Technological Change in Agriculture - Section 2

Issues in Technology Transfer

1. Characteristics of the technology
   - Efficiency
   - Effect on different inputs

2. Process of transferring and forces leading to adoption

3. Impacts
   - Production
   - Distribution

4. Macro vs micro views
   - Macro - aggregate, national aspects
   - Micro - farmer or village level

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World Expenditures on Ag Research vs.
Value of Ag Production, by Income Group, 1974

<table>
<thead>
<tr>
<th>Group</th>
<th>Per cap. y (U.S. $)</th>
<th>Ratio Res. Expend. to Value of Ag. Product</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>&gt; 1750</td>
<td>2.55%</td>
</tr>
<tr>
<td>II</td>
<td>1001-1750</td>
<td>2.34%</td>
</tr>
<tr>
<td>III</td>
<td>401-1000</td>
<td>1.16%</td>
</tr>
<tr>
<td>IV</td>
<td>151-400</td>
<td>1.01%</td>
</tr>
<tr>
<td>V</td>
<td>≤ 150</td>
<td>.67%</td>
</tr>
</tbody>
</table>

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Factor Bias of New Technology

Labor intensive (Labor using)                                             Labor saving
Land saving                                                             Land using (Land intensive)
Two Most Serious Constraints to 3rd World Agriculture  
(Hayami & Ruttan)

1. Limited Industrial Capacity to Produce Mechanical Technology  
2. Limited Local Research Capacity to Develop Biological Technology

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Three Phases in International  
Technology Transfer  
(and role of local research system)

1. Material transfer  
2. Transfer design of the new technology  
3. Transfer knowledge and capacity to produce locally adaptable technology

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Keys to Generating Locally Adapted  
and Economically Viable Technology

1. Transfer of Knowledge  
2. Local Capacity to Use and Adapt Knowledge

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Adoption Rates for Packages  
of New Practices with New Seed

<table>
<thead>
<tr>
<th>Crop</th>
<th>Entire package (4 practices)</th>
<th>Seed &amp; Chemical Fertilizer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wheat</td>
<td>9%</td>
<td>77%</td>
</tr>
<tr>
<td>Rice</td>
<td>17%</td>
<td>90%</td>
</tr>
<tr>
<td>Jowar</td>
<td>56%</td>
<td>71%</td>
</tr>
</tbody>
</table>
Profit = \[m\]r - \[m\]c - risk - uncertainty - learning costs - search costs

Adoption of New Wheat Variety

<table>
<thead>
<tr>
<th>Results</th>
<th>Change (\Pi/\text{ha.})</th>
</tr>
</thead>
<tbody>
<tr>
<td>Practice A: shifts from LYV to HYV</td>
<td>Slight</td>
</tr>
<tr>
<td>Practice B: apply optimum fertilizer to LYV</td>
<td>Higher</td>
</tr>
<tr>
<td>Practice C: apply optimum fertilizer to HYV</td>
<td>3 times &gt; ‘B’</td>
</tr>
</tbody>
</table>

Adoption pattern depends on:

- profitability
- riskiness
- divisibility, or initial capital required (appropriate technology)
- complexity
- availability
- credibility of the information (reduces risk and uncertainty)
Comparison of Yield Increase, Marginal Rate of Return on Capital and Risk of the Three Biochemical Technological Components

\[ V = \text{Use of Improved Varieties (Apizaco, Cerro Prieto, Centinela, Puebla)} \]
\[ H = \text{Use of Herbicide (1 lt/ha Esteron 47)} \]
\[ F = \text{Use of Fertilizer (80 kg/ha and 45 kg/ha of Nitrogen in Wet and Dry Zone, Respectfully)} \]

Source: Based on results from on-farm experiments, 1976-80

\(^1\) Calculated from 1980 prices.

\(^2\) Net return calculated in 20% of experiments with lowest returns. Monetary returns converted to kg/ha of grain at 1980 prices.