AEC 841--MODULE 3AA

THE FOOD SYSTEMS FRAMEWORK OF ANALYSIS

I. This section of the course deals with Developing a Conceptual Framework to Viewing Market Organization and Performance. This is built on several elements that have grown out of Industrial Organization analysis.

II. The Food Systems Framework encompasses both the "horizontal" slice approach of industrial organization (industry studies) and farming systems research, on the one hand, and the vertical approach of the subsector approach, on the other hand. Both need to be seen within an environment of incomplete information, which implies transaction costs.

Conceptual Framework:

III. Challenge: How to structure observations and analysis of the food system, which is enormously complex, in a way that is useful

   A. Understanding causes and potential solutions for problems of Food System Performance

   B. Serve as a guide of organizing research and action efforts.

IV. The conceptual framework presented here has two key elements:

   A. A conception of Demand that views consumption as a production process and focuses on a demand for attributes rather than for commodities

   B. The use of a food systems matrix to structure observations on the food system.

V. Element 1 of the Food Systems Approach: Conceptualization of Demand (Senauer et al., pp. 155-63).

A. Traditional projection of demand (e.g., FAO methodology) looks at changes in population growth (and demographic structure of the population) and at income growth to project future levels of demand for different goods. These approaches certainly have to be kept in mind in understanding how food system evolves. But we can get a deeper understanding of why the food system is evolving in a particular pattern by incorporating some elements of new theories of demand.

B. Traditional demand theory derives the demand function for a good from the maximization of an individual's utility function subject to an income constraint. Two key assumptions in this theory:

1. Arguments of utility function are goods and services, rather than attributes.
2. The income constraint is monetary income constraint.

C. Two key developments in demand theory over the past 30 years help us to understand better the evolution of demand and its impact on the evolution of the food system.

1. Kevin Lancaster's concept of goods as bundles of attributes (e.g., convenience, crispness, environmental friendliness) , where consumers demand attributes rather than goods per se.
2. Gary Becker's (Nobel prize in 1992) model of new household economics, which has 2 key elements:

a. Becker argues that households face two fundamental constraints: money and time. These two constraints can be combined into one in the analysis--i.e., a household's utility maximization is constrained not by monetary income but by its full income, which has two components:

   (1) Monetary income

   (2) Opportunity cost of the family members' time. Time can potentially be allocated to:

      (a) be sold on labor market

      (b) production of home-produced goods and services

      (c) leisure

   (3) Full income = non-labor income + opportunity cost of time, which can be devoted to wage-earning or other activities.

   (4) Time therefore becomes part of a full-income constraint. Utility is maximized given prices and constraint of full income (time and monetary income)

b. Consumption as a production process (Becker)

   (1) Physical transformation of goods into utility

      (a) Analogous to other production processes

      (b) Inputs (which can be substitutes or complements to each other)

i) Food

ii) Human Capital

iii) Time

D. Implications of Becker's and Lancaster's ideas for understanding the evolution of demand in the food system.

1. Demand for good is affected not only by its own price, that of other goods (complements and supplements), and the household's income, but also by the value of time. The **full price** of a good includes both the cash expenditures on the good and the time costs to make the good consumable.--E.g., unprocessed coarse grain vs. a dish of prepared rice.

2. Can define two types of **expenditure intensities** for various goods:

   a. *Expenditure intensity*--ratio of cash expenditure to full price

   b. *Time intensity*--ratio of time cost to full price.

   c. The two intensities are inversely related to one another.

3. Much of the evolution of demand for food and associated services as an economy grows can be analyzed in the light of Lancaster's and Becker's two concepts.

   a. The development process involves an increasing value of time (T.W. Schultz). As individual's labor productivity grows, by definition the opportunity cost of her/his time increases.

(1) While monetary income can increase, time availability is by nature fixed; hence, ratio of cash income to time available increases.

(2) Therefore, one would expect to see growing demand for goods with lower time intensity and higher expenditure intensity.

b. Lowering the time intensity of a product (e.g., moving from raw ingredients to a microwavable meal) essentially involves embodying more labor into the product earlier in the production chain--e.g., in food manufacturing rather than in the consumer's kitchen.

c. This shift from time-intensive to expenditure-intensive goods becomes increasingly important as the opportunity cost of those traditionally charged with meal preparation increases (predominantly women in most societies). E.g., with urbanization and more out-of-the home employment opportunities, demand for less time-intensive products increases.

(1) Already prepared flours in LICs.

(2) Fast food and microwavable dinners in HICs.

d. The food system responds to these changes in the relative prices of cash and time by developing new products that economize time and substitute the relatively more abundant factor of production, capital

(cash). This is an induced innovation process with respect to consumption. Note that Lancaster originally dubbed his analysis the "technology of consumption" approach.

4. Other element of the puzzle is Lancaster's point that what consumers demand are not products per se but attributes. This has at least two important implications:

   a. In the process of induced innovation, the food system firms often try to introduce new products based on desired attributes (hedonic concept) rather than a totally new product. For example, people want certain characteristics of traditionally prepared rice, but they want it ready in 5 minutes.

      (1) Much of food technology and genetic engineering focuses on the extent to which one can rearrange attributes within a product.

      (2) A constraint on the development of new technology is the extent to which characteristics are malleable within a product. Here, genetic engineering may play a key role in rearranging product attributes.

   b. Demand for various attributes may change over time, particularly as a result of:

(1) Increasing income. E.g., with higher income, people have filled their basic caloric requirements and may put more emphasis on (have a high income-elasticity of demand for):

(a) Ease of convenience (time constraint)

(b) Variety--e.g., growth in demand for ethnic food in US. Sales of salsa now exceed those of ketchup.

(c) Concern about environmental consequences of their consumption patterns

(d) Ethical concerns about animals

(e) etc.

(2) Changes in the information available to consumers about the consequences of their consumption choices

(a) Nutritional information

(b) Environmental information

5. The main point is if we think of goods as being bundles of characteristics rather than individual goods, and view them in terms of their time and expenditure intensity relative to changes in full income, we get a better picture of how the demand facing the food system changes over time. These changes in demand have major implications for food system structure.

E. Examples of how this approach to analyzing demand can help explain changes in the structure of the food system.

1. How the increased value of time has influenced the structure of the U.S. food system.

a. Increased demand for ease of preparation:

(1) More highly processed products, taken to the extremes of:

(a) Microwavable dinners

(b) Home delivered meals (e.g., pizza--one of the fastest growing elements in fast food industry)

(2) Increased away-from-home dining

(a) 46% of US food expenditure in 1990 went to food service

(b) Within food service, big shift from sit-down full service restaurants to fast food--again, reflects not just demographic changes (more young people with lower incomes in the market) but also changing relative time costs of different modes of consumption.

(c) Note increasing competition now between fast food restaurants and TOTE (Take-out-to-eat) and home delivered food. Again, competing on time basis.

Often TOTE or home-delivered pizza is faster than fast food, for the bundle of characteristics (cost, ambience, taste) sought. Supermarkets and fast food restaurants becoming less distinguishable from one another.

(3) Both greater prior preparation in purchased food and more away-from-home eating (often in franchised restaurants that highly value product uniformity throughout the system) lead to more demand for tighter specification in the food system, hence more emphasis on vertical coordination through contracts, integration, etc.

b. In retailing,

(1) more emphasis on one-stop shopping

(a) Growth of large store formats (hypermarkets, etc.). More than food sold. At Meijers you can do your banking, mail your letters, visit the dentist, buy pasta salad, eat lunch, then shop for corn flakes and auto parts.

(b) Supermarket focus on prepared foods--delis, salad bars, etc.

(c) The supermarket increasingly as a shell for franchises. How far might this go?

(2) Home delivery of groceries

(3) Purchasing up-scale food by catalogue or computer

2. Increased income and changing demand for different attributes in food:

a. Concern about more healthful food (also tied to the aging of the population)--Here, improved consumer information has played a big role. But as we will discuss when we come to the section of the class on nutrition labelling, considerable misinformation still exists. Many firms are differentiating their products on the basis of their <u>perceived</u> rather than actual healthfulness--e.g., Quality Dairy advertising its "zero cholesterol donuts."

(1) Improved nutritional content--e.g.,

(a) Shift in demand from fat--e.g., away from red meat

i) Role of grades and standards in the speed with which the system responds--e.g., discussion of Thomas and Pierson. Pricing efficiency

ii) Shift in menus in fast food restaurants to include more salads, low-fat meals, etc. (Kids food the last to catch up!) Note that

this shift has come in part because of increased competition from more expensive yet still moderately priced family restaurants, often with an ethnic motif--e.g., Olive Garden.

(b) More emphasis on fresh produce--e.g., in retail stores, and the development of international trade links (e.g., to Chile) to assure year-round supply.

(2) Concerns about food safety

(a) Main manifestation of demand has been for lower pesticide/chemical residues, even though the evidence is strong that main food safety problem is bacterial contamination.

(b) E.g., demand for organic produce. Issues:

i) What is "organic"? Current USDA proposals for new standards.

ii) What is real willingness to pay? Will consumers accept dings on their fruit? And what is the learning curve?

iii) How is this related to grades and standards, which are based primarily on visual criteria.

One estimate is that 40% of US pesticide use on tree fruits is to meet essentially cosmetic criteria of grades and standards.

(c) Possible tradeoffs between safety attribute of food and other desired attributes of food, e.g.,

i) Low fat--poultry and seafood are more susceptible to bacterial contamination if not properly prepared

ii) Rapid preparation--e.g., microwaves can have cold spots where pathogens are not killed

iii) Ethnic food, esp. uncooked seafood (sushi, oysters)--pathogen questions.

b. Environmental concerns, e.g.,

(1) Packaging--Inherent conflict between function of packaging (to keep the environment out of the food) and biodegradability.

(2) Pollution from food production throughout the food chain--Demands for "sustainable agriculture," which is not consistently defined.--Response of industry in advertising "green" products--recycled cereal boxes, etc.

c. Animal welfare--e.g., complaints about veal production techniques

d. Increasingly, more services to help the aged--e.g., delivery of groceries to home, single servings packages, etc.

3. How the food system has attempted to respond to the changing demand

a. Changing the mix of products and services offered, as outlined above

b. More market segmentation combined with product differentiation--trying to identify more closely different types of consumers and tailor products that fit their particular demands. In U.S. this has been fueled by:

(1) Lower population growth, which means that manufacturers and retailers can no longer expand volume by just counting on the expansion of the mass market. Need to expand market share and value added.

(2) Increased ethnic diversity in U.S. and recognition of the value of multi-culturalism (tourism via the palate).

(3) Improved data base, particularly from scanners, to monitor consumption patterns of different groups in the population.

(a) Tracking of expenditure patterns through scanning data, which is available for purchase from firms like Nielson.

(b) Targeting coupons at checkout to consumers' expenditure patterns.

c. The greater the degree of product differentiation, the more the need for tight vertical coordination in the subsystems through vertical integration, contracting, cooperative arrangements, etc.

4. Constraints to adapting to these changes

a. Fixed assets may slow response, but probably can't stop it.

b. Standards of identity and grades and standards

(1) "Old ones" may become obsolete or serve as barriers to innovation. E.g., requirement that ice cream contain 10% milk fat.

(2) Need for new ways of conveying standardized information to consumers. In the absence of such standards, firms have shown tendancy to use attribute information in a misleading way ("85% fat free")

c. As more services become embodied in food products, more labor become embodied in them "upstream." Often the larger labor input is in areas where gains in labor productivity may be more difficult to achieve (e.g., salad preparation in supermarkets--harder to automate than warehouse management). This may lead to higher

labor costs and potential labor conflicts as attempts occur to automate these generally low-skill jobs.

d. Demographics--fewer young people to work in low-wage fast food and similar jobs. (Turnover averages 250%/yr. in these jobs!). Higher wages will reduce their competitiveness with other forms of food consumption technology. Much of the gain in employment in the food system in recent years has been in these areas of relatively low labor productivity. This is reflected in the rising share of the consumer's food dollar that goes to labor (34.5% in 1988--the single largest component).

VI. Element 2 of Framework - Structuring observations on the food system in the broader economy - the Food Systems Matrix

A. The Economy as a Set of interlinked production - distribution consumption sequences (PDC's) - Fig. 1 (spider web)

1. Consumption as a production process
2. complexity of system
3. way to increase productivity of system

a. Increased productivity of individual physical transformation process - through improved technology and management processes

b. Improved coordination across stages - maize example

B. Description and Analysis - the Food Systems Matrix

1. Multi-dimensional Food System - How to describe?
2. Multi-dimensional matrix - visualized as different 2 dimensional projections (analogy of conic sections)
3. How you slice it depends on problem at hand
4. At least 4 different areas of study useful for organizing information about food and ag. sector (Fig. 2)
    a. Commodity Subsectors
        (1) From input provision to consumer or to where prod. loses its identity
        (2) Boundaries (both horizontal and vertical) are pragmatic and dictated by the problem at hand
        (3) Aim is to:
            (a) Describe and eventually quantify flows
            (b) Diagnose ways of improving
                i) productivity at various stages
                ii) coordination across stages
    b. Input subsectors or markets - e.g., labor markets, fert. markets - as 3rd dimension on 2-dimensional matrix
    c. Industry studies
        (1) Horizontal slice
        (2) Boundaries pragmatic on industry

(3) Reasons for this slice:

(a) more efficient than subsector approach for certain questions

(b) get insights into other questions - collusion, etc. across markets

d. Economic Coordination Services:

(1) Identification and enforcement of rights and obligations

(2) Finance

(3) Risk Management

(4) Information

(5) Roles of agents and networks