

**OFFICIAL**

**COOPERATIVE REGIONAL RESEARCH PROJECT STATEMENT**

**Project Number:** NE-165 (Revised)

**Title:** Private Strategies, Public Policies, and Food System Performance

**Duration:** October 1, 1996 to September 30, 2001

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## STATEMENT OF PROBLEM

The importance of post farm gate marketing activities cannot be overstated when analyzing the sustainability of agricultural production, rural economies, and access to safe, affordable food by all segments of the U.S. population. The NE-165 Project: *Private Strategies, Public Policies, and Food System Performance* is the primary national cooperative research effort that addresses the economics of post farm gate activities, the impact of public policies on these activities, and the resulting performance of the food system. In its renewed form, the Project will add an international context by encouraging research on international issues and cooperation with participants from Canada, the United Kingdom, and France.

## JUSTIFICATION

Post farm gate processing, marketing, and distribution of food is a critically important problem because of the size of this sector in the U.S. economy and the impact of its performance on farmers and consumers. Sales by the U.S. food marketing system totaled nearly \$800 billion in 1994. Value added by the food system represents about 81 cents of each food dollar spent (Gall). Equally important, the post farm gate share of the consumer's dollar has increased significantly not only in the long run—it was 58 percent in 1929—but also over the very recent past. Value added by post farm gate processing and distribution was 75 percent in 1988 (Dunham). The trend towards fewer very large and often vertically integrated agribusinesses is changing how the food system operates. Profits for both food processors and retailers have continued at record levels during the 1990s (Gallo). During the 1980s, the stock prices of food manufacturing firms in the Standard and Poor 500 Index increased nine-fold as the index itself tripled (Cotterill 1993). For these reasons the performance of the system remains a critical issue. Are profits due to increased market power, efficiency gains, and/or global expansion into "virgin" markets? Are food distribution systems on both sides of the Atlantic converging to a common structure and similar strategies? If so, what are the implications for performance in different countries and sectors? Could food be provided in a more affordable, i.e., efficient, fashion? Are consumers being supplied with the optimal amount of food quality, especially safety, information, and regulatory protection? How safe is safe?

ESCOP recognized the importance of this research in its 1994 report *Opportunities to Meet Changing Needs: Research on Food, Agriculture, and Natural Resources*. In its national and regional ranking of research initiatives, to "increase the use of integrated and *sustainable* (emphasis added) production systems" and to "enhance food safety" are tied for first place among 22 topic areas, while to "enhance agricultural and rural economies" is ranked fifth and to "enhance food quality and value" is ranked thirteenth. The Joint Council on Food and Agricultural Sciences in its *Fiscal Year 1997 Priorities for Research, Education, and Economics* identifies five high priority research areas. They include research on: 1) provision of a *safe, affordable, reliable, and nutritious* (emphasis added) food supply and 2) improvement in the global competitiveness of U.S. food products, including identifying quality assurance programs and assessing the impacts of public policy on competitiveness.

The need for economic research on food marketing is comprehensive and critical not only because of changes in the structure of markets and in private strategies but also because of recent and contemplated cuts in federal programs and the dismantling of federal food and agricultural policies. Key problem areas addressed by research in this Project are: the scope and impact of market power and new cost efficiencies; the effectiveness of new antitrust, food safety, and other regulatory measures; the impact of increased vertical integration and coordination in food industries and of internationalization of the food system; possible paths of convergence of food systems in developed economies on particular private strategies and competitive performance levels; food access for at risk, poor consumers given actual and contemplated cuts in federal programs; and the potential role of agricultural cooperatives as coordination and stabilization agencies in the event that federal farm programs are dismantled.

Given the length of this list of problem areas, the need for an international, coordinated, cooperative research effort is clear. Complete "solutions" for each of these areas may not be possible, but high quality research on any of them requires an integrated team approach that is beyond the span of any individual or institution. The proposed NE-165 Project is large because it seeks to focus and coordinate the efforts of many researchers to analyze specific issues in a comprehensive, multifaceted fashion. Absent focus and coordination, individual efforts almost always fall short. Participants in the previous Project have found integration and cross fertilization to be particularly stimulating to their research. In planning for a new Project, the participants overwhelmingly supported a unified approach to research on market structure, vertical coordination, food quality, and government regulation (see Critical Review below). NE-165 is more active and organized than most regional projects, and better able to coordinate the collaborative efforts of a large number of researchers, because it has a funded Core Research Group at the Food Marketing Policy Center (FMPC) at the Universities of Connecticut and Massachusetts. The resulting leadership and facilitation provided by the Policy Center ensures timely, visible, productive research forums, conferences, and symposia for the coordinated delivery of research on important issues. As evidence of a proven track record on this point we cite the eight conferences held or to be held during the second five years of the Project (1992-1996). Interaction and feedback with key policy agencies is particularly facilitated by the participation in the Project of members of the Agricultural Marketing Service, Economic Research Service, Packers and Stockyards Administration, and Rural Business-Cooperatives Service of USDA; Food and Drug Administration; Centers for Disease Control and Prevention; and General Accounting Office.

Several Project researchers have testified before Congress, written major policy white papers, served as expert economists in antitrust and regulatory matters, and worked with state legislatures, public interest groups, and other organizations to influence food system performance. NE-165 is credited with playing the crucial role in establishing the economics of food quality, especially food safety, as an active research field within economics, contributing to high quality analysis of new regulatory initiatives such as Hazard Analysis Critical Control Point (HACCP) for control of foodborne pathogens. Cost savings to the public from the Project are likely to sum to billions of dollars as research improves competition, efficiency,

food quality, and government policy. For example, recent FMPC policy research at Connecticut and Purdue has contributed to major national television stories on high cereal prices, Congressional focus on this issue (FMPC Newsletter), and actual price reductions by leading cereal companies that may save the average cereal consuming household \$200 per year. For research productivity, the benefits of continuing the Project will be seen in increases in collaborative research projects that improve the effectiveness of its members; NE-165 sponsored conferences, symposia, and workshops; and Internet and standard access to written work, including the NE-165 Working Paper Series and Journal Reprint Series.

The proposed research intends to have a major impact on scientific methods and understanding by developing new approaches to analysis of food markets. Of particular importance in this regard is 1) the integration of demand analysis into industrial organization work through the use of the greatly improved, scanner-based data now available on the brand level for food products, and 2) the development of improved methodologies to measure the benefits and costs of private strategies and public policies aimed at improving food quality.

## **RELATED CURRENT AND PREVIOUS WORK**

Related current and previous work includes work completed by the previous NE-165 Project (see Critical Review), other regional efforts, and other researchers. Southern Regional Project 216 on demand analysis is a locus for research that uses USDA household survey data (Raunikar and Huang, Eales and Unnevehr) and scanner data collected from supermarkets in a local market (Capps and Nayga) to analyze consumer preferences. That regional effort and recent demand analysis work by others, most notably Green and Alston and Moschini et al., will contribute to the proposed analysis of brand level (Land O' Lakes butter instead of "all" butter) and market level data (Land O' Lakes sales in Chicago rather than single household purchases). The proposed Project will also adapt and extend demand analysis to evaluate food safety, quality, demographic, and advertising impacts.

Work planned on advertising dovetails with research by Northeast Coordinating Committee NEC-63 on commodity advertising (Forker and Ward, Kinnucan et al.). That effort focuses on the funding of such advertising by check-off programs and the need for related national promotion boards to evaluate the effectiveness of such programs. In contrast, our analysis focuses on advertising from all sources, and most importantly on the impact of advertising of branded food products on consumer choice.

The other regional project that worked on post farm gate marketing issues was NC-194: *Organization and Performance of World Food Systems*. That regional research project has ended and been replaced by a coordinating committee, NCR-182, of the same name. It no longer has a funded core research group and is distinctly less active than the earlier research project. The focus of NCR-182 is on international trade and related policies. Similarly, S-256 and the International Agricultural Trade Research Consortium (IATRC) focus on international trade issues.

The international research in the proposed renewal of NE-165 focuses squarely on the organization of post farm gate food processing and distribution systems in other developed economies (Canada and the European Union). A 1995 conference organized by the Food Marketing Policy Center, the University of Reading, and Southampton University titled *Food Retailer-Manufacturer Competitive Relationships in the E.U. and USA: Emerging Research Issues*, serves as a basis for proposed collaborative research on comparative food system questions. Related current research includes Cotterill (1995), Hughes (1994) and Rama and Pieri (1995). In addition, WRCC-72: *Agribusiness Research Emphasizing Competitiveness* and the International Food and Agribusiness Management Association (IAMA) focus on the applied analysis of business strategies in the food marketing system. Finally, S-222: *Economic Issues Affecting U.S. Fruit and Vegetable Systems*, has emphasized a range of work that includes marketing issues related to that specific commodity group.

Among these projects, NE-165 is unique because it assembles agricultural economists and economists who are specialists in strategic marketing issues, organization of industry, and public policies related to competition and regulation. It is a global project that employs a particular mode of economic analysis, the subdiscipline called industrial organization and regulation analysis. The application of this common research paradigm to the food system is the unifying principle of this Project proposal. (For a more extensive discussion of Current and Previous Work, see the Appendix.)

In summary, a significant current research literature, much of it by NE-165 members, exists on the economics of post farm gate marketing of food products. This literature ranges across firm strategy, market structure, and vertical integration issues; an understanding of food demand and how it is shaped; private and public provision of food quality; and domestic and international food markets. In these areas, the NE-165 Project has been central in creating a network of economists, with links to other disciplines, to foster collaboration and increased research productivity. A major strength of the Project has been and will be the interaction and working together of a talented group of researchers to focus upon critical public policy issues and private strategies that determine related food system performance.

## **OBJECTIVES**

1. To analyze the impacts of changes in strategies, technologies, consumer behavior, and policies on the economic performance of the food system.
2. To provide economic analysis of private and public strategies in order to assess their impact on improvement in food safety and other quality attributes.

## **PROCEDURES**

All procedures emphasize the cooperative use of common methodologies by researchers at different universities and agencies to analyze changes in the food marketing system that affect economic performance. Under each objective, the procedures specify particular applications and approaches that will be pursued and how each station will collaborate in the work. The size of the Project allows multiple strains of complementary research to be pursued collaboratively under each procedure. In the next five years, with FMPC leadership and support, NE-165 will sponsor a worldwide web home page, Internet discussion groups, meetings, conferences, books, reports, and invited paper and symposium sessions that support the development of common research approaches, the summation of research results, and their dissemination to business, government, and consumer groups.

NE-165 is a very large regional research project. It involves over 70 researchers from several countries and several government agencies as well as universities. Given its size and the scope of its research, the procedures section first explains how NE-165 works to generate and support collaborative work between its members. Each procedure then 1) articulates key questions to be analyzed, 2) discusses anticipated results, and 3) gives a projected timetable to document when activity will occur within the proposed 5-year life of the Project.

### ***How NE-165 Does Collaborative Work***

NE-165 has developed a distinctive and highly productive framework for collaborative work. We propose to continue use of this proven approach in the next five years. Because the Project is large with several closely related research procedures, many smaller groups of researchers are working on particular procedures at any one time. Within this framework, the Project facilitates collaboration in two specific ways.

First, Project members working across the procedures meet annually to discuss developments in their work. The discussion identifies cost effective, collaborative efforts and teams of researchers to work on these issues. For example, researchers working on product differentiation in the food industry have teamed up with others analyzing whether different levels of food safety can be effectively marketed in the United States. The overall group plans the topics of conferences, symposia, and other presentations that forward the collaborative research agenda of the Project and its members.

Second, by careful planning, the conferences, workshops, and symposia organized by NE-165 are designed to generate and support collaborative work. Through a combination of calls for papers, invited papers, and research round tables, conference organizing committees bring researchers together to produce collaborative work for presentation on a defined schedule. The conferences are organized to generate joint papers between Project members using similar research techniques *and* to juxtapose complementary or potentially conflicting methodologies so they may be compared effectively. This structure generates published joint work and, very importantly, facilitates an intellectual collaboration that furthers the research agenda in ways



that go far beyond joint publications. Not only do researchers present their results but they also collaborate to critique and compare results, build consensus on the conclusions of research in progress, lay the groundwork for more consistent research approaches, and plan future joint work. This structured approach has allowed the NE-165 conferences to have a significant impact on research productivity and usefulness. The regular publishing of books and proceedings make the research gains of the conferences available to a broad audience.

An example of this process is the NE-165 conference on *Valuing Food Safety and Nutrition* held in 1993. The conference featured side-by-side comparison of five separate methodologies for measuring how much value society and consumers place on food safety and nutrition. Beyond the jointly-authored work presented, the more than 100 researchers present learned about the strengths and weaknesses of alternative methodologies from the leading practitioners of those approaches. This generated a true intellectual collaboration on how valuation should be done that has been influential in guiding researchers' subsequent work. In addition, Project members wrote several research grants and joint papers based on the effective working atmosphere and relationships established at the conference.

The procedures outlined below reflect the way NE-165 does collaborative work. They first discuss the key questions the research addresses. They then outline in significant detail what individual researchers will contribute to collaborative work in each area. We believe this specific detail is important to showing exactly how we propose to accomplish our scope of research and who will be responsible. Finally, the procedures outline expected outcomes and give a projected timetable for completion of work.

***Objective 1: To analyze the impacts of changes in strategies, technologies, consumer behavior, and policies on the economic performance of the food system.***

#### **Procedure 1.A: Changes in Strategies**

##### **Subprocedure 1.A1: Vertical Coordination**

***Key Questions:*** How will economic performance change as commodity subsectors such as pork or dairy become more tightly coordinated through vertical integration, contract production, and identity-preserved products? What are the impacts on farmers, consumers, and agribusiness firms of this industrialization of agriculture?

Changes in the structure of vertical coordination are now occurring in the food system. Azzam (Nebraska), Royer (Nebraska), Durham (Indiana), and Smith (Minnesota) will lead NE-165's collaborative research effort focusing on model development and analysis of vertical coordination in different parts of the food distribution chain. Azzam and Harrison (Louisiana) will cooperate to develop empirical models for assessing the economic performance of vertical market structures and for testing for market power.

Royer, Durham, Christy (New York), Tomek (New York), Smith, and Azzam will carry out a collaborative study of the effects of vertical integration and contract coordination in agricultural commodity subsectors. Royer, Smith, and Azzam will cooperate in modeling these effects. Royer and Wissman and Namken (USDA/RBS) will explore the potential for vertical coordination by producer-owned cooperative associations. Durham, Tomek, and Holloway (California-Davis) will examine the economic efficiency of market arrangements between producers and buyers in light of new vertical coordination mechanisms, niche markets, and identity-preserved commodities.

McLaughlin, Ward (Illinois), and Sheldon (Ohio) will jointly examine problems of coordination that occur outside of commodity subsectors in manufacturing, wholesaling, and retailing. McLaughlin and Ward will examine the use of category management and efficient consumer response (ECR) systems by manufacturers, wholesalers, and retailers in terms of vertical and horizontal coordination, network effects and externalities, incentives for adoption, and free-rider problems. Sheldon will contribute analysis of vertical restraints such as exclusive territories, slotting allowances, and tying arrangements between food manufacturers and retailers.

**Anticipated Results:** Agricultural economists have studied vertical coordination in a descriptive and empirical fashion since the 1930s. However, at no time have we been able to develop and test economic models based on profit maximizing firms in market channels dominated by few buyers (oligopsony), few sellers (oligopoly), or both (bilateral oligopoly). This procedure will develop and present rigorous economic models. These models will incorporate the role of cooperatives as well as investor owned companies; the role of identity preserved products, possibly with particular food safety attributes; and the coordinating role of contracts, futures markets, efficient consumer response, and supply chain management practices. Project members will collaborate in testing and comparing these models using data from particular food industries.

**Timetable:** During the 5-year Project, NE-165 will have 1 major integrating conference (targeted for 1998) presenting the models, including preliminary testing. Two special symposia at professional meetings (targeted for 1999 and 2001) will present full empirical tests of the models.

**Participants:** California-Davis, Illinois, Indiana, Louisiana, Minnesota, Nebraska, New York, Ohio, USDA/ RBS

### **Subprocedure 1.A2: Firm Market Strategies**

**Key Question:** How important are deviations from competitive markets due to 1) tacit collusion, i.e., "coordinated" market strategies and 2) market dominance and product differentiation, i.e., "unilateral" market strategies for the performance of food markets? How important to performance is the presence or absence of agricultural marketing cooperatives and small firms in food industries?

Research on firm market strategies will be organized in three parts. The first part is *Determinants of Horizontal Market Power in a Single Industry*. Changes in horizontal market power within a single industry arise from at least four different general market structures. With respect to the analysis of these different market structures there is a need for data on food industries. Work under this part will begin with NE-165 establishing a collaborate effort to provide this data on an on-going basis. Kaufman (USDA/ERS) and MacDonald (Ohio) will update retail market concentration data made available by Cotterill (Connecticut). Connecticut in cooperation with others will seek to maintain similar market concentration, market share, advertising, and price and profit data for food industries for use by all researchers cooperating on this procedure.

Within this group, an area of focus will be analysis of oligopoly (mergers, alliances, tacit collusion, restraints of trade, and acts to monopolize sales in an industry). Building upon recent theoretical work, Smith (Minnesota) and colleagues in France, including Sauvée, will collaborate to develop game theoretic models of tacit collusion for international food industries. Sexton (California-Davis), Cotterill (Connecticut), and Connor (Indiana) will work together to move beyond full models of tacit collusion to identify less data intensive but rigorous methods for evaluating oligopolistic coordination in markets. These models will be used with Information Resources, Inc. (IRI) data at Connecticut to analyze mergers in food industries.

A second focus will be product differentiation/firm dominance (unilateral exercise of market power in an industry). Rogers (Massachusetts) will use leading national advertiser data and IRI promotional information to provide analysis of changes in the use of media advertising and other promotional tools by branded food processors over time. This information will be used by other researchers under this objective. Work on the previous NE-165 Project analyzing the impact of large market share dominant firms on industry performance will continue under the new Project. The recent availability of grocery store-based scanner data at the brand level now makes it possible to extend such analysis to the issue of product differentiation and the ability of firms that sell differentiated products to elevate prices in a unilateral as opposed to a tacitly collusive fashion. Collaborative empirical analysis will be undertaken by Cotterill (Connecticut), Fletcher (Georgia), Connor (Indiana), Wessells (Rhode Island), Peterson (Virginia), and Perloff (California-Berkeley) using common data sources to estimate brand level demand systems, including estimation of own and cross price elasticities. These elasticities will be used to analyze the ability of firms that sell one or more brands in an industry unilaterally to raise price profitably.

A third focus is on oligopsony and will be closely coordinated with work under Procedure 1.A1. Public concern that farmers have few alternative outlets for sales of their products indicates a need to develop theories and assemble data to analyze oligopsonistic pricing at the producer-first handler level. Azzam (Nebraska) and Connor (Indiana) will analyze the tradeoff between market power and cost efficiency in such industries using simulation

models to evaluate welfare losses. Raper (Massachusetts) and Love (Texas) will focus on new methods of quantifying market power exertion, including the detection of simultaneous upstream and downstream market power exertion, and extending nonparametric methods of measuring market power exertion. Rogers (Massachusetts), Sexton (California-Davis), and Fletcher (Georgia) will collaborate in developing empirical models to test for monopsony or oligopsony power in producer-first handler markets. Preston (USDA/Packers and Stockyards) and others are assembling extensive information on producer-first handler relations in the meat industries and will conduct similar descriptive and analytical studies of these industries.

A second group of work under this subprocedure will focus on *Cooperative Marketing Strategies*. Sexton (California-Davis), Fletcher (Georgia), Rogers (Massachusetts), Cotterill (Connecticut), and members from USDA/Rural Business-Cooperatives Service will work together to analyze the performance implications of the operation of agricultural marketing cooperatives and changing agricultural policies, including primary commodity policies and market orders, on the performance of the food system. Rogers, Sexton, and Cotterill will develop theoretical models of optimal advertising and product differentiation strategies by agricultural marketing cooperatives. Several members from USDA/RBS will analyze cooperative strategies, including marketing strategies in niche markets and merger and consolidation activities. Based upon these empirical studies and legal analyses by Frederick (USDA/RBS, Procedure 1D), Royer (Nebraska) and Cotterill will collaborate to develop models of cooperative conduct analyzing whether agricultural marketing cooperatives exercise market power in a fashion similar to investor owned firms in oligopolistic markets.

A third group of work under this subprocedure will be on *Small Firm Marketing Strategies*. Manalo (New Hampshire) and Ash (Ag-Canada) will collaborate on research approaches to analyzing how small firms compete against large multi-national firms in global markets.

**Anticipated Results:** NE-165 will make pioneering contributions to new, advanced analyses of unilateral market power and the impact of cooperatives upon market performance. These will be articulated within the context of the competitive effects of small firms (entrants, niche market players) and of tacitly collusive strategies.

**Timetable:** Work in this area is underway with a visiting researcher at the FMPC and a research methods session and round table at the upcoming June, 1996 conference. NE-165 will plan a major international conference on this topic in 1997 and at least three principal paper or symposium sessions at professional meetings during the 5 years of the Project. A second conference on cooperatives' impacts may be held in the 2000-2001 period.

**Participants:** Ag-Canada, California-Berkeley, California-Davis, Connecticut, Georgia, Indiana, Massachusetts, Minnesota, Nebraska, New Hampshire, Ohio, Rhode Island, Texas, USDA/ERS, USDA/P&S, USDA/RBS, Virginia

### **Subprocedure 1.A3: International and Comparative Studies**

**Key Questions:** What does it mean that the food marketing system is becoming more global? How are multinational firms changing the location of economic activity in the food system? How are the structure, strategies, and performance of particular food industries changing?

Kaufman and Handy (USDA\ERS), Ash (Ag-Canada), and Connor (Indiana) will lead NE-165's collaborative research on understanding patterns of foreign direct investment and export sales activity by food manufacturers and retailers. Antonovitz (Iowa), Perloff (California-Berkeley), and Sheldon (Ohio) will collaborate in examining the impacts of increased vertical coordination and integration, market power and product differentiation, and environmental and food safety regulations on international trade. Love (Texas) and Raper (Massachusetts) will use game theory and new empirical industrial organization techniques to examine strategic interactions in international markets.

Sauvée (France), Cotterill (Connecticut), Traill (Reading-UK), Burns (Reading-UK), and Poole (London-UK) will conduct studies of selected food processing and distribution industries in the U.S. and the European Union to determine how the structure, conduct, and performance of those industries will change in the near future. This work will focus on the role of advertising in manufacturer brand power, the countervailing use by retailers of private or own-label products, and the factors determining own label prominence across food sectors and countries. Comparative analysis is expected to determine whether industries are converging to a common structure due to globalization and what that common industrial organization may be.

**Anticipated Results:** Global marketing systems, particularly those on both sides of the Atlantic, may be converging to a common system but it is not clear what the characteristics of the new system will be. The Project will generate and support collaborative work between North American and European economists to evaluate the impacts of global changes on food system performance and the competitiveness of manufacturers and retailers.

**Timetable:** International research collaboration has already begun between members of the new Project. For example, researchers from the United Kingdom and Italy will participate in the June, 1996 NE-165 conference in Washington, D.C. We plan a major conference to be held in 1999 and several smaller symposia on both sides of the Atlantic during the 1998-2001 period.

**Participants:** Ag-Canada, California-Berkeley, Connecticut, France, Indiana, Iowa, London-UK, Massachusetts, Ohio, Reading-UK, Texas, USDA/ERS

## **Procedure 1.B: Changes in Technologies**

**Key Questions:** To what extent are changes in technologies driving the organization of industries and commodity subsectors? How has productivity in food industries changed and why?

Case studies of process and management technology adoption within food industries will be coordinated by Mazzocco, Thompson, and Westgren (Illinois). The case studies will include intra-firm and inter-firm adoption of biotechnology and process innovation. Westgren and Sonka (Illinois) will contribute conceptual models based on transaction cost economics and the resource-based model of strategy that will be exploited in the case studies to measure economic benefits to adopters. Mazzocco, Sonka, and Antle (Montana) will assess the productivity effects of new processing technologies. Anderson, Wessells, and Gates (Rhode Island) will analyze technology changes which allow for aquaculture of new species, as well as those which allow for different inventory practices of live product in aquaculture and more traditional seafood inventories.

Members from Illinois, Morrison (California-Davis), and Smith and Roe (Minnesota) will collaborate to analyze the market and firm performance implications of technological changes. These changes may enhance interfirm relationships (such as through Efficient Consumer Response, Ward (Illinois)), expand the dimensions and extent of electronic communications (such as through use of the Internet, Thompson), and extend the marketer's capability to understand consumer behavior (such as through smart cards and other consumer specific devices, Ward). The means to analyze the effects of such technologies is not currently well defined. In such instances, exploiting a range of approaches is desirable and will be employed here.

Morrison, Smith, and Roe will examine productivity change in the food marketing system. Morrison will contribute a cost-based production theory model incorporating specific technology and behavioral factors to examine the technological/trade link in the U.S. food processing industry. Smith and Roe will analyze the link between industrial concentration and total factor productivity, with a special emphasis on assessing the extent to which value added is exported from the U.S. economy versus the technologies being exported and used to produce value added in major competing countries.

**Anticipated Results:** New theories of resource-based competition provide an alternative explanation to the traditional analysis of market power and performance in oligopolistic industries and tightly-coordinated subsectors. Work on this procedure will use these approaches to analyze changes in food system organization and performance. This work will be compared and contrasted to work under Procedures 1.A1-A3.

**Timetable:** Morrison will present this approach at the NE-165 Conference in June 1996. Research results will contribute to the integrating strategy conference planned in 1998.

**Participants:** California-Davis, Illinois, Minnesota, Montana, Rhode Island

## **Procedure 1.C: Changes in Consumer Behavior**

### **Subprocedure 1.C1: Consumer Demand Models**

**Key Questions:** Can we model brand level demand as well as industry- or category-level demand relationships? Can the results be used to analyze the impact of marketing activities, and shifts in food safety preferences and information, on demand for food products?

Project members will collaborate in developing advanced applications of consumer demand models for the food industries, with the effort led by Wessells (Rhode Island) and Cotterill (Connecticut). Several researchers will conduct parallel studies that will then be brought together for comparison and summarization. Anderson and Wessells (Rhode Island) will develop and test models to estimate the impact of marketing activities, both industry-wide and firm-specific, on consumer behavior in the aquaculture industry and wild fisheries. Fletcher (Georgia) will do the same for peanut products using data from a national survey. Cotterill, Peterson (Virginia), Raper (Massachusetts), and Rogers (Massachusetts) will do the same for a variety of branded processed food products using retail scanner data purchased by the Food Marketing Policy Center. Each of the demand models will use advertising data for both industries and brands collected by Rogers and other economic data collected and maintained by the FMPC.

Jensen (Iowa), Chern (Ohio), and Caswell (Massachusetts) will collaborate to study consumers' knowledge about food safety and nutrition and how this knowledge affects food product demand. They will seek a sharper understanding of consumer preferences and shifts in consumer purchases within related product segments. Peterson and Rogers will work together to examine the effects of generic, industry-wide advertising in meat products.

**Anticipated Results:** To date brand-level demand relationships have not been estimated for food products except for some work using national IRI scanner data and sporadic efforts with single store scanner data. Our estimates of own price elasticities for the 44 U.S. Census food industries are over 25 years old and extremely crude by today's standards. This effort will produce new category level price elasticities as well as brand-level marketing elasticities and demand analysis that will serve as a key component in policy making.

**Timetable:** Peterson (Virginia) will spend 1996-97 at the FMPC working full time on this area and will coordinate efforts with other NE-165 researchers to complete this work. Output will be reported at our strategy and food safety conferences throughout the Project.

**Participants:** Connecticut, Georgia, Iowa, Massachusetts, Ohio, Rhode Island, Virginia

## **Subprocedure 1.C2: Factors in Dietary Changes and Food Access**

**Key Questions:** Do consumers living in different areas or with different socioeconomic characteristics have markedly different access to food? Do they have different knowledge about diet and health?

Cotterill and Steahr (Connecticut), Kaufman (USDA), and Jensen (Iowa) will collaborate to analyze low-income communities and issues related to poverty, location of retail food stores, food costs, and food access. They will develop geographical information system applications for use with the 1990 census and trade-source data maintained at the FMPC and USDA to identify low-income communities classified by poverty characteristics. Kaufman will add zip code level information from the Food Nutrition and Information Service of USDA. Jensen (Iowa) will contribute food price indexes for different places, and across time, which will be indicators of differential access to food. Nayga (New Jersey) will analyze changes in U.S. consumers' diets and health awareness to determine the relationships to socioeconomic and demographic characteristics of consumer groups, especially low-income people, minorities, and the elderly.

**Anticipated Results:** The NE-165 Project will provide detailed analysis of differential access to food and dietary information among different types of consumers.

**Timetable:** The Project expects to hold symposia and policy briefings on the results of this work every two years during the life of the project.

**Participants:** Connecticut, Iowa, New Jersey, USDA/ERS

## **Procedure 1.D: Changes in Policies**

**Key Questions:** How do changes in food quality, especially safety, standards; agricultural commodity price support and marketing policies; and antitrust policies affect performance in the food industry?

Lichtenberg (Maryland), Fletcher (Georgia), Ward (Illinois), and Anderson (Rhode Island) will lead the NE-165 research effort to analyze food quality grading systems and the relationship between food safety standards and such systems. Caswell (Massachusetts) and Wessells (Rhode Island) will develop models to analyze the effects of food safety and quality standards on international flows of food products. Ash (Ag-Canada), Sauvée (France), Sexton (California-Davis), Fletcher (Georgia), and Swinbank (Reading-UK) will develop a framework for analyzing the impact of changes in agricultural commodity price support and marketing policies in the U.S., Canada, and the European Union on the organization of the post farm gate food system. Fletcher, Sexton, and Ling and Liebrand (USDA/RBS) will use the case study approach to analyze the opportunities and potential benefits for agricultural marketing cooperatives in a deregulated environment. Frederick



(USDA/RBS), Cotterill (Connecticut), and Sheldon (Ohio) will review how recent court antitrust decisions have affected the food system.

***Anticipated Results:*** The Project will contribute specific understanding of how particular policy changes are affecting the performance of the food system.

***Timetable:*** Research results regarding quality standards will be reported at a conference on the regulation of food safety and other quality attributes targeted to be held in 1998. Results on commodity pricing and antitrust policies will be reported at the strategy conferences targeted for 1998 and 1999.

***Participants:*** Ag-Canada, California-Davis, Connecticut, France, Georgia, Illinois, Maryland, Massachusetts, Ohio, Reading-UK, Rhode Island, USDA/RBS

***Objective 2: To provide economic analysis of private and public strategies in order to assess their impact on improvement in food safety, nutrition, and other quality attributes.***

The organizing principle and end goal of work under each Objective 2 procedure is to provide road maps of policy options and consequences.

## **Procedure 2.A: Consumer Risk Perceptions, Behavior, and Food Demand**

### **Subprocedure 2.A1: Risk Perceptions and Information**

***Key Questions:*** How do consumers form risk perceptions about food products? What characteristics of a risk are most important to consumers?

An empirically verified theory of consumer risk perception is essential for understanding consumer demand for food safety, behavior toward food safety, and effects of food safety information programs. At this time, there is no well developed general theory of foodborne risk perception. The construction of such theory will be a goal of collaborative research by van Ravenswaay (Michigan), Douthitt (Wisconsin), Zepeda (Wisconsin), and Grobe (Oregon). They will identify the major dimensions of risk perception (mean probability, ambiguity, elements of harm) and how risk perception is affected by contextual factors such as safety information, perceived effectiveness of personal risk management strategies, trust in public risk management strategies, and personal characteristics such as health status, gender, age, and income.

While consumer surveys do ask about risk perceptions, there is no consensus on the validity of existing measures. The goal of researchers will be to develop and validate these measures in several contexts. Consumer perceptions of risks from microbial pathogens in

several types of food will be measured by Lin (Florida), Crutchfield and Roberts (USDA/ERS), Fox (Kansas), and Bailey (Arkansas). Fox, van Ravenswaay, Douthitt, Zepeda, Grobe, Bailey, Fletcher (Georgia), and Anderson, Wessells, and Gates (Rhode Island) will measure consumer perceptions of risks from production processes (e.g., irradiation, pesticide use, biotechnology, aquaculture vs. harvesting wild seafood).

Empirical measures of the contextual factors and estimates of their impact on risk perceptions do not exist. Researchers will develop measures for each of the contextual factors and examine their effect on risk perceptions for several types of foodborne risks. Risk information measures and perceptions for fat, cholesterol, and other nutritional attributes will be developed by Chern (Ohio) and Douthitt and Gould (Wisconsin) and for food-related biotechnology by Douthitt, Zepeda, and Grobe. Fox, van Ravenswaay, Douthitt, Zepeda, and Grobe will examine the effect of media coverage and trust in government risk management on risk perceptions.

**Anticipated Results:** Application of risk perception and information modeling to a set of important food characteristics will yield an improved understanding of how perceptions are formed.

**Timetable:** The Project will target a major conference in this procedure area early in the Project in 1997 because this information is a building block for other Objective 2 procedures. Follow-up principal paper and symposia sessions are targeted for 1999-2000.

**Participants:** Arkansas, Florida, Georgia, Kansas, Michigan, Ohio, Oregon, Rhode Island, Wisconsin, USDA/ERS

### **Subprocedure 2.A2: Effect of Risk Perceptions on Consumer Behavior, Food Demand, Willingness to Pay for Safer Food, and Societal Welfare**

**Key Questions:** How much are consumers and society willing to pay for safer food? What does demand for safer food depend upon? How much would society's welfare be improved by a safer food supply?

The purpose of this research is to improve both the theory and methods for measuring the welfare impacts of reducing food safety risks. Welfare impacts of safer food have to be considered in a broad theoretical framework that encompasses all consumers' choices: changing household production practices (e.g., better kitchen sanitation), changing consumer behavior (e.g., choosing less risky foods, such as well-done hamburgers), being willing to pay a premium price for safer food, and exerting political pressure as taxpayers to change regulatory policies. Van Ravenswaay (Michigan) will provide leadership by developing a total economic value framework for identifying the benefits of food safety policy. Measures of personal risk management strategies will be developed by Douthitt, Zepeda, Grobe, Chern, Wessells, and Lin (Florida).

The impact of risk perceptions on food demand will be examined by a number of researchers, who will perform parallel case studies for particular food groups after consulting on the design of the research methodologies. The impact of perceived risk from rbGH on milk demand will be estimated by Douthitt (Wisconsin) and Zepeda (Wisconsin). Bailey (Arkansas) will examine the impact of perceived risk on demand for processes that reduce perceived risk from food consumption. Fox (Kansas) will examine the impact of perceived risks from pathogens and pesticides on a variety of different foods. The possible long-term effects of food scares on food demand will be studied by van Ravenswaay (Michigan). The Project members will bring results from studies of particular food groups together to compare methodologies and results, and assess whether findings are consistent across studies.

Coordinated measures of willingness to pay for specific risk reductions will be contributed by Project members Crutchfield and Roberts (USDA/ERS), Lin, and Bailey (Arkansas). A method of estimating willingness to pay for policies to avoid perceived risks of certain food biotechnologies will be developed by Douthitt and Zepeda (Wisconsin), and Grobe (Oregon). Willingness to pay for policies that reduce risk and ambiguity from pesticides will be conducted by van Ravenswaay (Michigan) and Antonovitz (Iowa). The Project will use Internet discussion groups, seminars, and conferences to standardize methodology and compare research results.

***Anticipated Results:*** The on-going work of the Project will provide improved estimates of the benefits of improving food safety. These estimates will be used by the federal government in policy-making and by food companies in designing products.

***Timetable:*** A major conference on benefit/cost analysis is targeted for 1998 or 1999. Project members will present symposia and policy briefings throughout the life of the Project.

***Participants:*** Arkansas, Florida, Iowa, Kansas, Michigan, Oregon, USDA/ERS, Wisconsin

## **Procedure 2.B: Risk Assessment and Benefit/Cost Analysis**

### **Subprocedure 2.B1: Risk and Economic Valuation Data**

***Key Questions:*** What are the risks posed by unsafe foods? How many people become ill and from what sources? How will changes in production and consumption practices change those risks?

Building on the foundation developed in the earlier NE-165 Project, USDA/ERS Project members, Fox (Kansas), Williams (FDA), and Steahr (Connecticut) will work collaboratively to improve risk and economic valuation data to implement new models

developed under this Project. Examples of better risk data include identification of high-risk foods, subpopulations, and production and consumption practices. Economic valuation data will be developed by Fox, Lin (Florida), and Roberts (USDA/ERS) as they collaborate on their National Science Foundation project—a result of NE-165's "free session" at the American Agricultural Economics Association's 1992 annual meeting. These will include measurements of preferences for public versus private risk reduction strategies which may vary by age, income, cultural, or other factors. The value of precise data will be examined for its ability to refine risk estimates by Jensen (Iowa) and Roberts (USDA/ERS). These data are crucial to building risk models to identify high-risk vs. low-risk production and consumption pathways for specific foods.

NE-165 members led by Roberts (USDA/ERS), Williams (FDA), and Jensen (Iowa) will facilitate sharing of information across disciplines and the creation of integrated food safety databases by: 1) setting up new Internet exchanges for food safety data, 2) fostering interdisciplinary interaction through professional associations, 3) analyzing and comparing existing medical databases on human illnesses caused by foodborne pathogens, 4) establishing a clearinghouse to set data standards and facilitate data collection, 5) serving on expert committees, and 6) evaluating alternative criteria for setting food safety priorities.

***Anticipated Results:*** The collaborative work of Project members will provide improved information on risk and risk reduction strategies. This information will improve decision-making because currently little is known about most of these issues.

***Timetable:*** Work from this procedure will be presented as part of a major conference on benefit/cost analysis to be held in 1998 or 1999.

***Participants:*** Connecticut, Florida, FDA, Iowa, Kansas, USDA/ERS

### **Subprocedure 2.B2: Economic Methodologies Associated with Foodborne Hazards**

***Key Questions:*** When we estimate the benefits and costs of reducing foodborne hazards, how sure are we of the accuracy of our estimates? What factors influence our ability to provide reliable estimates?

Project members will cooperate to improve calculation and presentation of the underlying uncertainties in benefit/cost analysis, including uncertainties in estimates of baseline foodborne risks and reduction of those risks. They will focus on improving methods for dealing with model uncertainty such as the choice between 1) willingness to pay for morbidity reduction versus cost of illness approaches and 2) between direct consumer valuation versus expert valuation of risk reduction. The NSF grant team (ERS, Florida, and Kansas) and Williams (FDA) will provide leadership for the development of

methodologies to explore the tradeoffs between public and private risk reduction efforts while considering consumer valuations of each.

Methodological advances in valuing risk reductions in other areas, such as labor and environmental economics, will be systematically explored and applied to valuation of food related risks. Members will consult with each other to develop standardized procedures aimed at producing more reliable and useable benefit/cost analyses. Sensitivity analysis will be used to examine the relationship between the valuation estimates and the specific assumptions used to generate them. Guidelines for measuring societal willingness to pay for both morbidity and mortality risk reductions will be developed. Measurement issues include valuing premature death versus life-years saved, selecting discount rates for health, and including altruism and household impacts in valuations.

This effort will also develop methodologies to compare different kinds of food-related risks and to prioritize those risks using different criteria such as food, type of hazard, or subpopulation affected. For example, it will investigate consumer valuation of tradeoffs for reducing incidence of foodborne disease versus reducing the severity of disease. Kuchler (ERS) will examine the relation between income and health to assess the unintended health consequences of government intervention.

***Anticipated Results:*** Project members will contribute significantly to improving benefit/cost estimation through improvement of research methodologies.

***Timetable:*** Research will be reported in a major benefit/cost conference to be held in 1998 or 1999. Project members will contribute analysis on an on-going basis to regulatory decision-making (e.g., benefit/cost analysis of HACCP systems to control foodborne pathogens).

***Participants:*** FDA, Florida, Kansas, USDA/ERS

### **Subprocedure 2.B3: Public and Private Benefits and Costs of Alternative Risk Reduction Strategies**

***Key Questions:*** What are the private and public benefits and costs of alternative methods of reducing health risks posed by food? How do food companies and regulators choose the most cost effective means of improving safety?

Project members will develop a coordinated framework for conducting benefit/cost analysis of alternative risk reduction strategies. Initial work will focus on Hazard Analysis Critical Control Point (HACCP) systems as a risk reduction strategy being widely adopted or considered by regulators and firms. The HACCP system is an approach to identifying and controlling food hazards. It is now being adapted to control pathogens at various points in the food chain from the farm to the consumer, in both U.S. and international markets.

Research will focus on producing reliable measures of the private and public benefits and costs of adoption of HACCP. Project members will consult in designing studies to refine existing estimates of the economic cost of different HACCP systems and how they vary, depending on the nature of the process, the target level of pathogen reduction, firm size, and industry sector. Cooperating in this effort will be Roberts, Crutchfield, and Handy (USDA/ERS); MacDonald (Ohio); Lin (Florida); Morales (North Carolina); Williams (FDA); Unnevehr (Illinois); Antle (Montana); Wessells (Rhode Island); Anderson, Martin, and Zarkin (Research Triangle Institute); Henson (Reading-UK); Fox (Kansas); and Caswell (Massachusetts). They will use Internet discussion groups, seminars, and conferences to cooperate in integrating economic principles into the HACCP concept. For example, they will develop a simple algorithm to determine when a hazard warrants being included in a HACCP plan, when testing should be done, or when a Critical Control Point is needed. Marginal benefit/cost analysis of pathogen reduction will be used to assess the net benefits to society of using HACCP as a regulatory tool. At the same time, such analysis will illustrate the private incentives or disincentives to adopt HACCP. Henson, Caswell, Unnevehr, and Antle will also compare the strategic responses to this type of regulation by affected industries in Europe, the United States, and other parts of the world.

With the HACCP work as a prototype, Project members will apply the economic methodology to evaluating other control options. This will include conducting benefit/cost analyses of other pathogen reduction options, such as irradiation of foods, consumer education programs, and labeling (to reduce risks through food consumption choices and improved food preparation practices), or government certification of reduced-risk products for sale in the marketplace. Fox and Lin will design a study to determine the relationship between the value to consumers of a specific risk reduction strategy and the technology employed (e.g., HACCP, irradiation, or HACCP plus irradiation). An important question is how the value of risk reduction changes with *ex ante* versus *ex post* control options. Project members from USDA/ERS led by Vandeman will contribute the development of economic indicators of food safety to track performance in the United States over time and to compare it to the performance of other countries.

The overall goal of this procedure will be to apply methodologies for analyzing data in a systems framework. For example, Roberts (USDA/ERS) and Lin (Florida) will identify high-risk pathways using probabilistic risk assessment models to determine the location of critical control points. Analysis of farm level, slaughterhouse, processing, marketing, preparation, and consumption data require interdisciplinary cooperation among scientists, including economists, to document the risk factors and probabilities at each node and link in the food chain.

***Anticipated Results:*** Benefit/cost analysis currently focuses on estimating the impacts of a specific proposed policy. The methodology, approaches, and results developed by the Project will widen that analysis to alternative methods of affecting food safety. This will contribute to the improved cost effectiveness of the food safety assurance system.