The Power of Technological Innovation in Rural America

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Today’s Outline

• Innovation:
  – What is it?
  – Why is it important?

• Rural Innovative
  – Half-truths and misunderstandings
  – A new perspective

• Foundations for Future Innovation
What is Innovation?

• Innovation is **NOT** an invention.

• Innovations are *commercialized* inventions that generate *new economic value* in the marketplace.
Three Impacts of Innovation

- Innovations ...
  - Create New Products
## Major Innovations by Small U.S. Firms

<table>
<thead>
<tr>
<th>Acoustical suspension speakers</th>
<th>Heart valve</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aerosol can</td>
<td>Heat sensor</td>
</tr>
<tr>
<td>Air conditioning</td>
<td>Helicopter</td>
</tr>
<tr>
<td>Airplane</td>
<td>High capacity computer</td>
</tr>
<tr>
<td>Artificial skin</td>
<td>Hydraulic brake</td>
</tr>
<tr>
<td>Automatic fabric cutting</td>
<td>Piezo electrical devices</td>
</tr>
<tr>
<td>Biosynthetic insulin</td>
<td>Pressure sensitive cellophane</td>
</tr>
<tr>
<td>Continuous casting</td>
<td>Rotary oil drilling bit</td>
</tr>
<tr>
<td>Cotton picker</td>
<td>Safety razor</td>
</tr>
<tr>
<td>Fluid flow meter</td>
<td>Soft contact lens</td>
</tr>
<tr>
<td>Geodesic dome</td>
<td>Six-axis robot arm</td>
</tr>
<tr>
<td>Gyrocompass</td>
<td>Spectographic grid</td>
</tr>
</tbody>
</table>

Source: NCOE, *Embracing Innovation: Entrepreneurship and American Economic Growth*
People Adopt Technology Quickly

<table>
<thead>
<tr>
<th>Technology</th>
<th>Year when household penetration reached 1 percent</th>
<th>Year when household penetration reached 50 percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Telephone</td>
<td>1890, 1946</td>
<td></td>
</tr>
<tr>
<td>Radio</td>
<td>1923, 1932</td>
<td></td>
</tr>
<tr>
<td>Television</td>
<td>1949, 1954</td>
<td></td>
</tr>
<tr>
<td>Computer</td>
<td>1980, 2000</td>
<td></td>
</tr>
<tr>
<td>Mobile Phone</td>
<td>1989, 2003</td>
<td></td>
</tr>
<tr>
<td>Internet</td>
<td>1991, 2001</td>
<td></td>
</tr>
</tbody>
</table>

Source: Goldman Sachs Economic Research calculations based on Dept of Commerce data.

US Economics Analyst, Iss. 05/06 Feb. 11, 2005
Glad Corn,
Mountain Lake, Minnesota
Three Impacts of Innovation

- Innovations ...
  - Create New Products
  - Improve Production Processes
This is Not 21st Century Agriculture
Technological Innovations Boost Efficiency

Labor Needed for U.S. Corn Production

Hours to produce 100 bushels of corn

- Horsepower
- Mechanical Power
- Hybrid Seed & Chemical Fertilizers
- Herbicides & Pesticides
- Biotechnology

Source: USDA
High Speed Internet Coverage
June 2000

Source: FCC
High Speed Internet Coverage
June 2007

Source: FCC

Number of Providers
- 7 or more
- 4 to 6
- 1 to 3
- Zero

Source: FCC
The Internet is Changing How Manufacturers Sell to Other Businesses.

U.S. Manufactured Shipments

Billion dollars

Source: Census Bureau
E-commerce is Changing the Payments Business

Checks Handled by Federal Reserve

Million pieces

Source: Federal Reserve Board of Governors
“Homeshoring” High-Skilled Service Jobs to Rural America

Wages for Software Developers

<table>
<thead>
<tr>
<th>Location</th>
<th>Dollars per hour</th>
</tr>
</thead>
<tbody>
<tr>
<td>Major Metro Areas</td>
<td>$100</td>
</tr>
<tr>
<td>Rural Areas</td>
<td>$75</td>
</tr>
<tr>
<td>India</td>
<td>$40</td>
</tr>
<tr>
<td></td>
<td>$35</td>
</tr>
<tr>
<td></td>
<td>$20</td>
</tr>
</tbody>
</table>

Source: Hall (2005)
Three Impacts of Innovation

• Innovations …
  – Create New Products
  – Improve Production Processes
  – Open New Markets.
In Retail, E-commerce Sales Growth Paces Total Retail Sales.

U.S. Retail Sales Growth

Percent change from year ago

Source: Census Bureau
In Agriculture, High-Value Products are Pacing Export Growth.

U.S. Agricultural Exports

Billions of dollars

High-Value Products

Bulk Commodities

Source: USDA
High-Tech Sectors Appear to Create More High-Growth Entrepreneurs.

Self-employed Income by Manufacturing Industry

<table>
<thead>
<tr>
<th>Industry</th>
<th>Thousand dollars</th>
</tr>
</thead>
<tbody>
<tr>
<td>High-tech</td>
<td>82.8</td>
</tr>
<tr>
<td>Medium-tech</td>
<td>74.8</td>
</tr>
<tr>
<td>Low-tech</td>
<td>55.8</td>
</tr>
</tbody>
</table>

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Innovation is More Prevalent in Populous Places.

Patents per 10,000 population

Source: Orlando and Verba (2005)
Smaller Communities Have Higher Patent Activity as Technologies Mature.

Patent Activity Over Time

Share of Patents

Years after patent class established
- 0 to 10 years
- 10 to 20 years

Source: Orlando and Verba (2005)
A New Economy is Built on Productivity.

**Productivity**

\[
\text{Value per Input} = \frac{\text{Value per Output}}{\text{Per Input}}
\]

- Efficiency: Output per Input
  *The ability to create more things with fewer inputs.*

- Value: Value per Output
  *The ability to create things of higher value.*

Which part of productivity does Rural America struggle with?
Lessons From The Past: What Boosts Real Farm Incomes?

U.S. Real Net Farm Income

Billion dollars (2000 = 100)

Source: USDA
Technologies of the Past

Focused on reducing cost: shifting supply

Does total revenue grow by shifting supply?
Technologies of the Future

Focused on Boosting Demand

Total revenue always grows
New Opportunities For the Rural Economy

• Value-added Agriculture

Japanese Watermelon
Cost:
Square Watermelon: $82
Regular Watermelon: $15 to $25

Source: BBC
New Opportunities For the Rural Economy

- **Market ready food products**
  
  *Premium foods (Angus Beef)*
  
  *Convenience foods – snackable, microwaveable foods*

- **Regional foods**
  
  *Local farmer food cooperatives or networks*
  
  *Direct sales to grocery stores and restaurants,*

- **Organic foods**
  
  *Despite higher production, price premiums are holding.*
New Opportunities For the Rural Economy

- Value-added Agriculture
- Product Agriculture
  - Transforming agricultural products into non-food products
    - Energy
    - Bio-lubricants
    - Pharmaceuticals

*Cargill Dow LLC (Blair, NE) converting corn to polymers.*
New Opportunities For the Rural Economy

- Value-added Agriculture
- Product Agriculture
- Recreation and Natural Amenities
Ski Nebraska
The Opportunity Of Natural Resources Recreation And Tourism

• In 2006, 87 million people in the U.S. engaged in wildlife recreation. (fishing, hunting, and wildlife watching)
• They spent $120.1 billion.

U.S. Gross Crop Receipts: $120.0 billion
U.S. Gross Livestock Receipts: $119.3 billion
New Opportunities For the Rural Economy

- Value-added Agriculture
- Product Agriculture
- Recreation and Natural Amenities
- Advanced Manufacturing
  - Lean manufacturing
  - High-tech industries
  - High-end products or hand-crafted
- High Skilled Services
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• Foundations for Future Innovation
  – Entrepreneurs
  – People
Human Capital and Innovation in Nebraska

State Rankings
- Colorado: 4th in Human Capital, 3rd in Innovation Ideas
- Kansas: 11th in Human Capital, 36th in Innovation Ideas
- Missouri: 21st in Human Capital, 40th in Innovation Ideas
- Wyoming: 22nd in Human Capital, 41st in Innovation Ideas
- Nebraska: 24th in Human Capital, 44th in Innovation Ideas
- South Dakota: 34th in Human Capital, 45th in Innovation Ideas

Source: Goetz and Freshwater, 2001
States That Grow More Entrepreneurs Have Stronger Economic Growth.

Employment and Entrepreneur Growth

Employment Growth (Wage and Salary: 1990-2004)

State Non-farm Proprietor Growth (1970-1990)

Calculations based on BEA, Regional Economic Information System data
What Do We Know About Metro and Non-Metro Entrepreneurs?

- Non-metro areas have more entrepreneurs on a per capita basis.

Proprietors Share of Employment, 2004

Calculations based on BEA data
What Do We Know About Metro and Non-Metro Entrepreneurs?

- Non-metro areas have more difficulty producing high-growth businesses.

Real Non-farm Proprietor Income

Thousand dollars, per proprietor

Metro

Non-metro

Calculations based on BEA data
Where Will Agriculture’s Next Generation of Leaders Emerge?

U.S. Age Demographics

Source: USDA, ERS
In Closing …

• Rural America is searching for new economic engines.

• New engines of growth often emerge from technological innovations that
  
  … create new products
  … improve production practices
  … or open new markets

• A new generation of entrepreneurs is needed.

*How can we change rural perceptions?*