Evidence in Agriculture: Input / Output Markets and ICTs

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Overview

• Background on J-PAL Agriculture Sector
• Constraints in Agriculture
• Policy Lessons: Input/Output Markets
• Evaluations of ICTs in Agriculture
• Conclusion
Over 70 completed and ongoing J-PAL agriculture projects
Since the start of ATAI

<table>
<thead>
<tr>
<th>Category</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Farmers surveyed</td>
<td>111,351</td>
</tr>
<tr>
<td>Female farmers surveyed</td>
<td>47,845</td>
</tr>
<tr>
<td>Farmers whose behavior has changed</td>
<td>17,932</td>
</tr>
<tr>
<td>ATAI Awards</td>
<td>55</td>
</tr>
<tr>
<td>Unique ATAI projects</td>
<td>42</td>
</tr>
<tr>
<td>Countries with ATAI projects</td>
<td>14</td>
</tr>
<tr>
<td>Researchers on ATAI projects</td>
<td>89</td>
</tr>
</tbody>
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Cereal Yields (Metric Tons/Hectare)
Fertilizer Use (Kilograms/Hectare)
What is hampering technology adoption?
Inefficiencies constraining tech adoption

1. Credit markets
2. Risk markets
3. Information
4. Externalities
5. Input and output markets
6. Labor markets
7. Land markets
Randomized evaluations provide a highly rigorous estimate of program impact

Before the program starts, eligible individuals are randomly assigned to two or more groups so that they are statistically identical before the program.

1. Population is randomly split into 2 or more groups
2. Intervention
3. Comparison
4. Outcomes for both groups are measured
5. Two groups continue to be identical, except for treatment
6. Any differences in outcomes between the groups can be attributed to the program
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Preview: input/output markets

- Infrastructure investment can decrease transport and input costs

- Price information has no positive effects on farmers, though other members of the value chain may benefit
Input and output market inefficiencies

Farmers may be unable or unwilling to adopt new technology due to barriers within:

**Input Markets**
- Missing or incomplete supply chains
- Unprofitably high input prices

OR

**Output Markets**
- Lack of access to additional markets
- Low prices for yields, including high quality crops
Effects of market structure

- Shallow markets with inelastic demand
  - Lower profits for farmers adopting yield-increasing technology

- Improve access to deeper markets
  - New technology brings higher profits as well as higher yields
Road development in Sierra Leone
Road development in Sierra Leone
Infrastructure: road development

Investment in roads lowers transportation costs and may increase access to and use of inputs.

Casaburi et al. 2013
Theory of price information

Farmers get price information

Farmers sell at markets where prices are high

Market prices converge
Impacts of price information

Members of value chains who can act on price information can benefit, whereas farmers are unlikely to experience benefits

**For farmers:**
- Limited effect on prices received by farmers
- Farmers may change behavior
- No gain on average for farmer

**For other actors in market:**
- Price information is actionable for some actors in the value chain
  - Traders
  - Fishermen
- Reductions in price dispersion
- Potential improvement in profits

Goyal 2010, Fafchamps & Minten 2012, Mookherjee et al 2013
Aker 2010, Jensen 2007
Price Information to Indian Potato Farmers

- 72 villages
  - 24 public price information villages
  - 24 mobile phone price information villages
  - 24 comparison villages

Mitra et al. 2015
Price Information to Indian Potato Farmers

- Price information had no average effect
- Price information through the **mobile phone** affected farm behavior when prices were unexpected
  - Farmers sold more at higher prices
  - Farmers sold less at lower prices
- Farmers lack outside options, preventing them from realizing gains from knowledge of price

Mitra et al. 2015
Reuters Market Light (RML) Evaluation in India

100 villages

35 villages

10 farmers offered free RML

3 farmers offered free RML

7 farmers surveyed to measure spillovers

30 control villages

10 farmers surveyed

Fafchamps and Minten 2012
Reuters Market Light (RML) Evaluation in India

- Modest take up
- No effect
  - Price received by farmers
  - Crop value-added
  - Crop losses resulting from rainstorms
  - Planting different crops
  - Cultivation practices
- Small increases
  - Selling at new markets
  - Sorting crops by quality

Mitra et al. 2015
Relationships between farmers and traders

- Trader relationships differ across contexts
- These relationships can affect farmers’ selling decisions
  - Sierra Leone: palm oil producers were hesitant to break relationships with traders by storing harvests rather than selling at low prices
  - Kenya: dairy farmers preferred to sell to coops and receive lower, bulked payments than sell to traders and receive daily payments
  - India: potato farmers’ ex-post bargaining relationships with traders limited the effectiveness of price information

Casaburi et al 2014; Casaburi and Macchiavello 2016; Mitra et al 2015
Price Information Summary

• Price information to farmers
  – Unlikely to affect farmer incomes or price levels
  – Farmer lack bargaining power
  – Transport costs remain high

• Price information to intermediaries or producers
  – Market prices converge and producers may benefit

Summary: input/output markets

- Price information has no positive effects on farmers, though other members of the value chain may benefit
- Infrastructure investment can decrease transport and input costs
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Types of ICT Interventions in Agriculture

1. Digital Financial Services
2. Information Delivery
   - Farming practices and inputs
   - Market prices
3. Interactive Platforms
   - Review services
   - Share with neighbors
   - Connect with the market
Digital Financial Services
Mobile Money in Context

Credit Supply

• Microfinance model is inappropriate for farmers
• Banks often do not lend to the agricultural sector
• Interventions
  – Digital financial services
  – Improved information about borrowers

Credit Demand

• Lack of credit is unlikely the primary constraint
• Take up of credit is low
• Interventions
  – Flexible collateral
  – Seasonal variation of farmer income
  – Labeling

Mobile Money in Mozambique

196 farmers

- 49 information on mobile money and fertilizer only
- 49 information on mobile money and fertilizer, plus savings bonus
- 49 information on mobile money and fertilizer, plus closest friends receive same information
- 49 information on mobile money and fertilizer, plus savings bonus and closest friends receive same information
Mobile Money in Mozambique

• Effects of savings bonus
  – Increased use of mobile money, including deposits
  – Increased non-frequent expenditures
  – Increased probability of fertilizer use
  – Decreased social pressure to share resources

• Effects of social network
  – Increased use of mobile money
  – Decreased social pressure to share resources

Batista et al. 2015 (preliminary)
Information Services
Information Delivery in Context

• Agricultural extension is the most common model
• Use of traditional extension services is low
  – Unprofitable technology
• Extension can be effective
  – Overcoming a behavioral bias (procrastination)
  – New or novel technologies (risk reducing seeds)
  – Incentivizing trainers
  – Mobilizing networks (similar farmers, multiple farmers)
  – Providing accessible, tailored, and timely information

Mobile Phone-Based Agricultural Extension in India

Cole and Fernando 2012, Cole and Fernando 2014
Mobile Phone-Based Agricultural Extension in India

1200 cotton farmers

400 mobile extension

400 mobile + traditional extension

400 comparison

Cole and Fernando 2012, Cole and Fernando 2014
Mobile Phone-Based Agricultural Extension in India

- High take up and use of mobile platform
- Switch to more effective pesticides
- Increased adoption of cumin
- Some evidence of increased yields in cotton and cumin
- Traditional extension had no effect

Cole and Fernando 2012, Cole and Fernando 2014
Harnessing ICT to Increase Agricultural Production in Kenya

Casaburi et al. 2014 (forthcoming)
Harnessing ICT to Increase Agricultural Production in Kenya

• High take up of the SMS and hotline interventions

• SMS messages lead to 11.5% yield increases

• Access to hotline decreased:
  – Likelihood of not receiving fertilizer
  – Likelihood of fertilizer delivery being delayed

• CAVEAT
  – Researchers are replicating the SMS intervention with a larger sample and so far so no effect on yields

Casaburi et al. 2014 (forthcoming)
Ongoing Information Delivery Studies

- An Evaluation of Digital Green's Agricultural Extension Program in India
- Harnessing ICT to Increase Agricultural Production in Kenya (ATAI)
- Precision Agriculture for Development in India
Price Information Review

• Price information to farmers
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• Price information to intermediaries or producers
  – Market prices converge and producers may benefit

Interactive Platforms
Coordinating Farmers with Cellphones in Pakistan

Rezaee et al. 2015
Coordinating Farmers with Cellphones in Pakistan

- More likely to return to government service provider rather than a private provider
- Higher insemination success
- Lower prices for insemination services

Rezaee et al. 2015
Ongoing Interactive Platform Studies

• Market Interventions (ATAI)
  – Building Market Linkages in Uganda

• Agricultural Information
  – Precision Agriculture for Development (PAD)
    • India, Kenya, and Ethiopia
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Summary: input / output markets & ICT

• Infrastructure investment can decrease transport and input costs

• Price information has no positive effects on farmers, though other members of the value chain may benefit

• ICT in agriculture can offer digital financial services, share information or facilitate interactive platforms

• But, information is only useful to the degree that it is profitably actionable
Thank you!

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