# Computing and the Developing World

CSEP 590B, Spring 2008
Lecture 4 – Internet, SMS
Richard Anderson, Umar Saif

## Administration

- Classroom Presenter IP Address
  - 131.107.151.68
- Book review one due April 30
- Schedule Shuffled
  - Next week: Video Based Education
- Upcoming Guest Lecturers
  - Tapan Parikh, Neal Lesh
- Readings: Authentication
  - User: csep590b
  - Password: student

## Highlights from Lecture 3

- Telehealth [Telemedicine]
  - Martinez et al.
    - Basic communication
      - High/ Low bandwidth, Sync and Async
  - Emergency notification, supply management, combating isolation, training, reports, consultation
- Long distance WiFi
  - 3Mbps, 20 km, LOS, isolated environment

## Tonight

- Rural Networking (Umar)
  - Poor Man's Broadband
  - TEK Internet Search
  - Inverse Multiplexing of Cellular Connections
  - Teleputer
- Agricultural Markets (Richard)
  - Robert Jensen
- SMS Applications
  - Warana Unwired

## Umar Saif

- Associate Professor of Computer Science and Engineering, LUMS, Lahore, Pakistan
- B.Sc, LUMS, PhD, Cambridge, PostDoc MIT
- Research: Ubiquitous Computing, OS, Distributed Systems, Networking
- Dritte.org

## Where are these flags from?

UW
MS
LUMS
Home

## Umar's Slides

## 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

| | | |
|---|---|---|
| | Country | Country |
| | Domain | Domain |
| UW MS LUMS Home | Problem | Problem |

## 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

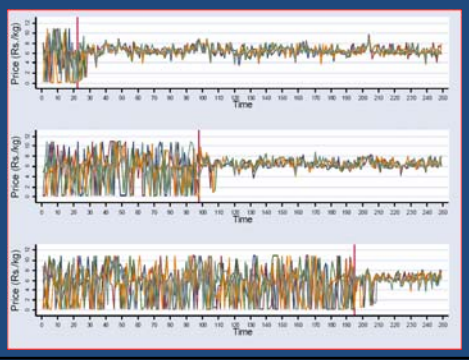
## Market Price Info

- 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



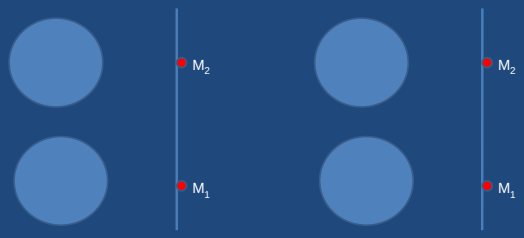

## Importance of Agricultural Output Markets

- Significant portion of the worlds 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"

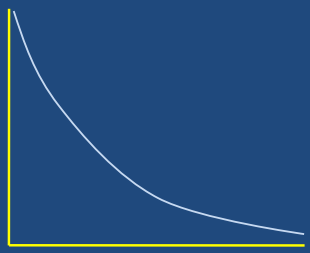
## Information and Market Functioning

- 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.

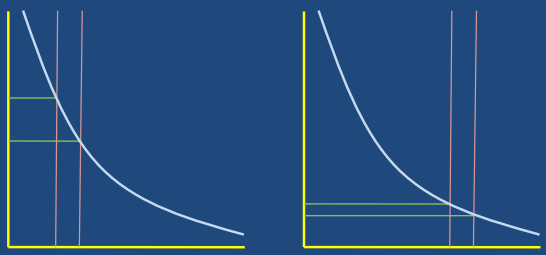
## Information for Fishermen




## Welfare Economics



## Mackerel Economics



## Economics

- Welfare theory argues for a net gain for produces 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 see
- Other benefits of cell phones for fishermen documented by Abrahim (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?



## 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 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

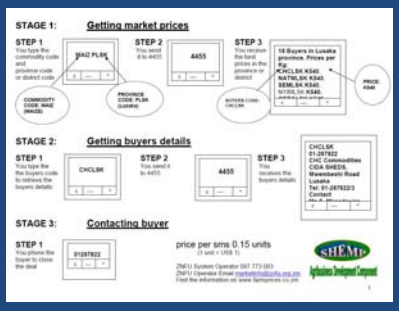
- 7 village pilot
- Training of kiosk operators on SMS system
- Usage comparable to kiosk
- Query time: 2 minutes
- Favorable response from farmers
  - Requests to expand the pilot
  - Use from phones outside of kiosks

## 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


## 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?

| Worse than useless | No impact | Minor : niche applications | Moderate: multiple locales and crops | Significant: widespread use | Revolutionary Will change agriculture |
|---|---|---|---|---|---|

- Why?

## Lecture summary

- Dealing with networking constraints
- Asynchronous web access
- Importance of Markets
  - Jensen, Sardine fishing in Kerala
- SMS based applications
  - Agricultural queries for sugar processing
- Other agricultural deployments unclear
- Research challenge – expand reach of networking
  - Internet and Cellular