The "double-edged sword" of agricultural technology.

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- Session 7:"Where your next meal may come from"
- Osher Lifelong Learning Institute, GMU
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:"Where your next meal may come from" = interesting title. What have been some of the past responses?
Ensure, liquid nutrient solutions? Pills and supplements (cousin Nina) Recall President Ford: Lunch was a waste of time (only yogurt and some fruit).

"Double-edged sword" = Trade-offs (1)

- In economics, every decision involves trade-offs.
- Need to look at legacy of US food system.
- Early R&D in agricultural production was response to agriculture's competitive market structure with many small producers and low margins
- Cochrane's Treadmill and the Land Grant system

(1) Schumpeter effect
(2) Rent seeking is normal in a competitive and non-competitive market (pure and perfect competition and oligopoly)
(3) Agricultural production and consumption also includes fiber and fuel (bio-fuel) as well as food.

"Double-edged sword" = Trade-offs (2)

- Public funding dropped in 1980's
- Private funding and rent seeking evident in many markets
- Need to look at stages of bringing food from the field to the table.
- We will try to de-emphasize the powerful forces that politics play in this arena, but need to keep in mind.

Free market push in the 1980's; deficit spending was a concern (1985 Gramm-Rudman Act) and also many recognized changing market structure to more concentrated and fewer firms that could capture the return to their investments in R&D.

Where has technology occurred?

- Cultivation and traction power (horses to tractors)
- Production (larger farms and input intensive)
- Harvesting (threshing bees anyone?)
- Storage and Handling (large centralized assembly)
- Transportation (vegetables CA vs. NJ)
- Food Processing (Napoleon started it all)
- Food Distribution (ice packed train cars for meat)
- Consumer Demand for Convenience (outsourcing)
- Food Consumption Points (home and away)

(C) Affected crop rotations (1/4 to 1/3 of past acreage was devoted to feed horses; lead to good cover crops and manure disposal
(P) Engines and other capital plus cheap energy replaced labor and enabled large farms and increased irrigation equipment to be used)
(H) Even today many small farmers will tell you that harvesting is their biggest bottleneck or concern (fruits, vegetables)
(S) Large, concentrated production require some stock holding until they are needed, where they are needed. Old economists recognized utilities derived from goods and services = time utility gained from storage function; location utility; form utility; possession (can be a disutility)
(T) Adds that location or place utility. River transportation in early 1800's with Fulton's steam engine (first steamship on Ohio River 1811); transportation between rivers still difficult, lead to canal building (1812-1850) ; Erie Canal (finished 1825); paid for itself in 10 years; reduced cost of freight from Buffalo to NYC from $100 per ton to $15 and from 20 days to 8 days. Trains followed.
(FP) Adds that form utility. Military K-rations and astronaut compact and quick food needs.
(FD) Adds that place utility ((Recall experiences in your youth? I was a milkman.))
(CD) Adds that form which means convenience in this case (Food out of a box? Italian relative and emphasize "Outsourcing is prevalent" chicken, fish sticks
(FC) Food contamination greater or less with new system? Chicken and eggs -- Role for radiation in food preparation?

Specific Instances of Technological Innovations

- Food Production and Genetic engineering
  - Round-up Ready Corn and Beans (GMO's)
  - BST in milk production
- Crop Production and Cultivation Practices (No-till)
  - No-till = Example of a win-win situation?
  - Optical sensors to apply herbicides
- Meat Production and Animal health-antibiotics
  - Breeding for "super bugs"?
  - Bio-ethics (cage size, slaughter plants)
- Increased Demands on Agriculture (Bio-fuels)
  - Net energy and GHG effects
  - Biomass removal from soil

I had technological progress here first, but wonder if it is progress or simply a replacement of certain functions or resources with artificial ones. Definition of sustainability…..

No-till (reduced heavy plowing and field disturbance)			
	Direct	Indirect	Unintended
Potential Pro's	1) Less fuel used in field preparation. 2) Less soil compaction. 3) Less labor at times of heavy labor demand for planting, etc.	1) Less soil erosion as additional crop material on soil surface hold and retain moisture.	1) More ground cover for wildlife. 2) Can lead to improved water quality with less nutrient runoff.
Potential Negative's	1) May need additional herbicides to control weeds. 2) Old plant material may not be as quickly incorporated into soil layer. 3) Some soils remain colder longer in the spring (soil is not as exposed to sunlight)	1) Yield decreasing at first, then oftentimes, improves.	1)

No-till is almost always a "win-win" (environment and economics of the farm) – less inputs (fuel and labor), not much yield effect so profits do not change much.
Many agricultural production management intensive innovations will fall into this category – optical sensors for herbicide application, precision fertilizer placement, strip field testing with satellite technology, etc.

Genetic engineering (GMO's)			
	Direct	Indirect	Unintended
Potential Pro's	(1) Less total amount of pesticides reportedly used. (2) Can incorporate pharmaceuticals in GMOs. 3) Increased food supply with less inputs and less stress on environment.	1) "Halo effect" 2) Lower food prices	1) Can produce in more "dicey" areas (more prone to drought, etc)
Potential Negative's	1) Can breed "super weeds" which are herbicide resistant and could lead to return to older, harsher weed killers. 2) Producers rely on GMO characteristics to substitute for traditional – more management intensive - cropping practices.	1) Non-modified corn plantings need buffer strips to prevent cross-pollination. 2) Less varied food supply 3) Could lead to monoculture production practices	1) Can produce in more "dicey" areas 2) Could contribute to more concentrated industrialization of agriculture 3) Potential human health effects 4) Potential ecological effects

Halo effect = Pests die attacking pest-resistant GMO's leave fewer pests to attack non-modified corn grown nearby. Est. benefits= $6.9 billion during past 14 years in five upper Midwest corn-producing states. Science – 10-8-2010.

Substantially equivalent = US stance; European = precautionary principle.

SUPERWEEDS HEARING – On Thursday, September 30, 2010, the Domestic Policy Subcommittee (Chairman Kucinich, OH) of the House Oversight and Government Reform Committee held a hearing entitled "Are Superweeds an Outgrowth of USDA Biotech Policy?" This was Part II of a two-part hearing. Part I was held on July 28. The issue discussed was whether USDA's support for genetically engineered crops has enabled the proliferation of weeds that are resistant to modern herbicides, including Roundup, forcing farms to adopt older, harsher weedkillers. Weedkiller resistance is particularly problematic for corn, cotton and soy crops.
Witnesses included Troy Roush, farmer, Van Buren, IN; Michael Owen, professor of agronomy, IA State Univ.; Stephen Weller, professor of horticulture, Purdue Univ.; David Mortensen, professor of weed ecology, PA State Univ.; and Andrew Kimbrell, Executive Dir., Center for Food Safety.

Bio-mass (ethanol, corn stover, switch grass, wood chips)			
	Direct	Indirect	Unintended
Potential Pro's	1) Increased domestic production of fuel; less foreign dependence. 2) Increased economic activity in towns with processing plants.	1) Less US money leaving US to buy imported energy. 2) Air quality is improved in some instances when ethanol is an additive.	1) Could spur use of other environmental feedstuffs for energy production.
Potential Negative's	1) May lead to increased soil erosion and lower SOM (soil organic matter) 2) May have larger carbon footprint than other liquid fuel alternatives.	1) As acreage of crops for biomass increase, acres devoted for food production could drop (food prices increase)	1) Indirect land effects (rain forest cut down to produce palm oil, sugar cane for fuel).

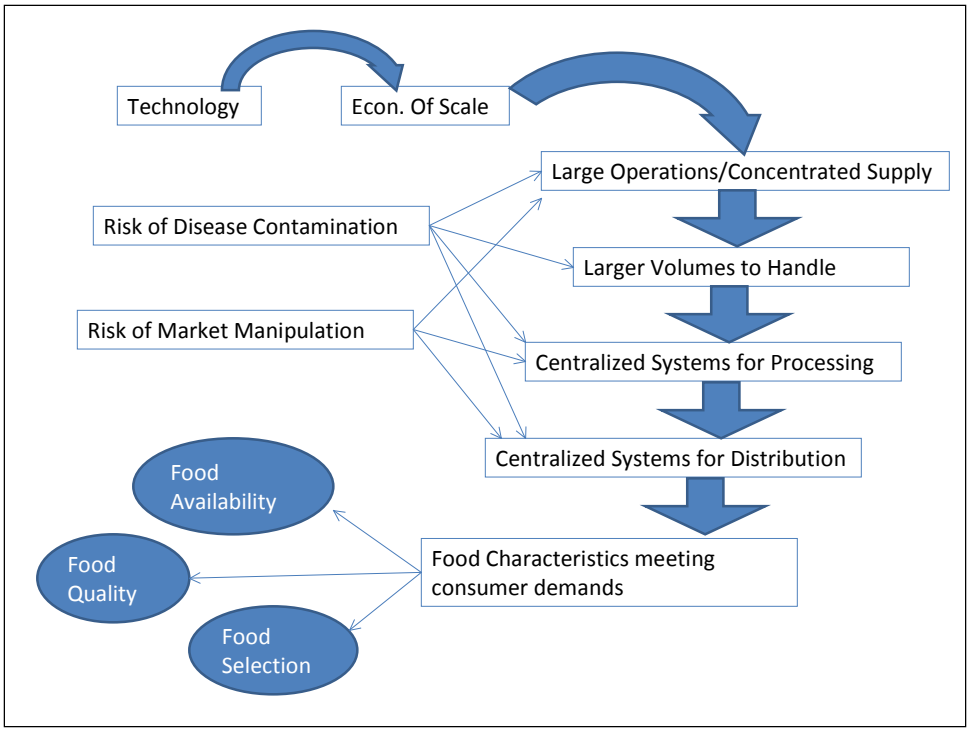
This is a huge issue. Like GMO's, biomass is trying to speed up mother nature or make it more precise. Many trade-offs; many studies, ERS and NRCS supported one at UT.

Some concluded thoughts

- Many times, technology moves faster than society can handle it (computers, cell phones, in everyday life).
- Trade-off's or the double edged sword of innovations are involved in every change (see following diagram).
- Urbanization and life-style changes reduce time for shopping and at-home food preparation (where is the free time that people talked about?).
- Demand for convenience create opportunity for mass production; profits spur innovation.
- Government programs and policy played a huge role which has not been discussed here adequately.
- Are longer life spans *prima facie* evidence that our food supply can't be all bad?
- Are you happy or satisfied with the food choices that you have and the trade-offs that they present?

Who is driving the economy? Consumers or Suppliers of goods and services? Madison Avenue?

Cheez Wiz canned spray cheese versus French foods, etc.



Market integration (chickens, dairy cooperatives, eggs, more recently hogs, not so much in beef) can be raw (eggs) or finished form
Could be like the K-Mart or Wal-Mart model of doing business.
Slaughter plants now have about an 80% Top-4 Concentration Ratio.

Some references --

Science, Volume 330 Issue 6001, October 2010, page 189 Communal Benefits of Transgenic Corn, *B. E. Tabashnik*

September 30, 2010, the Domestic Policy Subcommittee (Chairman Kucinich, OH) of the House Oversight and Government Reform Committee hearing entitled "Are Super-weeds an Outgrowth of USDA Biotech Policy?"

Journal of Soil and Water Conservation, July/August 2010, Conservation considerations for sustainable bioenergy feedstock production: If, what, where, and how much?, Jane M.F. Johnson, Douglas L. Karlen, and Susan

Many FREE forums at the National Press Club: Nov. 9, Food Policy and Obesity.
http://www.farmfoundation.org/webcontent/Farm-Foundation-Forums-363.aspx?z=na&a=363
http://www.wallacecenter.org/our-work/Resource-Library/wallace-publications/Northern-VA-LFS-Assessment-Final-Report.pdf

Other interesting sites and events:
C-FARE, IFPRI, Farm Foundation and Wallace Center (above), other NGO's

Topics Next week: Hidden costs

Focus will be on resource concerns and how they are affected by agricultural production:

SWAPA-HE

a. Soil Quantity and Quality
b. Water Quantity and Quality
c. Air Quality
d. Plant Health
e. Animal Health (Wildlife)
f. Human considerations
g. Energy Use