

## Computing and the Developing World

CSEP 590B, Spring 2008  
Lecture 5 – ICT and Agriculture  
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## Where are these flags from?



## Administration

- LUMS Holiday, May 1
- Schedule Shuffle
  - Apr 30, Agriculture
  - May 7, Handheld devices and Medicine
    - Brian DeRenzi
  - May 12, Open Source software
    - Neal Lesh
  - May 21, Education
  - May 28, Data Collection
    - Tapan Parikh
  - June 4, Non-literate UIs

## Highlights from Lecture 4

- Umar Saif
  - [umar@lums.edu.pk](mailto:umar@lums.edu.pk), [umar@mit.edu](mailto:umar@mit.edu)
  - [dritte.org](http://dritte.org)
- Internet realities
  - Many considerations very different from US
- Content distribution problem
- Offline internet browsing
- Inverse multiplexing on cellular networks
- Teleputer

## Tonight

- Agricultural Markets
  - Robert Jensen
- SMS Applications
  - Warana Unwired
  - Survey of other agricultural projects
- Digital Green



## Warana Unwired

- High profile kiosk project to support agriculture
- After 7 years, the project had only achieved a fraction of its goals and had very high maintenance cost
- Main application was replaced by a cell phone/SMS application



## Warana Sugar Cooperative

- At harvest, farmers send sugar cane to cooperative for processing
- Farmers receive reports of the amount of sugar cane processed by factory
- Before kiosk project:
  - Farmers visit central processing office
- After kiosk project
  - Farmers visit kiosk office
  - Kiosk operator places request
  - After one or two days, farmer gets report

## Warana: Cell Phone Solution

- Low cost mobile phone at the kiosk
- Smart phone running server at processing plant
  - Messages translated into DB query
  - "TON 123456 0807"
  - Answer sent back to calling phone
- Farmers would have kiosk operator place the text message
- Set up as experiment to evaluate cell phone against the PC

## SMS Applications (Homework 3)



Country	Country
Domain	Domain
Problem	Problem

UW  
MS  
LUMS  
Home



## Key ideas for SMS Applications

- 1.
- 2.
- 3.

## Markets and Development

- The key for solving rural poverty is greater agricultural income
- Improved markets are necessary for increasing income

## Market Price Info

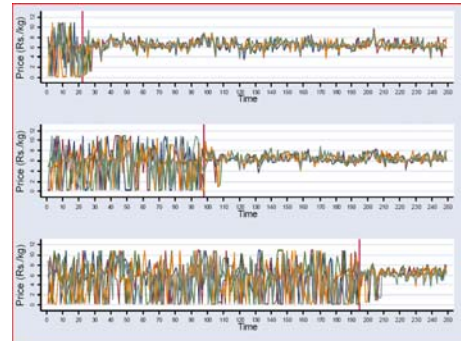
- Agricultural wholesale markets can have large price swings during the day
- Transportation costs and perishability limit producer options
- Advance notice of price information
  - Decision which market to use
  - Decision whether to bring goods to market
  - Decision whether to harvest
- Is there any evidence that this information actually is of value?

## Robert Jensen

- Study of wholesale prices of fish markets in Kerala
- Data covered the time period when cellular coverage was introduced



## Main result



## Why did prices stabilize?



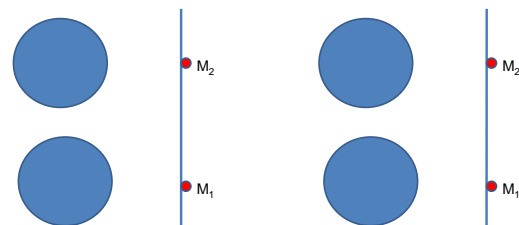
## Importance of Agricultural Output Markets

- Significant portion of the world's poor are in agriculture, fisheries, forestry
- Functioning of Markets important for well being of the poor
- Markets
  - coordinate dispersed consumers and producers
  - price coordinates allocation of goods
- Fundamental theorem of welfare economics
  - “Law of one price”

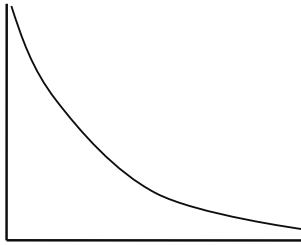
## Information and Market Functioning

- Sigler, Economics of Information
  - Costly search for information leads to price dispersion
  - Especially if infrastructure is poor and markets are dispersed
- Without information, no reason to assume markets are efficient
  - Consumers, Producers, Intermediaries don't adjust to scarcity
- Price dispersion reflects inefficiency. Improved information might improve efficiency and help the poor.

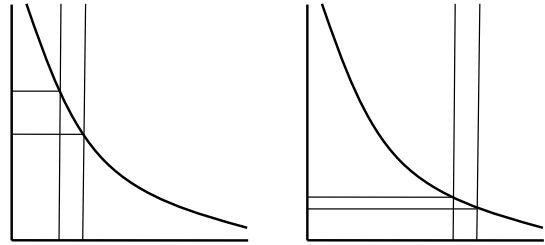
## Information for Fishermen



## Welfare Economics



## Mackerel Economics



## Economics

- Welfare theory argues for a net gain for producers and consumers
- Gains depend on the shape of the curve
  - Price elasticities
- Reduction in waste potentially benefits both groups
- Impact of reduced price variability on consumers not clear

## Study

- Beach Market Survey (N=15, 15 km apart)
  - Every Tuesday, 7-8 am, 1996-2001
  - All transactions
- Fisherman Survey (weekly, N=15\*20)
- Fishing village survey (monthly, N = 15)
- Consumer price survey (weekly, N = 15)

## Cell phone adoption

- Fishermen quickly adopted cell phones as they became available
- Fishermen would contact a large number of buyers while at sea
- Other benefits of cell phones for fishermen documented by Abraham (ICTD 2006)

## Conclusions (Jensen)

- Poor information limits functioning of markets
- Information makes markets work, and markets help the poor
  - It's the I, not the T
- Fishing in Kerala probably not a special case
- This was not a development project
  - People figured it out on their own

## SMS (Short Message Service)

- Protocol for text messages on GSM phones
  - 1120 bit messages
    - 160 7-bit, 140 8-bit, 70 16-bit characters

## SMS Costs world wide

Country	SMS Cost, Local	SMS Cost USD
USA		\$0.10
Pakistan	50 paisa	\$0.008
India	10 paisa	\$0.0025
China	0.15 yuan	\$0.02
South Korea	10 won	\$0.01
Namibia	0.40 NAD	\$0.05
Bangladesh	1 taka	\$0.015
Philippines	1 peso	\$0.02
Cambodia	150 riel	\$0.03
Bhutan	1 nu	\$0.025
Botswana	0.40 pula	\$0.06

## Smart phone vs. Dumb Phone

- Should ICTD work target “Smart Phones” or “Dumb Phones”.
- Why?

UW  
MS  
LUMS  
Home



## Warana Wired Village (1998)

- Case study of a failed kiosk project
- Very ambitious goals
- Funding split:
  - Central: 50%, State: 40%, 10% Cooperative
- 54 to 70 Village Kiosks
- Setup
  - Concrete building
  - PC (Pentium, Win95), UPS, Printer
  - Landline, 10 kbps connection

## Planned applications

- Warana on the Internet
- Database of farmer statistics
- GIS of 70 villages
- Local language interface
- Land record computerization
- Intranet site about crop pests
- Agricultural price info
- Personalized sugarcane information
- Internet connectivity

## Warana Experiment

- Question: can the Kiosk functions be replaced by SMS.
- Method: have Kiosk operators use cell phones instead of the PC. Other operations remained the same.
- Issues:
  - Physical space: kiosks and computers left in place
  - Printouts: handwritten and stamped receipts given by kiosk operator
  - Security and privacy: not a worry for the farmers. Access restricted to registered phones

## Warana Results: Cost Savings

- Compared to what?
  - Existing PC System
  - New PC System
  - Mobile SMS with Kiosk
  - Mobile SMS without Kiosk
  - GPRS with Kiosk
  - GPRS without Kiosk

## Study results

- 7 village pilot
- Training of kiosk operators on SMS system
- Usage comparable to kiosk
- Query time: 2 minutes
- Favorable response from farmers
  - Requests to expand the pilot
  - Use from phones outside of kiosks

## Other SMS based projects

## Zambian National Farmers Union

- ZNFU
- <http://www.farmprices.co.zm/prices.php>

## Market Price Queries



## tradenet.biz

- Agricultural trading in West Africa
- Primarily web based, but supports SMS notifications



## www.dam.gov.bd

- Web portal with price information for agricultural commodities in Bangladesh

Commodity	Retail Price As on 22.04.2008	Retail Price One Month Back 22.03.2008	Monthly change	Retail Price One Year Back 22.04.2007	Yearly change
1. Rice (Coarse)	33.00 + 35.00	32.00 + 33.00	4.42	23.00 + 22.00	48.14
2. Rice (Packd)	43.00 + 44.00	45.00 + 46.00	-4.40	28.00 + 29.00	61.11
3. Masur Dal	82.00 + 85.00	82.00 + 100.00	-2.77	66.00 + 72.00	28.26
4. Mung	56.00 + 60.00	55.00 + 60.00	3.87	-	-
5. Soyabean (oil free)	103.00 + 102.00	98.00 + 102.00	7.50	87.00 + 89.00	49.26
6. Chick	18.00 + 20.00	18.00 + 20.00	0.00	14.00 + 20.00	7.88
7. Garlic	25.00 + 36.00	28.00 + 40.00	-10.29	52.00 + 60.00	-45.54
8. Potato	12.00 + 14.00	11.00 + 12.00	13.64	16.00 + 17.00	-21.21
9. Brinjal	16.00 + 28.00	6.00 + 16.00	100.00	12.00 + 20.00	27.50

## Why things fail literature

- Richard Heeks
  - Information systems and developing countries: Failure, Success, and Local Improvisation

## Failures

- What percentage of startup companies fail?
- Leading cause of failure \_\_\_\_\_
- What percentage of IT projects fail?
- Leading cause of failure \_\_\_\_\_



## Design-Actuality Gaps

- Components from the designers' own context
- Conceived assumptions about the situation of the user
- "Information systems per se have a tendency to be designed according to models of rationality"

## Hard vs. Soft Models

Dimension	"Hard" rational design	"Soft" political actuality
Information	Standardized, formal, quantitative information	Contingent, informal, qualitative
Technology	Simple enabling mechanism	Complex, value-laden, status-symbol
Process	Stable, formal; outcomes as optimal solutions	Flexible, complex, constrained, informal
Objectives and values	Formal organizational objectives	Multiple, informal, personal objectives
Staffing and management	Staff viewed as rational beings	Staff viewed as political beings
Management systems and structures	Formal, objective processes	Informal, subjective processes
Other resources: time and money	Used to achieve organizational ends	Used to achieve personal ends

## KACE: Kenya Agricultural Commodity Exchange



- Private sector firm collecting and distributing market information to smallholder farmers
- Market information to help small holder farmers
  - Reduce power of middleman
  - Marketplace arbitrage
- Exchange of goods through offers to buy and sell

## KACE MIS

- Rural market based Market Information Points (MIPs)
- District-level Market Information Centers (MICs)
- Mobile Phone Short Messaging Service (SMS)
- Interactive voice Response (IVR) service
- Internet based database system
- Mass media (radio)

## Mobile Phone

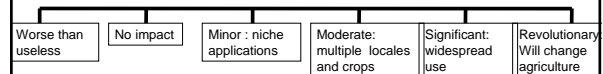
- Branded service with Safaricom
  - 7 Ksh per message (\$ 0.10 )
- Simple SMS interface
- Prices updated daily
- Separate voicemail system
  - Pre-recorded in English and Kiswahili
  - Menu based
  - 20 Ksh

## Status

- 2004 – 2 MICs, 11 MIPs
- Support from foundations
  - USAID, Rockefeller, etc.
  - Long term model – user fees, revenue sharing with phone companies
- Moderate SMS, and website use
  - End of study an upswing in Voice use
- Possible improvements in market conditions

## Mobile phone based market information systems

- How important do you expect these to be?



- Why?

## Digital Green

- Microsoft Research India Project
- Mediated Video to promote agricultural practices
  - Locally produced video
  - Mediated by villagers



## Small holder farmers

- Vast majority of rural poor are farmers
- Farms are generally very small
  - Total production limits possible income
- Many farmers have limited access to inputs
  - Seed
  - Fertilizer
  - Water
- Farmers squeezed by debt and reduced land



## Agricultural Productivity

- Underlying assumption
  - Farm productivity (and sustainability) can be improved through introduction of new agricultural practices
- Traditional agricultural extension
  - Training & Visit
  - 100,000 extension offers in India
  - Extension office salary: Rs. 4,000 per month

## Extension Problem

- Disseminate agricultural knowledge
- Promote practices that increase yields and preserve environment

Main source of Agricultural Information	% farm households (n = 51,770)
Other farmers	17%
Salesmen	14%
Radio	14%
Television	9%
Newspaper	7%
Extension worker	6%
Cooperative	3%
Buyer	2%
Government	2%
Other	8%

## Digital Green Project

- **Green:** NGO Promoting sustainable agricultural practices
- Digital Green: Collaboration between MSRI and Green using facilitated Video
- Phase I
  - Figure it out
- Phase II
  - Evaluation
- Phase III
  - Scale and spin out

## Basic Ideas

- Video record farmers implementing practices
- Extension worker appears in video with local farmers
- Video replay done in public setting with a mediator
- Pay close attention to costs
- Build archive of agricultural video material
  - digitalgreen.org
- Digital video is the enabling technology

## Example topic: Azolla cultivation

Azolla: Aquatic fern that can be used to augment animal feed

1. Dig a hole in the ground
2. Line with plastic tarp
3. Secure tarp
4. Add some cow dung and cow urine
5. Add some Azolla
6. Wait a few weeks
7. Harvest



## Parameters

- Mediated vs. non-mediated
- Mediator skill level
- Video participants
  - Facilitator
  - Farmer
- Themes
- Screening locations

## Evaluation

- Experimental study
  - 9 month study
  - 8 villages (Digital Green)
  - 8 control villages (Green extension workers)
- Digital Green
  - TV + DVD Player per village (USD \$225)
  - Mediator: 3 sessions per week
    - USD \$38 per month honorarium
  - 150 local language videos
  - 500 screenings
  - 1000 farmers participated

## Results

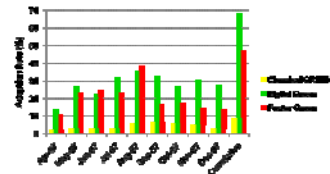
- Participation
- Surveys
- Adoption
  - 280 farmers per month attended a screening
  - Approximately half expressed interest in adopting practices
  - Between 9% and 26% implemented a practice
- Main result: four month study
  - In Control 8% adopted at least one practice
  - In DSH 55% adopted at least on practice

## Key aspects of Digital Green

- Sustained local presence
- Mediation
- Repetition (and novelty)
- Integration into existing extension operations
- Social homophily between mediator, actor, and farmer
- Desire to be “on TV”
- Trust built from identities of farmers and villages in videos

## Poster Green

- Same as Digital Green, with local mediator, but no TV/DVD
- Mediator makes posters and holds regular group sessions



## Cost per adoption

System	Cost (USD) / village / year	Adoption (%) /Village/Year	Cost / Adoption (USD)
Classical Green	\$840	11%	\$38.18
Digital Green	\$630	85%	\$3.70
Poster Green	\$490	59%	\$4.14

## DigitalStar

- List two other potential applications of the DigitalGreen methodology

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## Lecture summary

- Importance of Markets
  - Jensen, Sardine fishing in Kerala
- SMS based applications
  - Agricultural queries for sugar processing
- Other agricultural deployments unclear
  
- Digital Green: Mediated Video