge of answers to certain questions, or to underestimate the ability of villagers to respond to questions regarding details of their livelihoods (e.g., costs, expenditures, market prices, village politics).
- A well-administered survey requires up-front buy-in from administrators on survey goals and methods. Confusion over survey objectives or lack of confidence in survey design may lead to reluctance on the part of administrators to implement it.
- The appropriate organization to administer the survey periodically should possess an awareness of the area and social dynamics within the villages to put the questions in context, and extrapolate the necessary information from different types of responses. This expertise

however must be balanced with the need to avoid respondent bias. Administrators with deep local relationships may have a subtle or direct influence on villager answers (for example, if a local Micro-credit representative is administering a survey, a potential client might want to overstate economic stability to be eligible for loans in the future).

- In addition, different organizations may have vested interests in obtaining specific sets of results with certain technology implications. For example, government agencies may desire to influence survey results in a way that inflates the importance of a government application.

Appendix II: Survey Instruments

Each survey instrument has been carefully designed to collect specific information in line with the purposes outlined. In this section, we make explicit our assumptions and rationale behind different sections of each survey instrument.

The Household Survey attempts to collect specific information about the income, expenditures, employment and communications of village households.

The survey is divided into eight basic sections:

- Household Demographic Data
- Migration
- Employment
- Agriculture
- Expenditures
- Remittances
- Government Interaction
- Media Profile

Within each section, we have built in questions that relate communication profiles to particular economic and social activities of family members. For example, when asking a respondent about members of the family who are migrant workers, we ask questions that provide a description of how the family may communicate with the migrant while they are away.

Section 1: Household Demographic Data

Purpose: To establish a record of family members who can be tracked over time as part of a baseline economic analysis.

This section collects data on the level of education and the proficiency in particular languages of the region. These data can help guide the design of interfaces that require language (speech or text) inputs or outputs, and can trace whether the uses of IT among villagers creates an incentive to improve educational attainment. If villagers find technology useful and accessible, members might seek training in this area. Also, as new uses

for IT can be developed within the village, new job opportunities working with IT might encourage training and job creation within villages.

Section 2: Migration

Purpose: To collect data about members of the household who migrate away from home for work.

The section on migrants determines linkages of families to people outside their home or village. These linkages are important in designing networks that aid communications between family members. In addition, migrant information captures additional data about the economic inputs of migrant workers into household income and can establish, for example, whether information can help make finding or participating in migrant work more efficient.

Section 3: Employment

Purpose: To establish a rich picture of the employment systems in north Madurai. Understanding the employment structure of the region will help us track economic indicators such as income more precisely and will inform application design and willingness to pay for potential services such as the Spot Labor Market application.

The employment section retrieves data on how often people are employed, in what sectors, the type of work they perform, how far they travel to work, income from employment, technology used at work and rates of unemployment. These indicators can track how employment status may be improved through the introduction of certain key information or knowledge.

In addition, the employment section informs application design by capturing which sectors require coordination efforts to reduce structural unemployment and for which regions employment postings might most effectively improve a villager's chances of finding work or reduce travel costs to and from work.

The employment section considers both *agricultural* and *non-agricultural* employment. While in the field, we discovered that employment in North Madurai works on a basic two tiered cycle: During the monsoon season, employment is primarily agricultural and during the dry season, work shifts away from agriculture and toward tasks such as masonry and the production of small commodities.

This information helps determine whether service provided through IT will enhance the standard of living of the population through enhanced labor market efficiencies - providing better jobs, more employment (particularly during the dry season) or improved salaries. Answers to these questions will also help us

understand how efficiently labor markets work, and test whether more fluid information about opportunities can help the households receive higher incomes, or be employed to the extent they desire.

During our research we discovered that work is also heavily divided by region. For example, in some areas, charcoal making occupies the majority of time devoted to non-agricultural work while in other areas masonry predominates outside of agriculture. Data on the prevalence of different types of work in different regions will inform the design of applications by defining *data types* and *data flows* such that the right information reaches the right people.

Section 4: Agriculture

Purpose: Agriculture makes up roughly 90% of most economic activity for the rural poor who live north of Madurai and Melur. As such, estimating an economic baseline for these regions must include a robust assessment of agricultural activity. In addition, applications such as the posting of price information requires an understanding of which prices are important to economic activity in the region. In particular, understanding the proportions of crop production and more specifically the inputs required to farm those crops informs the design of price dissemination applications.

This section captures how many acres of specific crops are planted, the input and labor costs of planting them, the yields per acre per crop, the time to market, the distribution networks and prices at the end of the ‘supply chain.’ This information can inform us about where information inefficiencies may be hindering the process of agricultural production.

Some farmers, even in poor areas, do own their own land. Of individual landowners, the average plot of land is roughly 3.5 acres or slightly less. These landowners reported that they do sometimes lose income due to inefficiencies in timing distribution of their crops. They also reported that a lack of timely employment hindered their agricultural output indicating a need for both agricultural and employment services.

Section 5: Expenditures

Purpose: The prices that households face for consumption goods may be subject to the same market forces and information disparities affecting produced goods. This section attempts to create an initial picture of household expenses, both to discern post-intervention changes and to establish application design priorities—e.g., IT resources may be best focused on items and markets where the household spends a significant portion of its income, for examples cultural events such as weddings. In addition, the section is analogous to Agriculture in that it also aims to test whether knowledge about prices in expanded markets will change the prices available to households. While differences in prices received by households and different

markets can be a function of transportation costs to remote places, lack of information may exacerbate price differences.

Section 6: Remittances

Purpose: A significant portion of a household's income may stem from remittances delivered on a regular basis. This section attempts to determine how individuals receive remittances, how they become aware of them, and how long it takes for them to receive the funds once they are notified. By collecting data on remittances it may be possible to establish a pattern of interaction to isolate bottlenecks and delays in the payment process. Once these deficiencies are understood, it may then be possible not only to design an IT solution, but to track its effectiveness over time once implemented.

Section 7: Government Interaction

Purpose: To determine the extent of villager interactions with government, their frequency and purpose. This type of questioning can help inform how IT services can be established to facilitate more efficient interactions with government agencies. The purpose of such a service would be both to reduce the tremendous time commitments currently required to interact with government, and to make this interaction more effective.

Section 8: Media Profile

Purpose: To capture a rich picture of current communications and to identify key areas where village communications can be made more efficient. In addition, information about communication can help construct willingness to pay measures that can inform the sustainability of overall project design efforts.

HOUSEHOLD MEMBERS

I would like to ask you about all the people who are members of this household.

By this I mean all people, including children, who:

Live in this household (live here more than 15 days each month), I'll ask about those living outside the village later

Can you give me the names of all people who live in this household? Please list the head of household first.

Name	1 Age	2 Male/ Female	3 Is [Name] currently enrolled in school?	4 What is the highest level of education [Name] completed? (0- 12, college or diploma)	5 What is [Name] 's relationship to the household head? Head 1 Son/Daughter. 2 Father/mother. 3 Husband/Wife 4 Brother/sister.. 5 Cousin..... 6 Other relative.. 7 Not related..... 8	6 Is [Name] proficient in Tamil?			7 Is [Name] proficient in English?			8 Is [Name] proficient in other languages?		
						Denote as Good Fair Poor G F P Read Write Speak			Denote as Good Fair Poor G F P Read Write Speak			Denote as Good Fair Poor G F P Read Write Speak		
1		M / F	Y / N			Y/N			Y/N			Y/N		
2		M / F	Y / N			Y/N			Y/N			Y/N		
3		M / F	Y / N			Y/N			Y/N			Y/N		
4		M / F	Y / N			Y/N			Y/N			Y/N		
5		M / F	Y / N			Y/N			Y/N			Y/N		
6		M / F	Y / N			Y/N			Y/N			Y/N		
7		M / F	Y / N			Y/N			Y/N			Y/N		
8		M / F	Y / N			Y/N			Y/N			Y/N		
9		M / F	Y / N			Y/N			Y/N			Y/N		
10		M / F	Y / N			Y/N			Y/N			Y/N		

AGRICULTURE

19 Does this household grow any crops? **YES/NO**
IF NO, SKIP TO NEXT SECTION.

I would like to ask you a little bit about the crops you grow.

20 How much land do you own (Acres). _____ Acres

	21	22	23	24	25	26	27
Crop	How many acres do you plant of these?	How much do you spend in each acre for ____?	What is the yield per acre for ____?	What is the longest time you have ever stored ____ to sell later?	To whom did you sell it?	Where do you sell it?	How much did you sell it for?
				Do not store 1 0- 15 days 2 1-3 months 3 3-6 months 4 longer than 6 months	1 Friend 1 2 Trader 2 3 Wholesaler 3 4 Retailer 4 5 Consumer 5	Local market 1 Market in Melur 2 Market in Madurai 3 Other 4	
Rice							
Sugar Cane							
Lentils							
Cotton							
Groundnut							
Coconut							
Other							

Open-ended questions:

How do you find out about prices?
 What other information do you need?

APPENDIX II: SURVEY INSTRUMENTS

Now I would like to ask you about the inputs you use for primary crops.

28 Does this household purchase any inputs? (e.g., materials, equipment)

YES/NO. IF NO, SKIP TO NEXT SECTION

	29	30	31	32	33
Inputs	Last season, how much _____ did you buy/rent? (NOTE QUANTITY AND UNITS)	Where do you usually buy it?	In how many places do you check prices or buy products?	How do you find out about prices? (List all that apply.)	How much did you buy it for? _____ Rs. per _____
		Local market 1 Market in Melur 2 Market in Madurai 3 Other 4		Go to market to check 1 Trader tells 2 Friend tells/Word of mouth 3 Newspaper 4 Radio 5 Phone 6 Panchayat Office 7 Agricultural Office 8	
Seeds					
Fertilizer					
Other					

34 How much does it cost to transport your crops to market, per cycle?

_____ Rs.

APPENDIX II: SURVEY INSTRUMENTS

51

Do you sell dairy products?

YES/NO (IF NO, SKIP TO NEXT SECTION)

For the following questions, answer in terms of the one or two primary forms of feed used.

	52	53	54	55	56
	Do you buy feed for _____? (list animals)	Where do you buy it?	Do you check several different prices before selling?	How do you find out about prices?	How much did you pay for it?
		Trader comes to you 1	Y/N	Go to market to check 1	
		Local market 2		Trader tells 2	
		Market in Melur 3		Friend tells/Word of mouth 3	
		Market in Madurai 4		Newspaper 4	
		Other 5		Radio 5	
				Phone 6	
				Panchayat Office 7	
				Agricultural Office 8	
				Other 9	
Oil feed					
Paddy waste					
Paddy husk					
Ground cake					

APPENDIX II: SURVEY INSTRUMENTS

EMPLOYMENT

Now, I would like to ask you about employment. For each person in this household, can you please tell me whether they do any work for pay for someone outside of this household? First, I would like to focus only on those persons who have a regular relationship (work for the same employer, source, farm). And for now, I want to ask only about employment during the monsoon season.

[INTERVIEWER: USE THE SAME NAMES/NUMBERS AS ON PAGE 1]

ID	57 Does [Name] have a regular job with the same employer? Circle Yes or No. IF YES, SKIP TO NEXT PERSON	58 Do any of the following describe how [Name] is employed? List all that apply.	59 When [Name] works, how many days does he/she work in a typical week?	59 In what sector does [Name] work?		60 What type of work does [Name] perform?		61 How far does [Name] travel to their primary job? (List all that apply.)		62 Typically, how many Rupees does [Name] earn per week?	63 Would [Name] be willing to work more days if they could find work? What other job(s) would [Name] consider?
				Primary	Secondary	Primary	Secondary	Primary	Secondary		
		Works for same people most of the season 1 Part of organized labor gang 2 Seeks work regularly: Daily 3 Seeks work regularly: Weekly 4 Seeks work regularly: Monthly 5 Unemployed 6 Self employed (e.g., own business/cottage) 7 Works for same people all of the season 8		Manufacturing/ Industry 1 Animal/ dairy 2 Agriculture 3 Construction 4 Weaving 5 Mining 6 Other 7	Managerial 1 Skilled 2 Unskilled labor 3	Your village 1 Village inside panchayat 2 Village outside panchayat 3 Melur 4 Madurai 5					
1	Y/N										Y/N
2	Y/N										Y/N
3	Y/N										Y/N
4	Y/N										Y/N
5	Y/N										Y/N
6	Y/N										Y/N
7	Y/N										Y/N

Open-ended Questions:

What difficulty do you or your family have finding work?

When looking for work how do you go about finding it?

EXPENDITURES

64 | About how much does this household spend in a typical month? Rs.

Worksheet:

On average, how much does your household spend on ____ [Insert Item] ____ per week?

Item	Average Weekly Expenditure	Average Monthly Expenditure	Average Yearly Expenditure
Food	_____ Rs.	_____ Rs.	_____ Rs.
Medical	_____ Rs.	_____ Rs.	_____ Rs.
Transportation	_____ Rs.	_____ Rs.	_____ Rs.
Cultural/Social (e.g., marriages)	_____ Rs.	_____ Rs.	_____ Rs.

REMITTANCES

65	Does your household ever receive any cash from other persons, for example, relatives or friends who do not live nearby? (Circle YES or NO.)	YES/NO	IF NO, SKIP TO NEXT SECTION
----	---	--------	-----------------------------

Do you receive remittances from:

66	Elsewhere in Madurai?	YES/NO
67	Elsewhere in Tamil Nadu?	YES/NO
68	Other regions in India?	YES/NO
69	Outside of India?	YES/NO

70	Typically, how do you receive remittances?	Once per week?	1
		Once per month?	2
		Every other month?	3
		Twice per year?	4
		Every other year?	5

71 What is the amount of a typical remittance you receive?

72	Typically, how long does it take to receive a remittance after you discover that one has arrived for your household?	One day	1
		One week	2
		Two weeks	3
		Three weeks	4
		One month	5

GOVERNMENT

	73	74	75	76
Transaction	What government entity did you have to go to?	How much did you pay for this transaction in total? (NOTE QUANTITY AND UNITS)	How far do you travel to get it?	How do you find out about these services?
	Revenue village 1		Your village 1	
	Firka 2		Village inside panchayat 2	
	Thaluk 3		Village outside panchayat 3	
	Revenue subdivision 4		Melur 4	
	District 5		Madurai 5	
Get a birth certificate				
Land ownership				
Marriage license				
Death certificate				
Welfare				

With which government level do you interact the most?

What is the highest level of government you have approached, and why?

MEDIA PROFILE

Medium	Do you use _____?	Where do you use _____?	When do you use?	Most often, for what purpose do you use _____?	How often do you typically use _____?
		At home 1 Friends or relatives 2 Public facilities 3	Morning 1 Afternoon 2 Evening 3 Night 4	Education/training 1 Health 2 Business/commercial 3 Government Info 4 News 5 Sports 6 Entertainment 7 Emergency/Security 8 Other 9	Never 1 Everyday 2 Every week 3 Every month 4
Television	Yes / No				
Radio	Yes / No				
Newspaper	Yes / No				
Computer	Yes / No				

Open-ended question:

**What information do you not get via the above that you need to know?
 Why do you need to know this?
 If you could, would you pay for access when needed? How much?**

MEDIA PROFILE

Organization	Do you keep in touch with any of the following organizations away from your village? YES/NO	How do you communicate with people / organizations ? Messenger 1 Phone 2 Fax 3 Letter / Post 4 By traveling to see them in person 5 E-mail 6	How often do you communicate with people / organizations ? Once a week 1 Once every two weeks 2 Once a month 3 Once every two months 4 Once every six months 5 Once a year 6
NGO	Y/N		
School	Y/N		
Health Clinic	Y/N		

Madurai District

Community Questionnaire

IDENTIFICATION #: _____ **DATE OF INTERVIEW:** ____ / ____ / 2001

NAME OF INTERVIEWER: _____

NAME OF RESPONDENT: _____

ROLE OF RESPONDENT _____

VILLAGE / MUNICIPALITY _____

Relevant community:

1. What villages are included within this Panchayat? (Draw a picture if possible about structure of villages within this Panchayat community). Please highlight location of:
 - a. Highlight roads
 - b. Water sources
 - c. Primary health care centers
 - d. Schools
 - e. Post office
 - f. Caste demographic divisions if they exist (names and locations of caste groups, and % of population)
 - g. Temple
 - h. Market

Infrastructure of village

In this village is there?	How far to nearest?	How much does it cost to get the service at the ___?
Post office		
Telephone		
Telegraph		
Cluster office		
Weekly market		
Bank		
District govt. office		
Police station		
Bus stop		
Mill-sugar		

2. Which of these are frequented the most by people from this village?

Utilities**Electricity**

3. Do households in this village have electricity? Most households or just a few?
4. About how many hours per day is there electricity? Are there many days where there is no electricity?
5. Does anyone in the village own a generator?

Water

6. What is the source of water used in households? Do households have running water? How do they fetch water?
7. What is the major source of drinking water for most people during the dry season? During the rainy season? (Private tap, public tap, well without pump, well with pump, spring/river/lake/rainwater.)

Transportation

8. Does a paved road pass by this village?
9. How far from the village is a paved road?
10. What is the major road in this village made out of? (dirt, paved, unpaved, no road)
11. Is the road that comes to this village impassable during certain times of year? For how much time is it usually impassible?
12. What are the nearest villages/city/towns?
13. Which villages/city/towns do people most often visit?
14. What is the main form of transportation to get to these places?
15. About how long does it take?
16. How much does it cost?
17. Does public transport pass by this village? How far away must you go for this? How often does it pass by?
18. Does anyone in this village own a car? Truck?

Demographic information

19. How many people live in this village at present, excluding migrants?
20. About how many people would you say live away from home as migrants or students?
21. In the past 5 years, have more new households moved to this village or have more moved away?
22. What are the principal groups represented in this village?
23. What are the hamlets in this village? Is there a predominant hamlet, and is it based on religion/caste/family?
24. Are there many female-headed households?
25. What are the major languages spoken in this village?

Economic Activity

26. What are the major economic activities in this village? What is the major source of work for villagers?
27. How do the activities divide among gender, age and caste?
28. Percentage distribution (% of people involved in) each activity? In Monsoon vs. Dry seasons?
29. How much unemployment is there in dry and monsoon times?
30. What is the average monthly or daily wage paid in this village for:
31. Transplanting
32. Harvest
33. Weeding
34. Any other manual labor (please specify)
35. How much does an agricultural worker earn per day, on average during the agricultural season?
 1. Man
 2. Woman

3. Child

Labor Markets

36. How do people find jobs, both casual and regular jobs? Is it different in the monsoon and dry seasons?
37. Do they use Kotths? How many in this village? How are the gangs organized?
38. How do the Kotths find about job opportunities? How far do they travel to find them?

Goods Markets

39. How many markets are there near the village?
40. Is there a permanent (daily) market in this village?
41. Is there a periodic market in this village? How often is the market?
42. How are the goods from this village transported to the markets?

Agriculture

43. What are the major crops grown in this village? How many planting cycles are there per year?
44. How are these crops usually sold?
45. Does this village have storing facilities? How much does it cost to store crops (rice, lentils)?
46. Is there a cooperative in this village?
47. Do farmers use ___? Machinery, chemical fertilizer, pesticide.
48. Is there a tractor in this village?
49. Are there any irrigated fields in this village?
50. Are there many sharecroppers?
51. Do people buy and sell land?
52. What are the main agricultural problems in this village?

Government agricultural extension

53. Is there an agricultural extension center in this village? How far away is the nearest one?
54. Does an officer from the agricultural extension visit this village? Where are they from? What services do they provide? How often do they come? Who do they usually serve?

Migration Work

55. Where do most people go when they leave this village for work?
56. What type of work do most of them do? About how long do they stay away?
57. Do people come to this village for work? Where from? How long do they stay?

Social Dynamics

58. How do people arrange marriages? How do they share information, within the village and with others outside the village?
59. Which are the most time/resource consuming social engagements in this village?
60. What do most people do for entertainment (films, soap opera, board games)?

Relationship with government

61. What are the mayor obligations of this Panchayat? The main concerns the public comes to you about?
62. How many people attend the Panchayat meetings, and how often are they held? What are the main issues touched upon?
63. Do people vote? How many people vote? For what?
64. What are the most common interactions (transactions, welfare stamps, caste certificates, land ownership certificates, etc.) with government for people in this village?

Disaster Management

65. What type of calamities affect your area? Do you ever get floods? Fires?
66. What do the villages do in emergencies? How do they contact help?

NGO and other organizations

67. Are there any groups active here? Social, religious?
68. Are there many NGO's operating in this village? Which ones? What kinds of things are they involved with?

Communications profile

69. Does anyone own a TV? Cable? VCR?

Madurai District

Education Questionnaire

IDENTIFICATION #: _____ **DATE OF INTERVIEW:** ____ / ____ / 2001

NAME OF INTERVIEWER: _____

NAME OF RESPONDENT: _____

ROLE OF RESPONDENT _____

VILLAGE / MUNICIPALITY _____

Schools available

	Primary Schools	Secondary Schools	College/Diploma
How many ___ are there in this village?			
How many teachers?			

1. Where is the primary school in this village (which grades)?
2. How many teachers are at the school? Do they live in the village?
3. How many classrooms are there?
4. How many students are enrolled in the school? How many attend?
5. About what % of boys/girls of school age are enrolled?
6. About how much does it cost to go to school, including fees, books, uniforms, etc.

7. Are there any private schools? About how much does it cost to go to school, including fees, books, uniforms, etc.

8. Is there a high-school in the Panchayat? If not how far from the Panchayat?
9. How many children from the panchayat attend high-school?

10. How far is the closest college?
11. Is anyone currently enrolled in a college program?

12. Is there an adult literacy program in this villages?
13. Are there any Non-formal education centers in the villages?

CURRENT TELECOMMUNICATION SERVICES

What type of service provider do you have for the following services?

	Telephone company	Satellite provider	Cable company	Internet Service Provider (ISP)	Not applicable
Basic telephone service					
Multiple-line phone system					
TV programming					
Dial-up Internet					
Cable modem Internet					

Does your organization use a computer? Yes/No (If No, go to...)

If Yes: How many computers does your organization use?

Is your computer connected to the Internet? Yes/No/Not applicable

What is your current telecommunications capacity?

- Business line with dial-up connection
- Dedicated 56K
- ISDN
- 256K DSL
- Dedicated T-1
- Don't know
- Not applicable

What do you think is the major use your facility could have of the Internet now and in the future?

	Don't know	Uses
Now		
One to two years from now		
Three years from now and later		

Madurai District

Health Care Questionnaire

IDENTIFICATION #: _____ **DATE OF INTERVIEW:** ____ / ____ / 2001

NAME OF INTERVIEWER: _____

NAME OF RESPONDENT: _____

ROLE OF RESPONDENT _____

VILLAGE / MUNICIPALITY _____

Availability of Services

1. How many villages does this facility serve? How many people does this PHC serve?
2. Is there universal access to health care? (i.e. access to all castes/creeds)
3. How many people work here?
4. How many hours per day is the facility open?
5. Is a doctor available every day the facility is open?
6. How many hours per week is the doctor normally available?
7. Do you have in-patient care? How many beds?
8. On average, how many patients does this facility see in a day?
 - a. In-patient (stay at least 1 night)
 - b. Out-patient

Illness Profile of Area

1. What diseases are most prevalent?
2. Is there preventive care and/or responsive care? (i.e. are the diseases they struggle with things that could even be addressed through the WWW?)
3. What populations do they hit? (i.e. male/female, young/old)
4. What is the spread/transmissibility pattern of diseases? (e.g. if the disease is spread by mosquitoes then the advantage of "preventive education" may be more limited than if the disease is spread by sex workers)

Facilities

In the village, is there a --?	How many?	How far is it to the nearest?	How much time does it take to get there? Cost?
Doctor			
Nurse			
Pharmacy			
Midwife			
Traditional birth attendant			
Healer			
Hospital			
Village Health Centers			

Services

1. Ask if have emergency facilities. Ask how far if not. Ask how coordinate visits? Ask how long it takes, how far, how costly. Ever any problems in coordinating. Adversely affect people’s health?
2. Do they make referrals to other facilities? How do they do that? How long does it take? Ever not get through?

	At any facility within this village can you get?	If after hours, where do you go?	Is there a fee for these services?
Antenatal care			
Family planning services			
Immunizations			
Injections for dog bites			
Diarrrhea remedies			
Treatment of wounds			
Malaria treatment			
Emergency services			
Minor surgery			
Major surgery			
Laboratory (blood tests)			
Electrocardiograms			
Blood pressure			
Sterilizing machine			

3. Does this clinic have electric power? How often? Hours per day. Own a generator?
4. What is the primary source of water?
5. What facilities do you have in the village? Ask about x-ray machine, operating room, laboratory, refrigerator.

Supplies

At any facility within this village can you get?	At any facility within this village can you get?	How far do you have to go?
Tetanus vaccine		
Anti-malarials? (chloroquine, mefloquine)		
TB treatment		
Anti-inflammatory		
Infection treatment		
Snake bite treatment		
Diarrhea remedy?		
Anti-worm		
Penicillin or other antibiotics		
Tetanus vaccine		

1. If they have it, ask about how order it. How long it takes. Ever problems with following up, or supply? Ask also about supply of gauze, blood, drugs, aspirin, etc.
2. How effective in your opinion? (i.e. Quality of care on a scale of 1-10)
3. What are the rate of diseases recurring? (ie. twice a year or monthly)
4. What is the level of education of health care providers?
5. Is there a system of keeping medical records?
6. Health worker (use time-frame of last 3-6 months, but longer for training)
 - a. How much time spent on training?
 - b. How much time spent on travel to treat patients?
 - c. How much money spent on travel to treat patients?
 - d. How much money spent on training?

CURRENT TELECOMMUNICATION SERVICES

What type of service provider do you have for the following services?

	Telephone company	Satellite provider	Cable company	Internet Service Provider (ISP)	Not applicable
Basic telephone service					
Multiple-line phone system					
TV programming					
Dial-up Internet					
Cable modem Internet					

Does your organization use a computer? Yes/No (If No, go to...)

If Yes: How many computers does your organization use?

Is your computer connected to the Internet? Yes/No/Not applicable

What is your current telecommunications capacity?

- Business line with dial-up connection
- Dedicated 56K
- ISDN
- 256K DSL
- Dedicated T-1
- Don't know
- Not applicable

What do you think is the major use your facility could have of the Internet now and in the future?

	Don't know	Uses
Now		
One to two years from now		
Three years from now and later		

INTERNET CAFÉ QUESTIONNAIRE

What is the Internet used for mostly?

Who comes?

How long do they stay?

How much do they pay?

How has demand changed since you opened?

How satisfied are you with the following characteristics of your current telecommunications service?

	Satisfied	Neutral	Dissatisfied	Not applicable
Speed of operation				
Price of services				
Customer service				
Reliability (system is "up")				
Accessibility (no busy signals)				

CURRENT CONNECTIVITY

How are your computers connected? Check all that apply.

- Locally on a local area network
- Outside to one or more locations (WAN)
- Outside to an Internet Service Provider (ISP)
- Not connected
- Not applicable

How do you obtain technical support for the following:

	In-house	Contractor	Combination (in-house and contractor)	Not applicable
Local area network (LAN)				
Wide area network (WAN)				
Applications/software				
Personal computer and operating system				

MARKET QUESTIONNAIRE

Price questionnaire:

Item	Unit	Price from shop?	Price from market	Lowest price/highest price
Rice (basmati)	Kg			
Rice (lower quality)	Kg			
Eggs				
Onions				
Potatoes				
Chicken				
Milk				
Lentils (a)				
Lentils (b)				
Salt				
Soap				
Fire wood				
Diesel				

Appendix III: Agricultural Price Data

Following are domestic price and volatility charts for selected agricultural goods in India. All prices are daily except where noted otherwise. The “volatility” measure is derived from period over period percentage price changes. This price data informs Table 5.1 of the Price Application section.

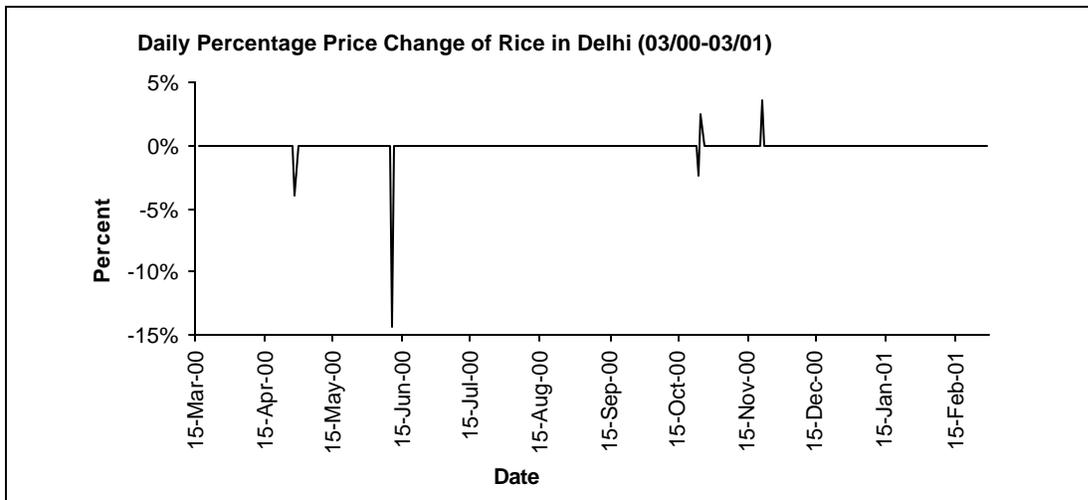
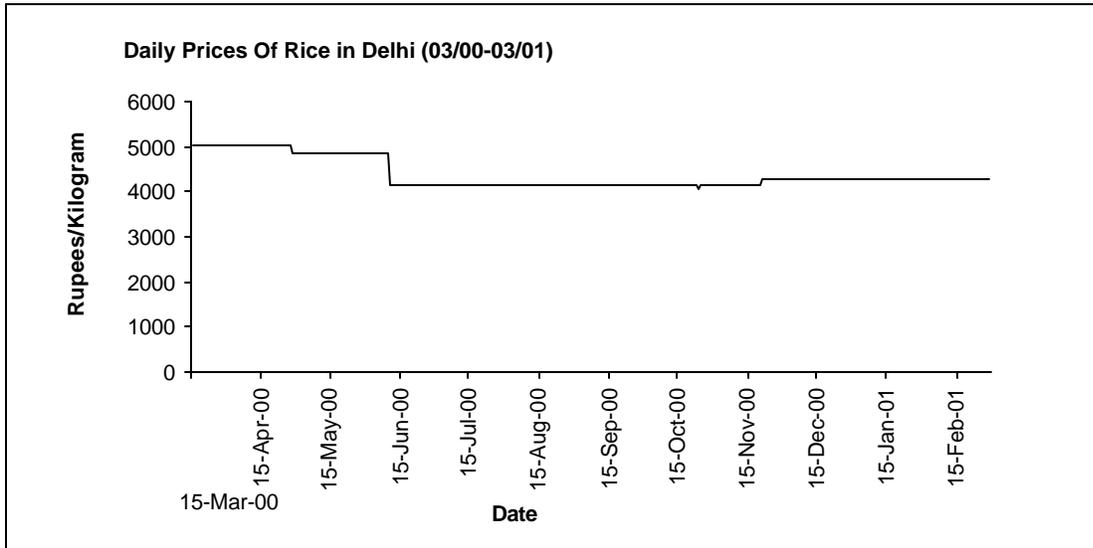
We use standard deviations over the various time series as one measure of the variation (i.e., price volatility) in a given set of data. While we are only able to compare standard deviations between sets of data that have the same mean, we can normalize the measure by dividing each series by the mean of the respective distributions and express as a percentage. This calculation yields a coefficient of variations that can be used as a comparative measure of price volatility. Calculated coefficients of variation and the assessed volatility for various commodities (which inform Table 5.1) are as follows:

Commodity	Coefficient of Variations	Assessed Volatility
Rice	7.52%	LOW
Sugarcane		
Chennai	3.70%	
Mumbai	3.42%	
Delhi	2.69%	
Haipur	4.03%	
<i>Average</i>	3.46%	LOW
Coconut	22.16%	HIGH
Groundnut	13.86%	MEDIUM
Maize	12.31%	MEDIUM
Onions		
Delhi	36.62%	
Chennai	32.72%	
<i>Average</i>	34.67%	HIGH
Potatoes		
Chennai	18.85%	
Delhi	21.58%	
Hyderabad	12.76%	
<i>Average</i>	17.73%	HIGH
Pulses		
Moong (UP)	6.60%	
Moong (Maharashtra)	8.37%	
Moong (Karnataka)	4.18%	
<i>Average</i>	6.38%	LOW
Ricebran	15.55%	MEDIUM

Note that graphs for Sugarcane, Onions, Potatoes display goods traded in different markets, while the graph for Pulses displays different brands of goods traded in the same market. These latter price differentials thus suggest differences in quality.

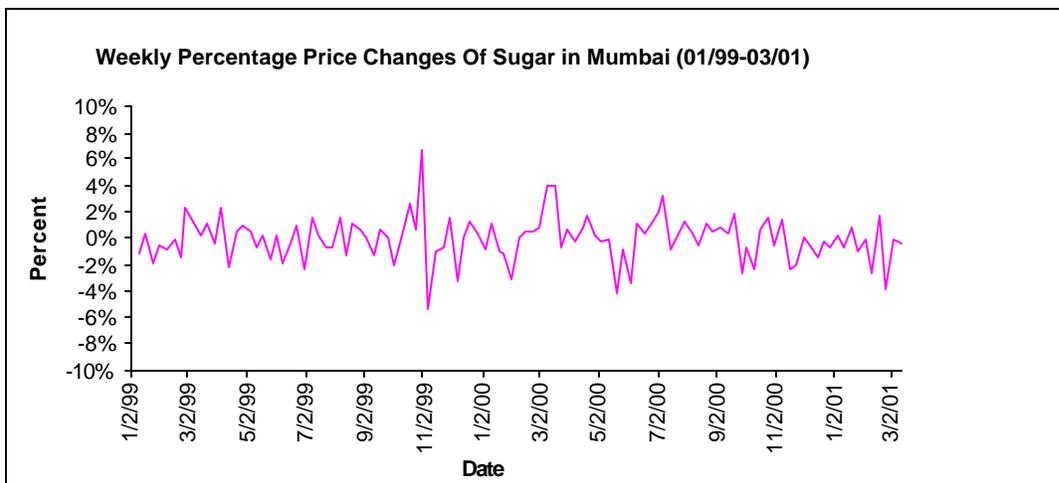
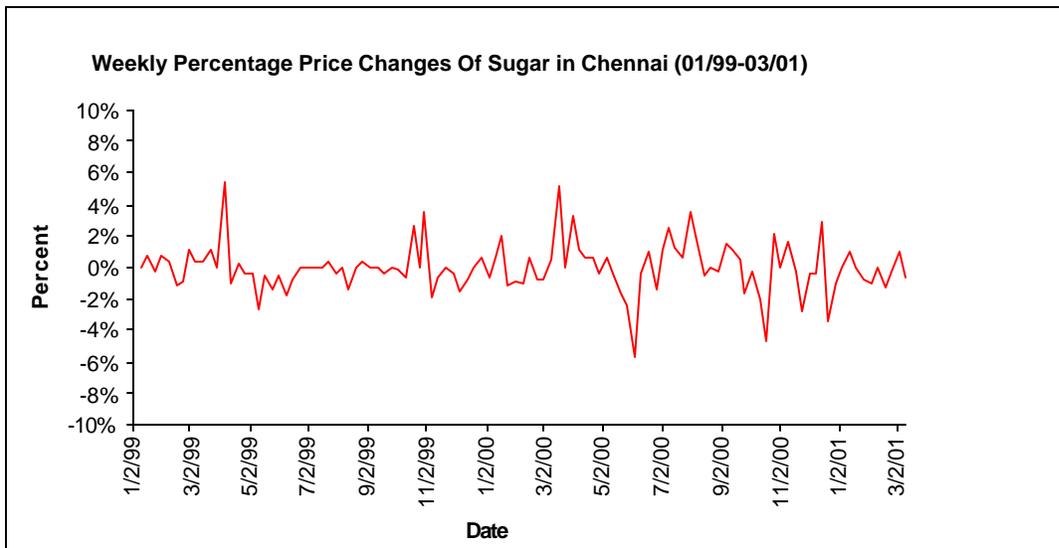
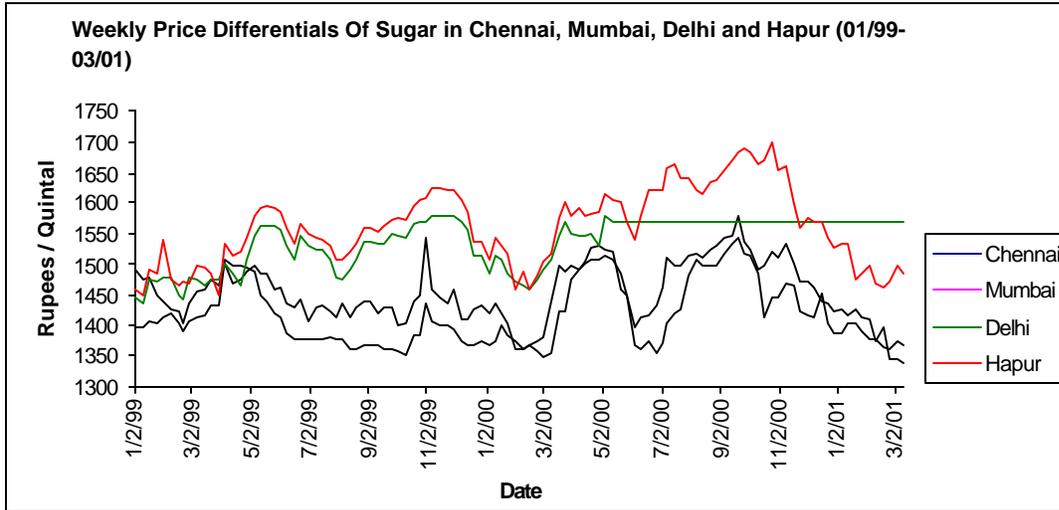
Prices for Rice

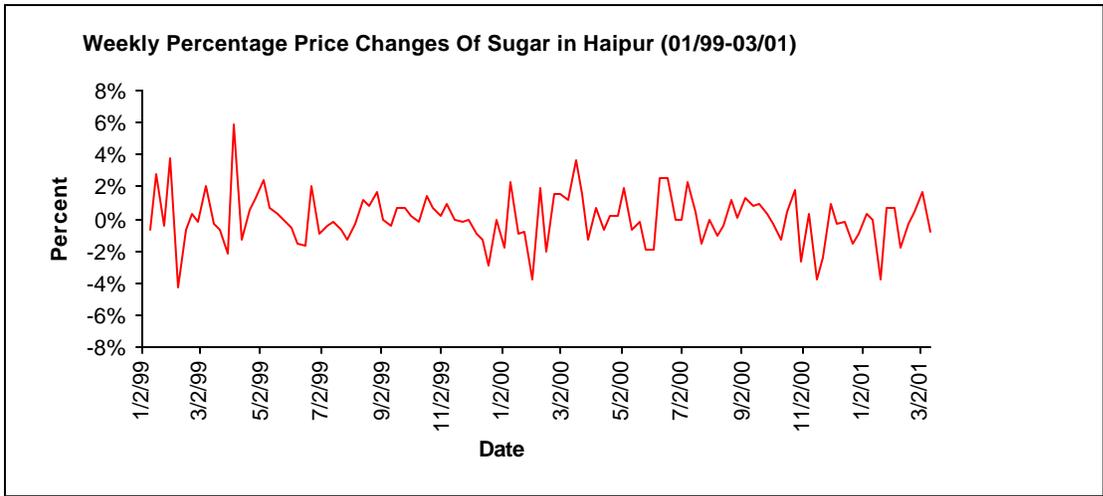
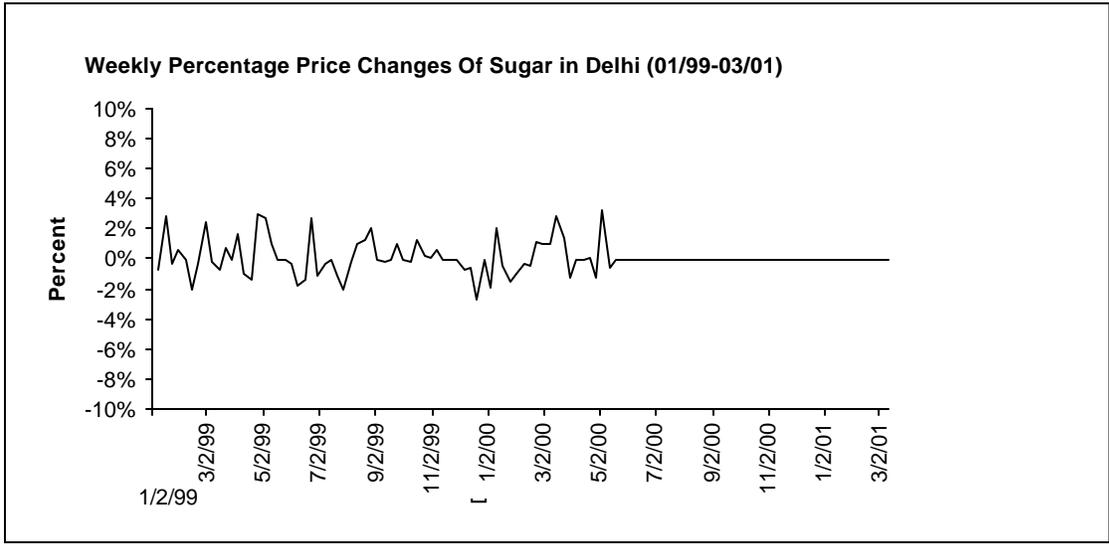
Source: <http://www.commodityindia.com>



Price Differentials for Sugarcane

Source: India Sugar Mills Association (ISMA) Data reported by: <http://www.commodityindia.com>;
 Prices based on Sugar Prices in Chennai, Mumbai, Delhi, Hapur

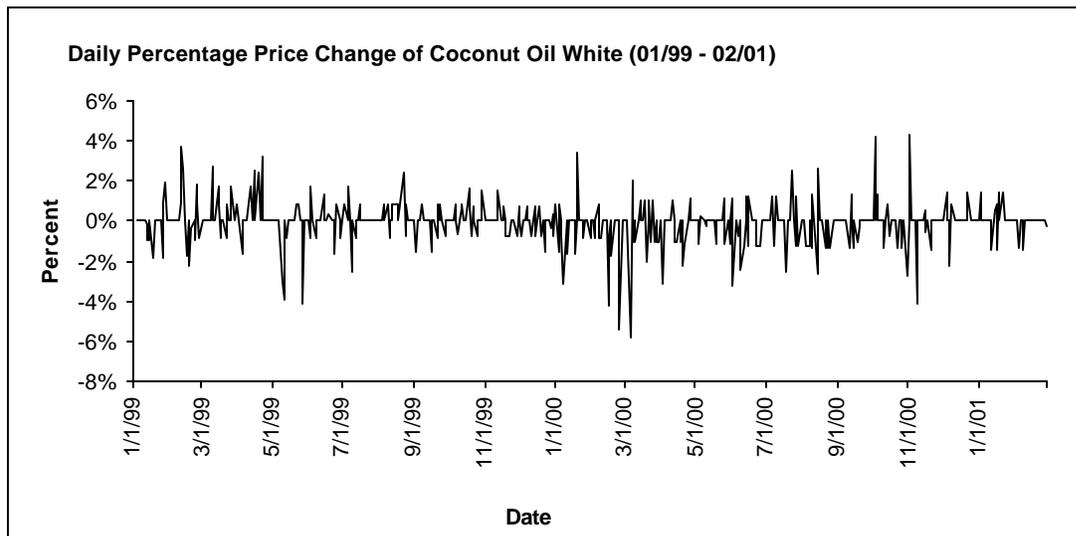
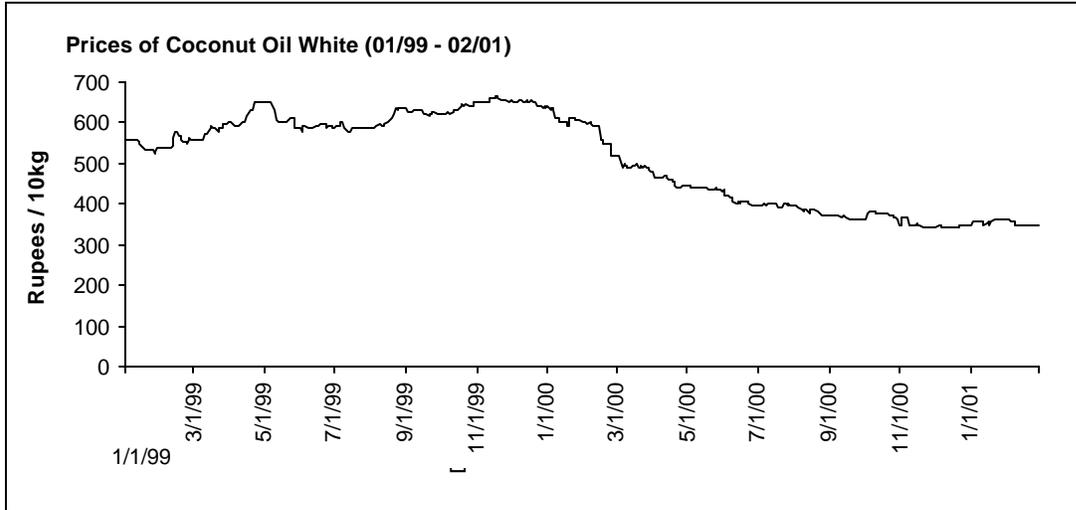




Price Differentials for Coconut

Source: <http://www.commodityindia.com>

Prices based on Coconut Oil Grade White at Mumbai market

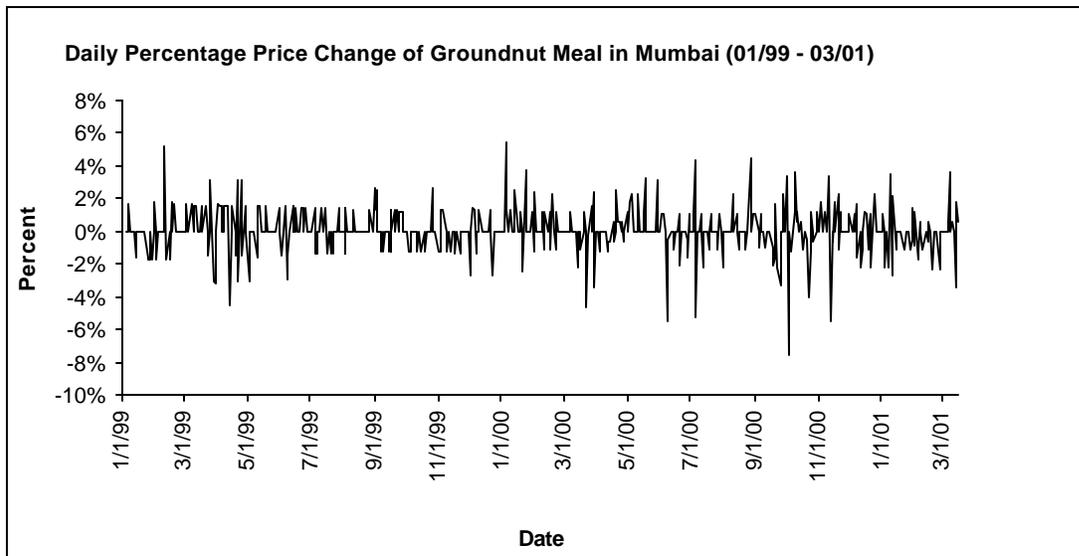
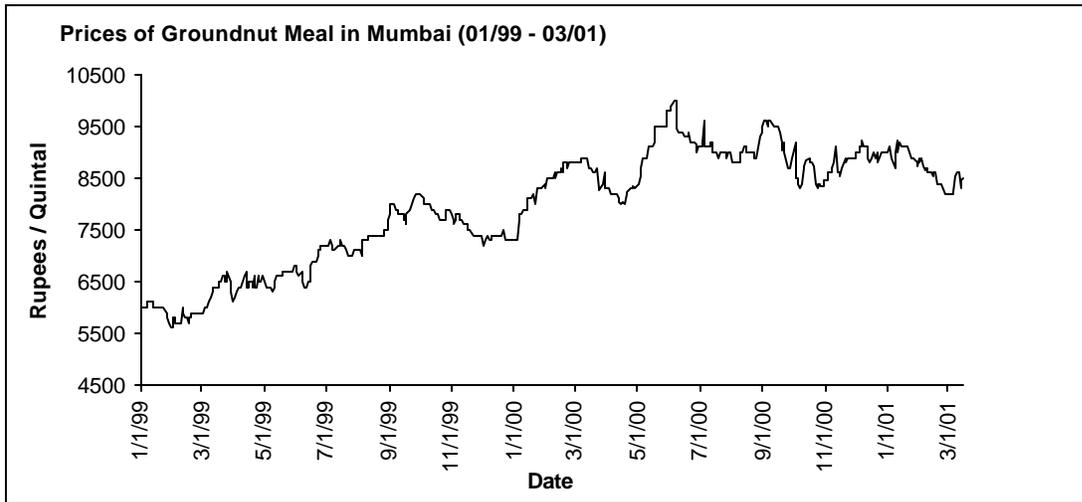


Prices for Groundnut

Source: *Bombay Oil Seeds and Oil Exchange (BOOE)*;

Data reported by: <http://www.commodityindia.com>;

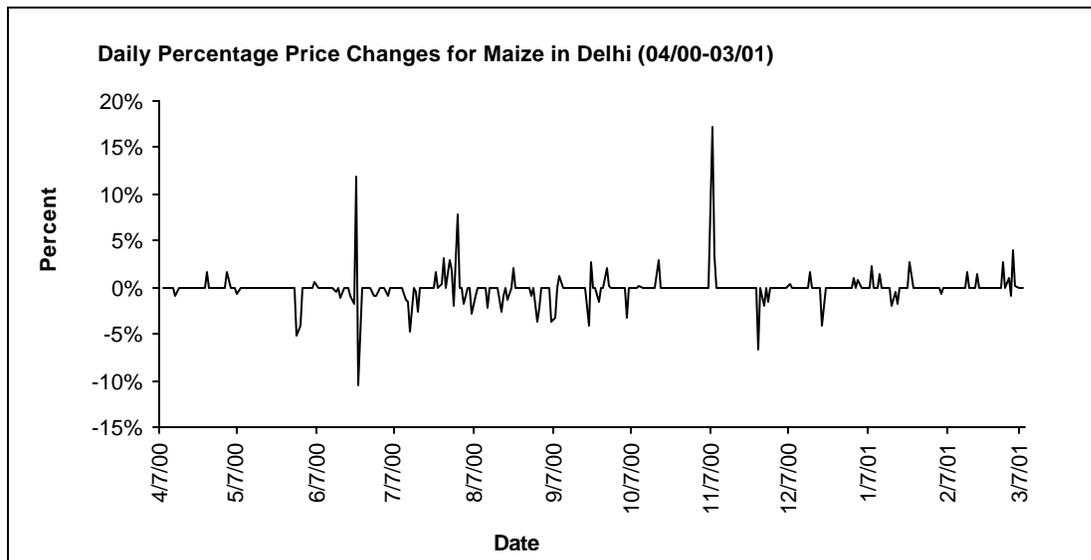
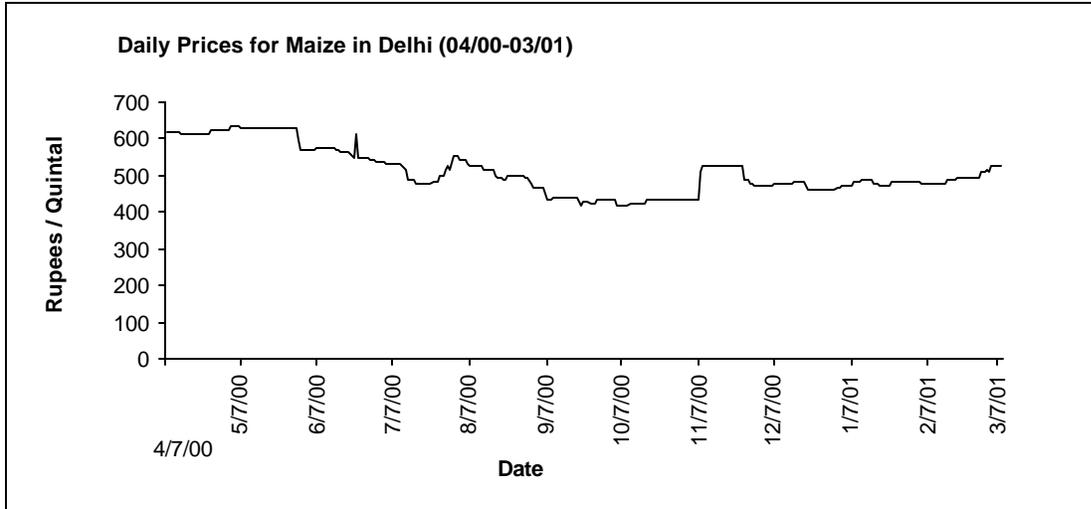
Prices based on Groundnut Meal Prices in Mumbai



The following products comprise the “Vegetables” category of Table 5.1: Maize, Onions, Potatoes, Pulses

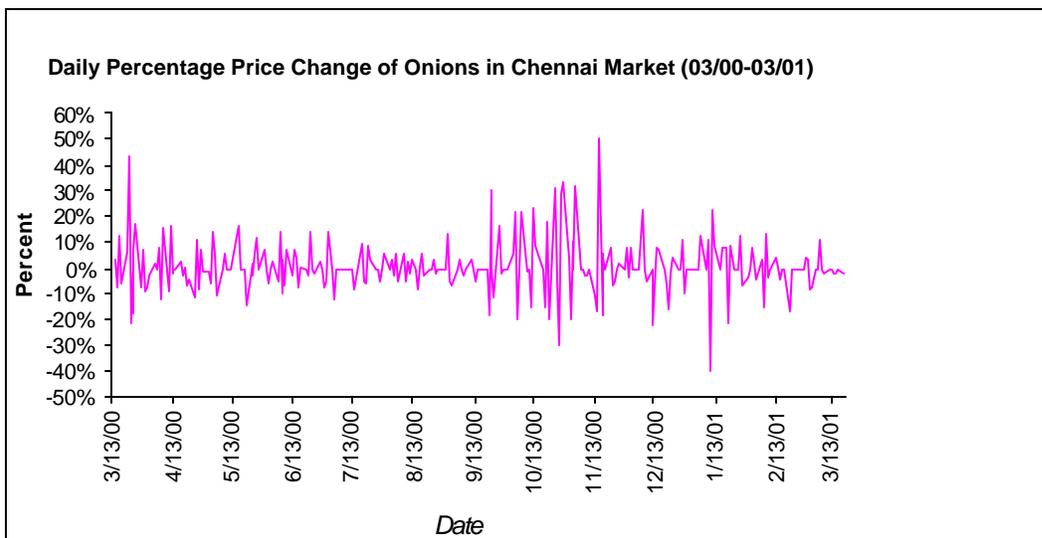
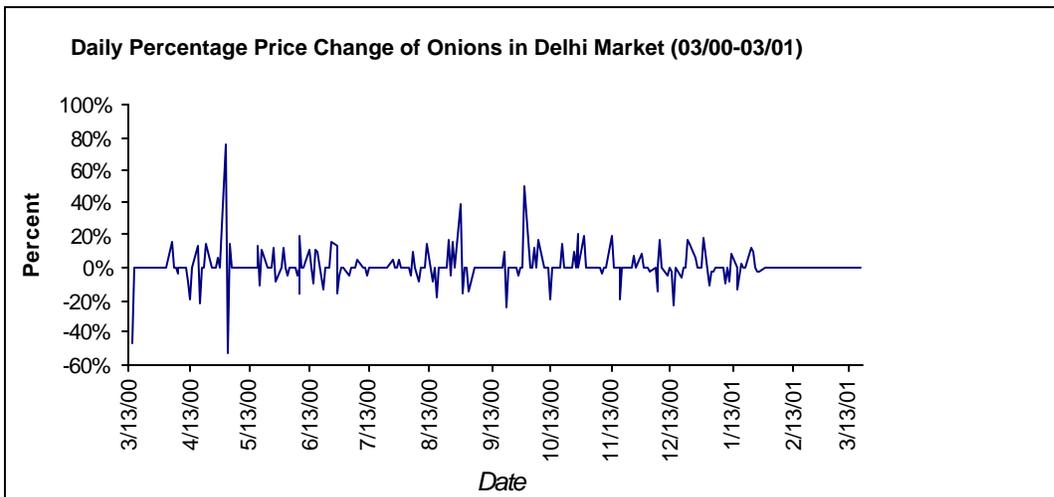
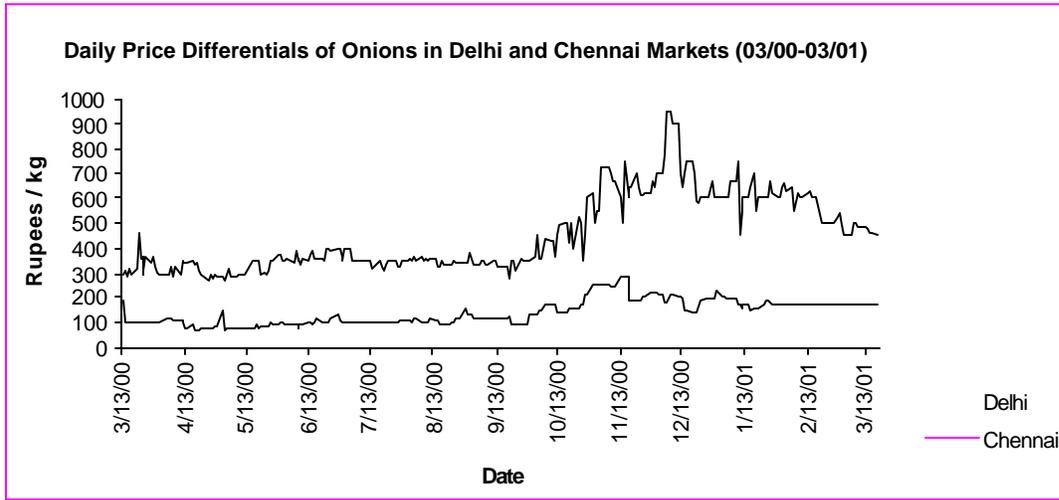
Prices for Maize

Source: <http://www.commodityindia.com>



Price Differentials for Onions

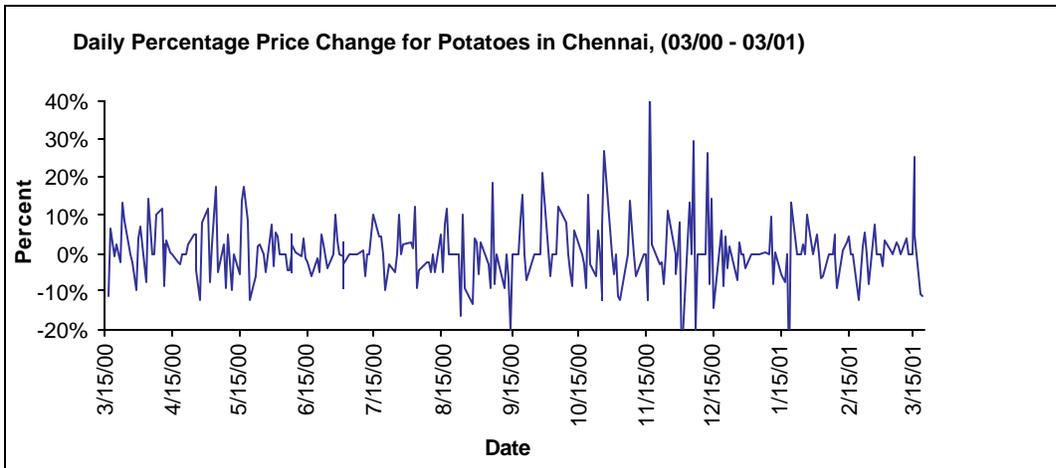
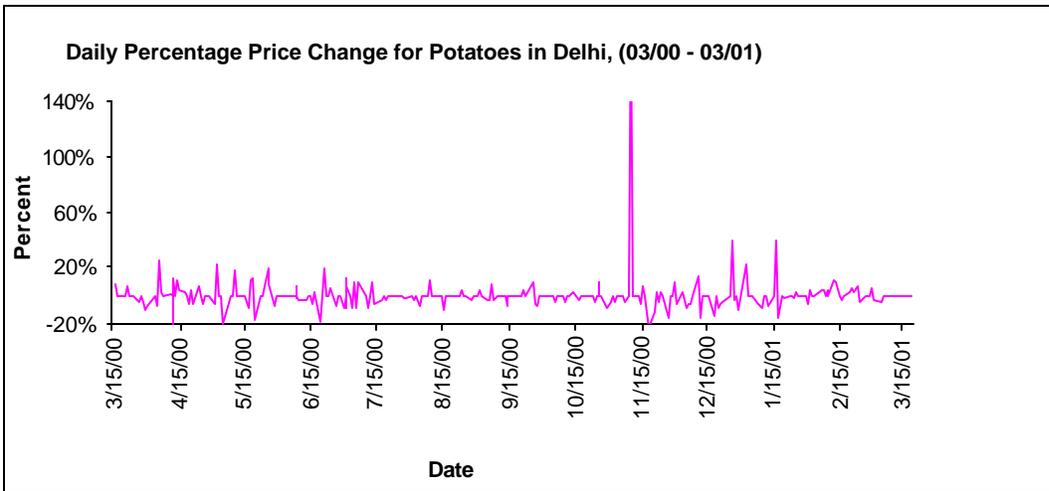
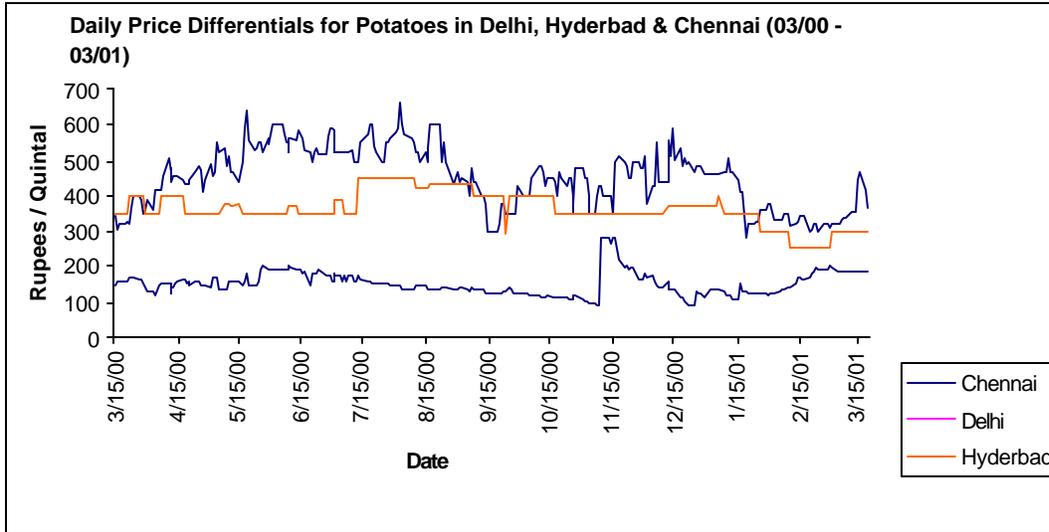
Source: <http://www.commodityindia.com>; Prices based on Onion Prices in Delhi and Chennai

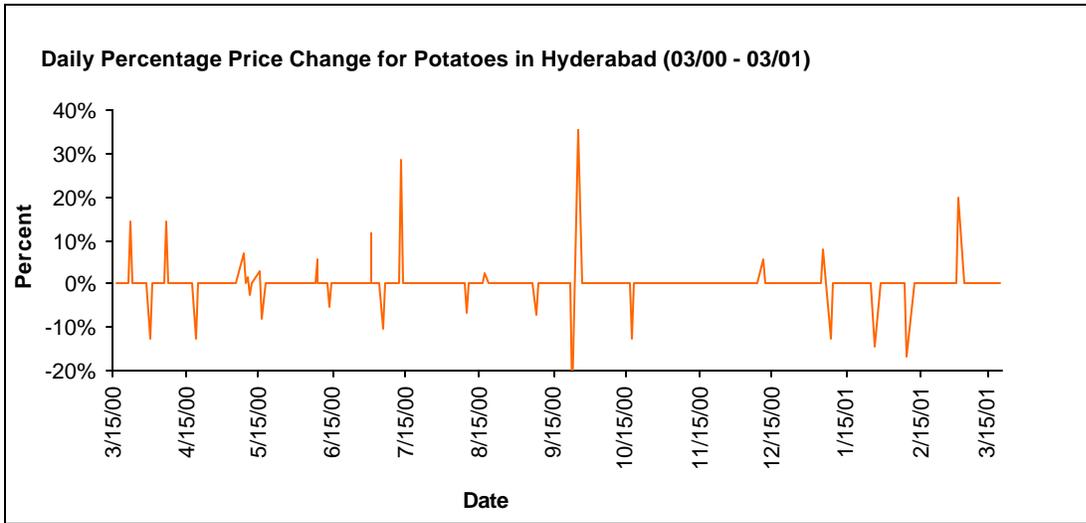


Price Differentials for Potatoes

Source: <http://www.commodityindia.com>

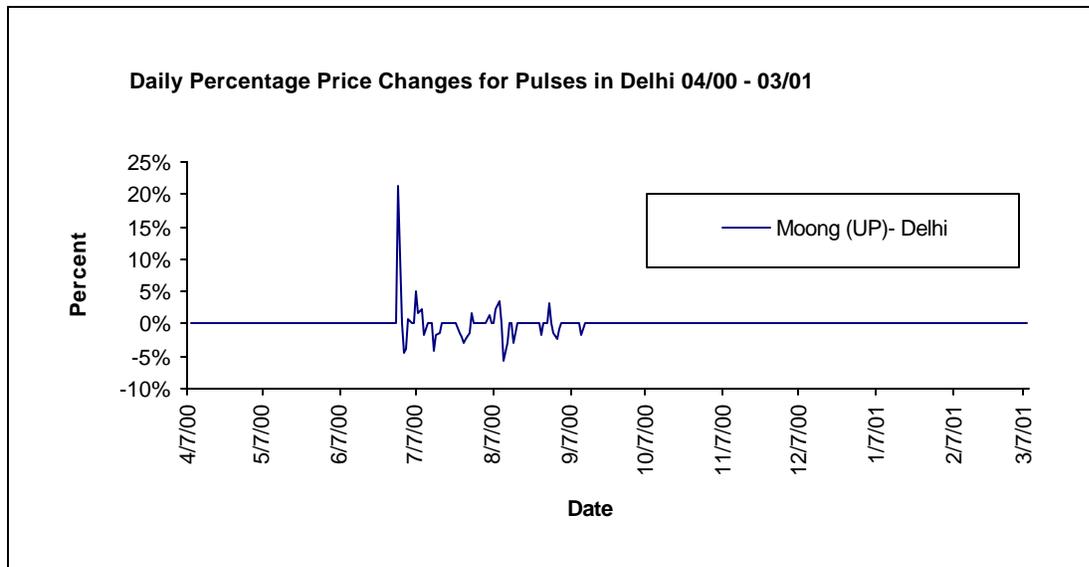
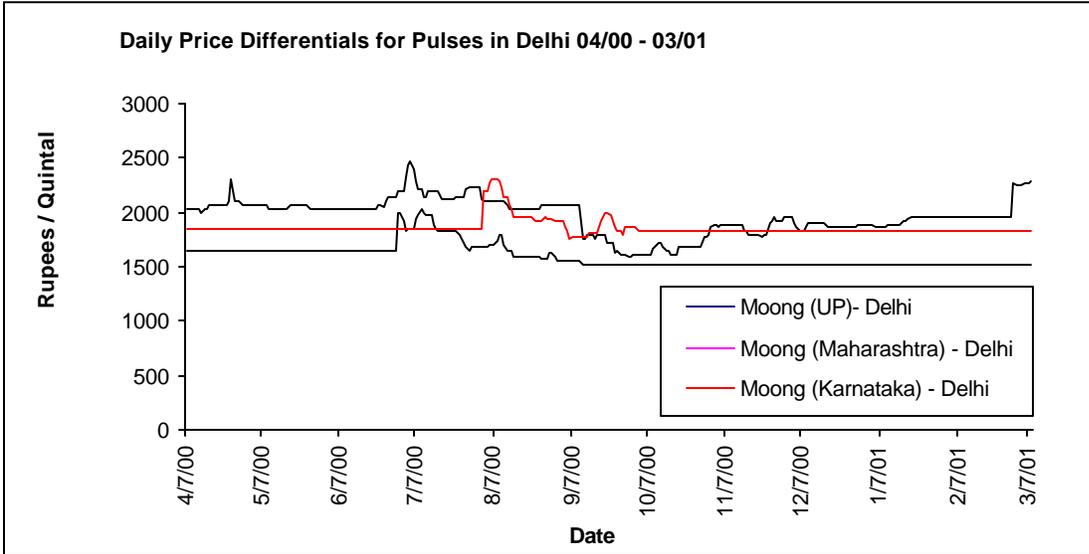
Prices based on Potato Prices in Delhi, Hyderabad Chennai

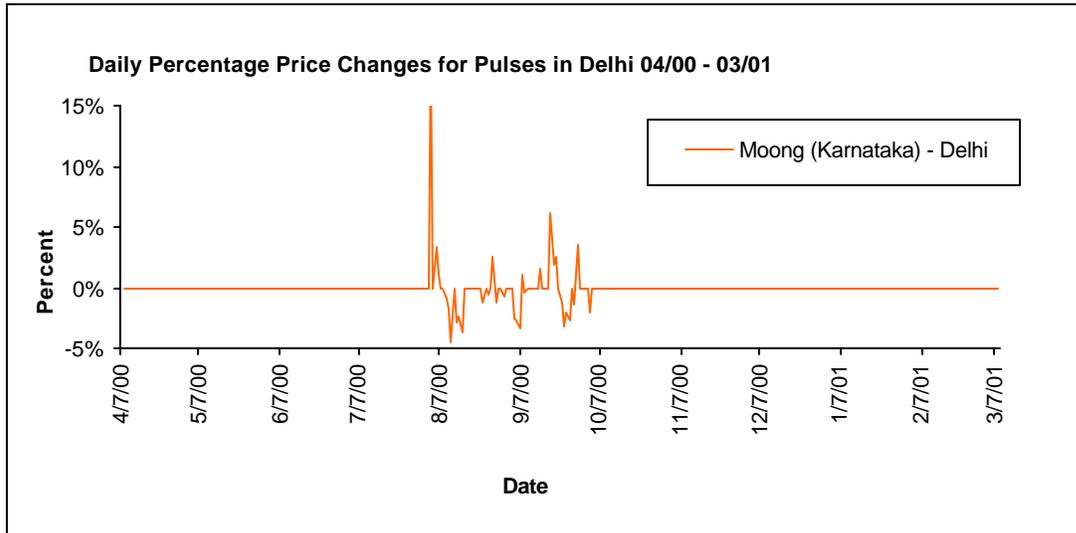
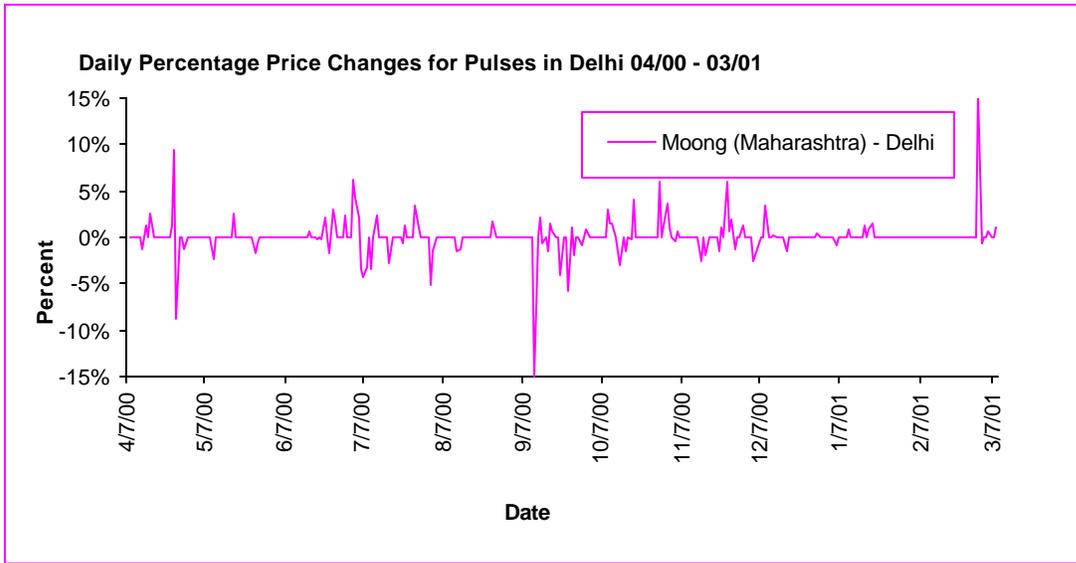




Price Differentials for Pulses

Source: <http://www.commodityindia.com>

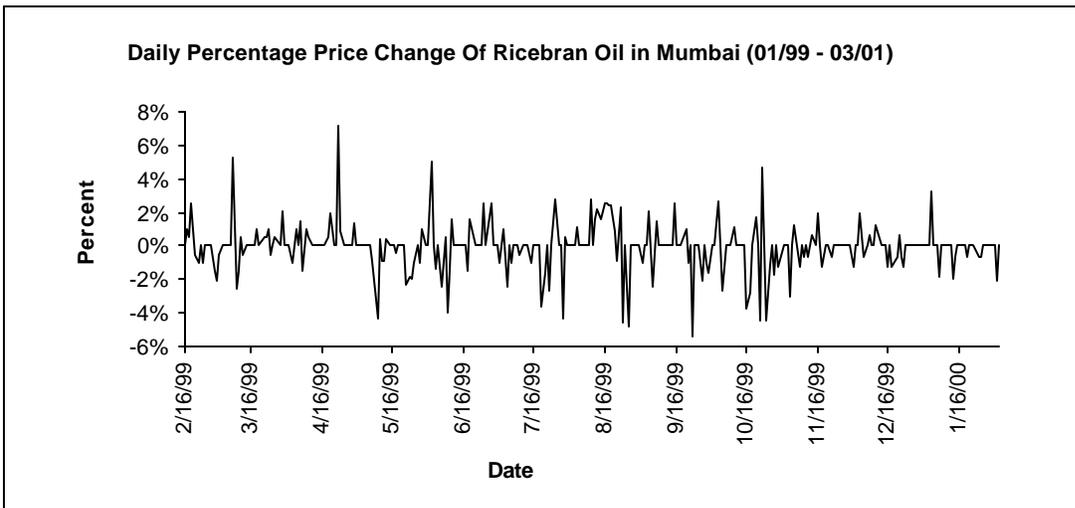
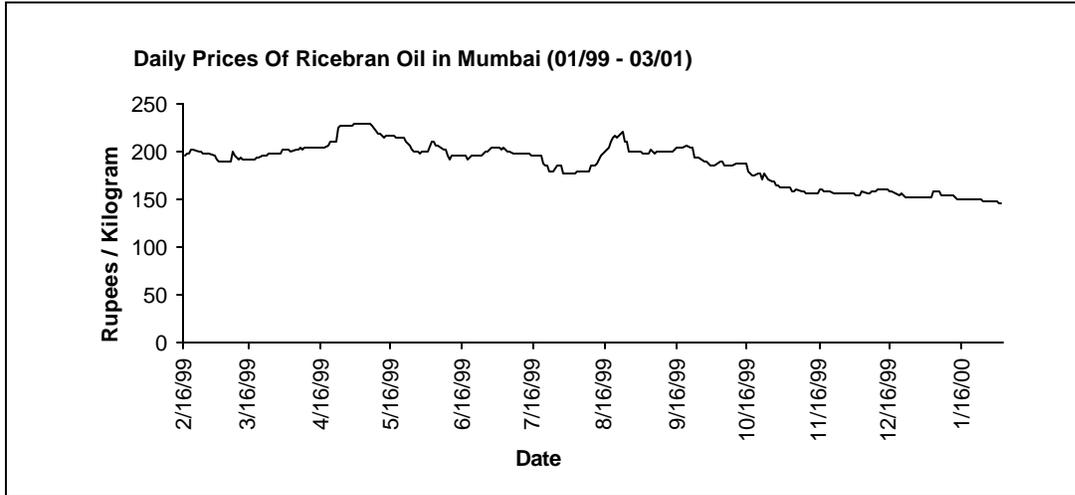




Price Differentials for Feed (Ricebran)

Source: *Bombay Oil Seeds and Oil Exchange (BOOE)*;

Data reported by: <http://www.commodityindia.com>



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