SECTION 1: COVER PAGE

Project title: A Probabilistic and Cost-Based Index of Food Threats

Specific RFP Aim(s): Category of 2.3: Systems Strategies for enhancing the preparedness, responsiveness, recoverability, and resiliency of the food system

Key Personnel:
PI: Hamid Mohtadi, Professor, University of Wisconsin-Milwaukee
Co-PI: Jean Kinsey, Professor, University of Minnesota
Other Key Personnel: Dennis Degeneff, TFIC, Research Associate, University of Minnesota

Project start and end dates: September 2007 to May 2009

Funding Request: (includes above personnel, one Masters and one PhD student, and one PhD staff at TFIC)

Project Budget: $145,000 first year, total of $141,000 second year

ABSTRACT: There have been on average about 76 million foodborne illnesses, 325,000 hospitalizations, and 5,000 deaths in the US each year. In addition, since 2001 concern over intentional food contamination has been rising. Although the magnitude of health and human impacts or economic damage from intentional or accidental agents has not reached “catastrophic” levels, such a potential remains. For example, the World Health has been gravely concerned that food may be used as vehicle for terrorism. Evidence does point to a recent rise in the severity of intentional food attacks. Evidence also suggests that that many, if not all, food incidents have the potential to be intentionally caused and conversely, many known intentional food incidents may well be reported as accidental before true causes are discovered. It follows that an optimal policy of federal and state governments, and a best practice strategy by the private sector, entails fortifying the food defense system since by implication such a policy would also help to fortify the food safety system. This is a clear instance of dual use practices and polices encouraged by DHS. The need to protect against such potential catastrophes requires an ability to assign risk to different events. This requires the knowledge of the likelihood of occurrence to each event. Yet, this seemingly simple task has not been possible thus far: The fact that such catastrophic events have fortunately not taken place yet, also implies the absence of hard data from which to build a probability-based risk metric framework. This poses a major stumbling block for any public policy maker and or private firm that is interested in investing security protection.

This project develops a data-based probabilistic algorithm for food vulnerabilities and applies those probabilities to estimate the expected costs (losses) both in the market (loss of sales) and in health care. This will enable policy makers and food companies to prioritize and rationalize the expenditure of scarce resources on the most critical food defense issues, enhancing the preparedness, responsiveness, recoverability, and resiliency of the food system.

We expect to develop expected market and health costs for as many foodborne illness events as the data permits. By incorporating market data over existing health and productivity data we produce a more comprehensive measure of social and economic loss. Further, incorporation of market loss measure is a far more incentive-compatible to food companies than measure based on social costs and more likely to allow food companies to “rationalize” their risk-mitigating strategies. We will engage public audiences in our research design and subsequently share with them our findings. The audience will be food industry leaders and local, state and federal policy makers. We will provide organizations with risk planning tools (matrices integrating probability and costs) to assist them in managing food safety risk. Companies can these in developing a financially based justification for commitment of capital and resources to minimize the risk of food contamination. We will utilize the extensive network of The Food Industry Center at the University of Minnesota (with which we are involved) to contacts with the food companies and their executives.
SECTION 2: TEXT

I. Introduction an Highlights

A. The problem and the Unmet Need

1. The problem: There have been on average about 76 million foodborne illnesses, 325,000 hospitalizations, and 5,000 deaths in the US each year (Mead et. al. 1999, CDC). In addition, since 2001 concern over intentional food contamination has been rising. For example, the World Health Organization (WHO 2002) is gravely concerned that food may be used as vehicle for terrorism. Evidence does points to a recent rise in the severity of intentional food attacks (Mohtadi-Murshid, 2006a, 2006b).

Protection against food system vulnerabilities is protection against both accidental and intentional (terrorism) incidents at once. In fact Kinsey (2005a, 2005b, 2005c) has argued that the two reinforce each other. Evidence shows that many food-related pathogens that accidentally enter the food system have also been used intentionally to cause harm. (See data by outbreaks of FDA regulated foods complied from CDC by the Center for Science in Public Interest, CSPI). Examples are Salmonella typhimurium, Salmonella Shigella, Shigella dysenteriae type 2, botulinum toxin, and the like (see Mohtadi-Murshid 2006c). In addition, many other biological and naturally occurring substances that have been intentionally used to cause harm are of the type that could easily have been mistaken for accidental. Examples are typhoid cultures, carbamate, capsaicin, fecal matter, tuberculosis bacilli, influenza, etc. (ibid). Finally, one finds a third group of “unspecified chemicals” or food poisoning cases in the CDC dataset, such that an intentional motive cannot be ruled out. Although the magnitude of health and human impacts or economic damage from these agents has not reached “catastrophic” levels, such a potential remains, as indicated by the alarm at WHO (above).

2. The Unmet Need: The need to protect against such potential catastrophes requires an ability to assign risk to different events. This requires the knowledge of the likelihood of occurrence to each event. Yet, this seemingly simple task has not been possible thus far: The fact that such catastrophic events have fortunately not taken place yet, also implies the absence of hard data from which to build a probability-based risk metric framework. This poses a major stumbling block for any public policy maker and or private firm that is interested in investing security protection.

B. Project’s Significance in Addressing the Unmet Need

1. Existing Efforts and how our project differs: Existing food protection efforts have ignored the role of probabilities and instead prioritized investments solely on severity. For example, data on health costs from food contaminations are estimated by the Economic Research Service, USDA, and used by various agencies for public policy. This amounts to the implicit assumption that all catastrophic events are equally likely which is a gross error, leading to massive resource misallocation.

The method proposed here addresses this major gap. It does so by invoking the statistical properties of certain distributions, known as Extreme Value Distributions, which allow us to use data on ordinary food poisoning events to deduce the probability of large catastrophic events. In effect, information about the “body” (modal part) of these distributions, allows us to extrapolate to the probabilities of catastrophic events that belong to the “tail” of these distributions.

We use data from a dataset at the Center for Science in Public Interest (CSPI) that includes nearly 7000 foodborne events over a 15 year period with the food source, date and the number of hospitalizations.

2. Novel and Innovative Aspects of the Project: One innovation is the use of Extreme Value Distributions. The PI has used this method before in a prior DHS project to calculate the probability of terrorism using CBRN (Chemical, Biological and Radionuclear) agents. That project’s results are not detailed enough to address the likelihood any particular food or categories food events. The use of specific food information from CSPI allows us to develop metrics that focus directly on food events or events related to food categories. Thus, applying our methodology to this dataset is a second innovation. Our third innovation is to trace changes in consumer purchases by specific products over time, using Nieslen data.

3. New Capabilities: By the end of this project we will have developed an index in which total costs (health costs and producer losses) of food events are combined with their associated probability to yield a probability weighted “expect cost” index.

C. Project’s Overall Objectives and Specific Goals

1. Overall Objective: This project develops a data-based probabilistic algorithm for food vulnerabilities and applies those probabilities to estimate the expected costs (losses) both in the market (loss of sales) and in health care. This will enable policy makers and food companies to prioritize and rationalize the expenditure of scarce resources on the most critical food defense issues, enhancing the preparedness, responsiveness, recoverability, and resiliency of the food system.

2. Specific Goals: To achieve this objective the project has several specific goals: Goal 1 is to devise a data-based probabilistic algorithm for vulnerabilities using data both from CSPI and from our prior data on intentional CBRN events. Goal 2 is to estimate the
magnitude of the cost of illness for selected pathogen contamination events AND the economic losses to the food industry due to lost sales of contaminated product (over time until sales recover) **Goal 3** is to combine the probability estimates and these cost estimates to create an expected cost (loss) of food contamination events.

## D. NCFPD as the Preferred Funding Mechanism

A major segment of this project involves food defense, as has been explained. DHS and by extension NCFPD are the natural institutional arrangement for this purpose. Moreover, our prior research in the use of Extreme Value Statistics for intentional CPRN events was also funded by NCFPD.

## II. Methodology

### A. Projects Research Design

**Goal 1. Devising Probabilistic Algorithms:** This goal consists of two stages: In the first stage, we compile data. First, data on intentional food contamination: The potential for intentional contamination is likely to arise from chemical, biological, or radionuclear (CBRN) contaminants. Our prior research, funded by DHS through the NCFPD, led to the development of a unique dataset for 1964 to 2005 on intentional chemical, biological, radionuclear (CBRN) events worldwide that included food products (Mohtadi and Murshid, 2006c). This data set is found on the WEB site for NCFPD ([http://www.ncfpd.umn.edu/files/GlobalChron.pdf](http://www.ncfpd.umn.edu/files/GlobalChron.pdf)), from which all US food related intentional events will be extracted.

We then compile data for natural (unintentional) foodborne illnesses events. This event data identifies the date, food source, pathogen, and number of cases (victims) and is available from the Center for Science in Public Interest (CSPI) ([http://www.cspinet.org/foodsafety/linked_outbreaks.pdf](http://www.cspinet.org/foodsafety/linked_outbreaks.pdf)) for 1990 to 2004 with nearly 7000 observations. The data is based on reports to the Center for Disease Control (CDC) from states’ health departments through a Foodnet information system. The foods involved are those regulated by FDA and USDA. The intent is to use this data to estimate the probability of foodborne illnesses events based on severity (number of cases), conditioned on the pathogen and eventually on food type.

In the second stage, we will use novel statistical techniques to gauge the probability of food events, using the data chronology above. The probabilities will be calculated based on a given range of severity (e.g., 50 to 100 cases, 100 to 150, etc…). To calculate these, we estimate a Pareto and a Generalized Extreme Value distribution. Since Pareto distributions are well known, we will only describe the Generalized Extreme Value distribution: In developing accurate metrics of catastrophic risk, the challenge is how to extrapolate from observed to the unobserved levels of data. Classical statistics is not well-suited for this task. The approach here is to estimate catastrophic risk using Extreme Value analysis. By exploiting limiting arguments, Extreme Value method describes the stochastic behavior of extremes. The Extreme Value Statistics, which we have used in prior research, calibrates the probability density of the maxima of the events. (see Coles 2001, Embrechts et al. 1997). However, this method is highly data intensive. Furthermore, the estimates may involve very long tails which may overestimate the probabilities. Therefore, we will also examine a Pareto distribution of the exceedances relative to a given threshold. The PI's background and experience in using this method and in working with data on deliberate contamination will provide the basis and expertise for the work in this stage (Mohtadi and Murshid 2006b, 2006c and 2007). The data are available and well suited for this analysis.

**Goal 2. Estimating Costs:** This goal will also consist of two stages.

**Stage 1. Market Cost of Food Contamination: In-Market Event Analysis using A.C. Nielsen Homescan Database:** In order to create a meaningful risk management policy, we will need to measure consumer behavior in response to specific food-related threats and aggregate the effects to understand the economic impact of such events. For this purpose we will analyze several historical food safety/security incidents using A.C. Nielsen Homescan data. These events will be chosen based on (a), severity (b), probability of occurring (from the first part) and (c) overlap with the intentional food contamination events.

For each event, pre and post time periods will be defined for relevant geographic areas and all purchases of the food types/products implicated in the event will be aggregated across households. The purchases will be seasonally adjusted to neutralize seasonality effects. Post-incident periods will be subtracted from the pre-incident, with the difference reflecting the economic impact of the event in both dollar and physical volume. To the extent possible, substitute product categories will also be evaluated in this way to attempt to estimate potential product substitution or halo affects of the incident.

For this purpose, we will collaborate with ERS, USDA to employ the Nielson Homescan Data. The Co-PI and the U.M. Department of Applied Economics have had extensive relations with ERS. Currently, the USDA has an agreement with VNU, the parent organization of A.C. Nielsen, that provides access to Homescan Data. Homescan is a service of A.C. Nielsen comprised of a nationwide panel of consumer households that report purchase behavior for several consumer product categories including food, tracking consumer purchases in multiple types of retail outlets including grocery stores, club stores, super centers, drug and convenience stores. This
data enables analysis to be conducted across three dimensions: food items/products, time and geography. USDA has the A.C. Nielson data for 1998-2005, covering about 75% of the total market and is the only data available that will allow us to ascertain the trends in sales.

**Stage 2. Health Costs of Contamination Measurement:** The Economic Research Service (ERS) of the USDA estimates the costs of illness and death for a number of critical foodborne illnesses (Kuchler and Golan, 1999). ERS has an established “cost of illness calculator” (http://www.ers.usda.gov/data/foodborneillness/; 21.1k). These estimates have been used in regulatory cost-benefit and impact analyses (Roberts and Marks, 1995). Our approach here will be to use the ERS estimates to calculate the total cost of illness for a specific type of foodborne illness event.

Health care costs will be based on the number of cases (victims) per incident. Ideally, we want to learn the number of hospitalizations and deaths for each incident we analyze (from the CDC), but in the absence of this information, there are 2 possibilities. 1) Treat each set of “cases” as all having been hospitalized and assign an average cost to each case. 2) Using the proportion of hospitalizations and deaths from known events and assign that proportion to the events where the division of hospitalizations and deaths is not known. For example, consider Salmonella contamination. In an April of 2003 report, ERS estimated the annual breakdown of victims of Salmonella. This consisted of (a) those who saw no physician and recovered fully (1,294,107 cases), (b) those who visited physician and recovered fully (101,903 cases), (c) those who were hospitalized and recovered fully (15,906 cases) (d) and those who were hospitalized and died (582 cases)

http://www.ers.usda.gov/Briefing/FoodborneDisease/Salmonella.htm. For each of these categories, medical and productivity costs (cost of life years lost) are calculated. From this information, and from the total # of cases for that event, we can calculate the health and productivity costs of the event. If the ERS’s contamination event has a different timing from the event being analyzed here, we will use CPI data on health costs to adjust for the differences.

**Goal 3. Combining Probabilities and Costs:** We will integrate the probability data with the data on market loss and health costs of contamination to generate an expected cost value for a number of select food products. The procedure will be as follows: first, the probability figures are calculated as a function of the degree of severity as provided by the CSPI’s “number of cases” variables. Next, a number of high-severity events are selected from the CSPI data. [In addition, important events are listed in FDA’s Recall Enforcement Reports (http://www.fda.gov/opacom/Enforce.html)]. For these events, we will calculate three attributes. 1) The probability calibrations stated above, the conditional probability that a “similar” event will recur is calculated for that particular pathogen and that particular food category. 2) For that event, we will track the effect on consumer purchases from the Nielsen Homscan data in order to calculate the market loss for that event. 3) The total health cost of that event is calculated by extrapolating from the proportions given by ERS, as was given in the example of salmonella earlier. Multiplying the probability of an particular type of foodborne illness event times its “cost” (lost sales and cost of illness) will produce our expected cost data for that event. We will repeat this analysis for approximately 20-30 representative events, the exact number depending on the availability of data. Even though the limit on the availability of CSPI data after 2004 imposes a limit on being able to calculate costs associated with very recent events, the predictive nature of our analysis comes from the probability estimates and renders the results relevant for any time period.

**B. Knowledge Transfer for Food Protection and Defense**
This project develops a data-based probabilistic algorithm for food vulnerabilities and applies those probabilities to estimate the expected costs (losses) both in the market (loss of sales) and in health care. This will enable policy makers and food companies to prioritize and rationalize the expenditure of scarce resources on the most critical food defense issues, enhancing the preparedness, responsiveness, recoverability, and resiliency of the food system.

**C. Key Challenges and Ways to overcome them**
Calculation of the cost of events needs to be based on comparing Homscan trend data both before and after the event and, in turn, comparing this change with prior seasonally adjusted changes. Thus, data would ideally be available to us for at least one prior year for the product in question. While we are aware of this data intensity, this should not be a major limitation since we expect Homscan data to be available from 1998 onward. Potential problems finding data on hospitalizations and deaths for the foodborne illness events identified in the CSPI data and tracked in the Nielson data was discussed in the procedures above. This is a challenge, but we discussed ways to overcome any lack of data. (Another limitation is that the Homscan database will cover purchases from foodservices and restaurants. Thus, while events such as the 2006 Spinach contamination with E.coli are captured, the contamination of green onions at Taco Bell would not.)

**D. Areas of Collaboration with Existing NCFPD and other Centers of Excellence**
The probability component of this project is related to the PI’s another NCFPD project, now completed, titled “Risk Metrics Project.” At the time of this writing, no other DHS center is involved with this project, but certain aspects of this project will have implications for
information sharing across food supply chains in which case they will be related to the PI’s ongoing project both through U.M.’s NCFPD and through USC’s CREATE that involve information sharing along food supply chains.

E. Multi-Institutional Collaborators
This project represents a multi-institutional effort: The PI of the project, Hamid Mohtadi, is full professor of Economics at the University of Wisconsin at Milwaukee, and visiting professor of Applied Economics at the University of Minnesota. The Co-PI, Jean Kinsey, is full professor of Applied Economics at the University of Minnesota and the Co-Director of the Center for Food Industry (TFIC). The PI was the acting Co-Director of that Center in 2006-2007. The probability analysis will be under the direction of Mohtadi while the analysis of costs and Nielsen data will be under the direction of Jean Kinsey with the collaboration of Dennis Degeneff, who is also at the U. of Minnesota.

III. Project Output and Outcome

A. Anticipated Results
We expect to develop expected market and health costs for 20-30 foodborne illness events as the data permits. We will then rank these events accordingly to their expected cost values. This will be the final product to be calculated under risk management category. The value of this work over the existing work is three-fold. First, by incorporating probabilities, we move from the scenario (as if) analysis to actual risk valuation. Second, by incorporating market data over existing health and productivity data we produce a more comprehensive measure of social and economic loss. Third, incorporation of market loss measure is a far more incentive-compatible to food companies than measure based on social costs. This is more likely to allow food companies to “rationalize” their risk-mitigating strategies.

B. Intended Potential Stakeholders and end-users
The ultimate value of our output is the promotion of greater food safety. Direct stakeholders of this work are the public, the food companies and the federal agencies (FDA, USDA) monitoring food safety and DHS in terms of intentional food events.

C. Anticipated Outcomes
The ultimate expected outcome is that at least some of the food companies and regulators will report a change in business procedures or regulatory (enforcement) protocols as a result of the research findings and their learning about them and having an evaluation tool against which to judge their activities. The ultimate evaluation of success is whether at least some of the participants from the research planning phase or from the symposium, report that their behavior has been changed to reduce the risk of a foodborne illness event.

D. Potential Dual Benefits
It is clear from the discussion in the Introduction that many, if not all, food incidents have the potential to be intentionally caused and conversely, many known intentional food incidents may well be reported as accidental before true causes are discovered. It follows that an optimal policy of federal and state governments, and a best practice strategy by the private sector, entails fortifying the food defense system since this would also help to fortify food safety. This is a clear instance of dual use practices and polices encouraged by DHS.

E. Technology Transfer Applications
There are none anticipated at this point.

F. Plans for Dissemination of the Results
We will engage public audiences in our research design and subsequently share with them our findings. The audience will be food industry leaders and local, state and federal policy makers. We will provide organizations with risk planning tools (matrices integrating probability and costs) to assist them in managing food safety risk. Companies can use these in developing a financially based justification for commitment of capital and resources to minimize the risk of food contamination.

The Food Industry Center at the University of Minnesota (with which we are involved) has extensive contacts with the food companies and their executives. Regular bi-annual meetings of the Center’s Program Leadership Board (PLB) provides an opportunity to gain input for the development of communications and tools to help organizations manage risk (see roster of PLB members). Committees of this board will be consulted on foods and pathogen contamination events of greatest concern to them in making our selection of the types of foodborne illness events to analyze in depth. Early involvement with this audience will allow us to go back to them for an assessment of changes in their behavior after they learn our results.
IV. Project Timetable

<table>
<thead>
<tr>
<th>Dates</th>
<th>Activity</th>
<th>Main Party Leading the Effort</th>
</tr>
</thead>
<tbody>
<tr>
<td>9/01/2007-8/31/2008</td>
<td>1. Develop probability metrics</td>
<td>Hamid Mohtadi (A research fellow &amp; a Ph.D. student will assist)</td>
</tr>
<tr>
<td></td>
<td>Milestone 1 by 8/31/2008 A working paper from above</td>
<td></td>
</tr>
<tr>
<td>9/01/2007-8/31/2008</td>
<td>(parallel activity) 2. Track and analyze consumer purchases for select foods &amp; cast in seasonally adjusted values.</td>
<td>Jean Kinsey and Dennis Degeneffe (Degeneffe, a research fellow, and a Masters student will assist)</td>
</tr>
<tr>
<td></td>
<td>Milestone 2 by 8/31/2008 Develop a work in progress report.</td>
<td></td>
</tr>
<tr>
<td>October 2008</td>
<td>4. Seek advise from industry leaders at TIFIC’s Program Leadership Board’s October meeting</td>
<td></td>
</tr>
<tr>
<td>9/01/2008-12/31/2008</td>
<td>(parallel activity with 1) 5. Calculate the health costs for select food products.</td>
<td>Hamid Mohtadi and Jean Kinsey (a Masters student will assist and will consult with ERS, if necessary)</td>
</tr>
<tr>
<td>1/01/2009-5/31/2009</td>
<td>6. Integrate data parts to develop expected costs 7. Communicate the nearly completed results to industry and policy makers and gauge its impact. 8. Travel Washington D.C. to present results</td>
<td>Hamid Mohtadi (Koel Ghosh and a Masters student will assist)</td>
</tr>
<tr>
<td></td>
<td>Milestone 3 by b/31/09 Write final research paper, present and publish results</td>
<td>Hamid Mohtadi, Jean Kinsey Dennis Degeneffe and others (e.g., PhD student)</td>
</tr>
</tbody>
</table>

V. Literature Cited

Center Disease Control (http://www.cdc.gov)
Mohtadi H. and A. Murshid “Analyzing Catastrophic Terrorist Events with Applications to the Food Industry,” (with A. Murshid) in *The Economic Costs and Consequences of Terrorism*, Harry Richardson (ed), Edward Elgar 2006a (London, UK), ISBN #1845427343
Mohtadi H. and A. Murshid “A Global Chronology of Incidents of Chemical, Biological, Radioactive and Nuclear Attacks: 1950-2005” (with A. Murshid) published at the website of the National Center for Food Protection and Defense (NCFPD) at http://www.fpd.umn.edu/, 2006c
SECTION 3: BUDGET (See separate EXCEL sheet)
SECTION 4: APPENDICES

I. Relevant Expertise and Qualifications of the Investigator Team

The core team for this project, Hamid Mohtadi, Jean Kinsey and Dennis Degeneffe, bring an enormous wealth of expertise and experience to bear:

**Hamid Mohtadi** (PI) is an accomplished economist with numerous publications and research grants. Since 2004, Mohtadi has received four research grants on food security issues, three of which have been through NCFPD and one through CREATE. His Risk Metrics research grant which deals with probability measures is one whose methodology is expanded and here; Besides the methodological relevance of the Risk Metrics project to the present proposal, the findings from the proposed project will also have relevance to other DHS, research grants, Optimal Investments in Security Measures, and Supply Chain Resiliency in Response to Catastrophic Shocks (in which Mohtadi supervises a PhD dissertation.) Mohtadi has published several articles in this area. He has also worked on other food industry topics, including information sharing in food supply chains and has published in this area as well. Altogether Mohtadi has published nearly 40 articles in refereed journal and in books. In 2006-2007 Mohtadi was the co-director of the Food Industry Center at the University of Minnesota and prior to that he has been an associated faculty of the Center since 2000. Mohtadi has also been an Alfred P. Sloan associate faculty related to the food industry. His analytical and statistical expertise and his research experience in food industry and his contact with the food industry executives makes him ideal to lead this proposal. Mohtadi received his PhD from the University of Michigan, His M.S. from Columbia University, and his B.S. from Miami University of Ohio.

**Mohtadi’s Related Projects:**


**Alfred P. Sloan Foundation Research Award, 2000-2001:** “Information Technology and Information Sharing in the Food Industry.”

**Mohtadi’s Related Publications and Working Papers:**


“Analyzing Catastrophic Terrorist Events with Applications to the Food Industry,” (with A. Murshid) in *The Economic Costs and Consequences of Terrorism*, Harry Richardson (ed), Edward Elgar 2006 (London, UK), ISBN #1845427343


“A Global Chronology of Incidents of Chemical, Biological, Radioactive and Nuclear Attacks: 1950-2005” (with A. Murshid) published at the website of the National Center for Food Protection and Defense (NCFPD) at http://www.fpd.umn.edu/.


Jean Kinsey (Co-PI) is internationally known in the area of the economics of food research and food industry. Her numerous publications and research grants attest to this fact. She has also been the recipient of several major grants from DHS through NCFPD dealing with food security. A number of these projects has led to Masters and PhD dissertations which she has supervised. As the principal co-director of the Sloan Center, the Center for Food Industry, TFIC, her contact with the food industry are enormous as are her deep knowledge of the workings of industry. Kinsey has been elected President of the American Council on Consumer Interests (1983) and the American Agricultural Economics Association (2000) and was named Distinguished Fellow of each organization (ACCI-1997 and AAEA-2000). She also chaired the board of directors of the Federal Reserve Bank of Minneapolis 1996-97 and is on the Board of Managers of PJM. Kinsey received her M.S. and Ph.D. from the University of California at Davis and her B.S. from St. Olaf College in Northfield, MN.

**Kinsey’s Related Projects:**

  - Consumer/Citizen Survey Project
  - Benchmarking Survey Project
- USDA Agricultural Conversion Project 2004-2007
- NRI, USDA Preventing Age-Related Weight Gain in Midlife Women 2007-2009

**Kinsey’s Related Working Papers:**


**Dennis Degeneffe (Key Personnel)** Dennis Degeneffe joined The Food Industry Center in February 2002. He contributes as a Research Fellow to the Center’s research initiatives and is lecturer in the MBA Program in the Carlson School of Management at the University of Minnesota. In his capacity as Research Fellow, Dennis’ specialty is segmentation of consumers, and is currently involved in conducting research under grants from the National Research Initiative, the USDA and the Department of Homeland Security and the National Institute of Health. Prior to his appointment at the University of Minnesota, Dennis held the position of Senior Director of Consumer Insights at the Pillsbury Company. Dennis is past chair of the University of Wisconsin A. C. Nielsen Center for Marketing Research’s External Advisory Board. For this reason, his contribution to this proposal will be invaluable. He has taught Applied Marketing Research in the Graduate School of Business at the University of St. Thomas.

**Degeneffe’s Related Working Papers:**

II. CV of PI and Co-PI

CV for HAMID MOHTADI

Department of Applied Economics
University of Minnesota
1994 Buford Street
St. Paul, MN 55108
Office: (612) 625-8241
mohtadi@umn.edu
website: www.apec.umn.edu/faculty/mohta001/

Department of Economics
University of Wisconsin
P.O. Box 413
Milwaukee, WI 53201
Office: (414) 229-5334
mohtadi@uwm.edu
website: www.uwm.edu/~mohtadi

EDUCATION

Ph.D., Economics, University of Michigan, Ann Arbor, 1983
M.S., Applied Physics, Columbia University, New York, 1975
B.S., Physics, Miami University, Oxford, 1973

EXPERIENCE AND RESEARCH AREAS

risk analysis, economics of supply chains, food industry, information economics,
growth, trade and technological change, governance, public finance,

CURRENT AND PAST POSITIONS

Concurrent positions:

University of Minnesota, Center for Food Industry at the Dept. of Applied Economics:
Co-Director and Visiting Professor, 2006-2007

University of Wisconsin at Milwaukee, Economics Department:
Professor, 2003-present

Past Positions:

University of Wisconsin at Milwaukee, Economics Department:
Associate Prof., 1990-2003; Assistant Prof., 1983-89

University of Minnesota, Department of Applied Economics

University of Minnesota, Carlson School of Management: Adjunct Professor,
Summer 2002, Research Faculty Associate, 2004-present

University of Giessen, Germany, Department of Economics: Guest Associate Professor, 1996 and 2007 (Summer).

University of Denver, Graduate School of International Studies: Visiting Assistant Professor, 1987-88.

Columbia University, School International Affairs & Public Policy / Barnard College: Visiting Assistant Professor, 1982-83.
HONORS, FELLOWSHIPS, AWARDS, PROFESSIONAL AFFILIATIONS

Phi Beta Kappa

Best Paper Award, Institute for Operations Research and Management Science (INFORMS-CIST) conference, Atlanta, GA, October 2003

Research Fellow: Economic Research Forum (ERF)

Faculty Research Associate, Alfred P. Sloan Center for Food Industry

Faculty Research Associate, Carlson School of Management, University of Minnesota

Nominated: Distinguished Teaching Award, Spring of 2003

Nominated: Best paper in Digital Economy Track of the Hawaii International Conference on System Sciences HICSS, January 2002

Graduate School Henry Krumb Fellowship, Columbia University

Member: American Economic Association

Member: Institute for Operations Research and Management Science (INFORMS)

PROFESSIONAL SERVICE

Associate Editor

International Economic Journal

Journal Referee

GRANTS AND AWARDS FUNDED


This research develops metrics for catastrophic risk by applying methods from a branch of statistical research, the Extreme Value Theory. The research first collects data on intentional biological and chemical and radionuclear events worldwide since 1953, then calibrates the probability density functions of “fat-tailed” distributions based on Extreme Value Theory. This work has led to one published paper, “Analyzing Catastrophic Terrorist Events with Applications to the Food Industry,” (with A. Murshid) in The Economic Costs and Consequences of Terrorism, Harry Richardson (ed), Edward Elgar 2006 (London, UK), one web publication, one conference proceeding and two working papers.


This work is in progress and is based on my prior work on supply chain information sharing and on risk metrics project above. (PI: Hamid Mohtadi)


This work is based on survey data gathered from manufacturers, retailers and distributors in the food industry and is the subject of a doctoral dissertation

Alfred P. Sloan Foundation Research Award: 2000-2001

4. “Study of Information Technology Adoption by Firms: Applications to the Food Industry.” ($48,000) (PI: Hamid Mohtadi)

This work involved modeling of the information sharing processes among organizations. Methods and ideas developed in this research will be the basis of the Homeland Security Research under project 2. This research resulted in the following papers: (a) “Information Exchange and IT Adoption in Supply Chains: Application to the Food Sector” (with Jean Kinsey), in the American Journal of Agricultural Economics, (b) “The Empirics of Information Sharing and IT Adoption in Food Supply Chains,” working paper under submission, University of Minnesota, (c) “Analyzing Interorganizational Information Sharing Strategies in Supply Chains,” winner of Best Research Paper, INFORMS-CIST conference, Atlanta, GA, October 2003, working paper under submission University of Minnesota and Wisconsin (with R. Kauffman).

Economic Research Forum (ERF) and the European Union (FEMISE): 1999-2000

5. “Construction of Industry-Level Capital Stock and Total Factor Productivity Data for Select Developing Countries” ($51,000) (PI: Hamid Mohtadi)

This work led to a paper titled, “Estimates of Capital Stock and Total Factor Productivity for 3-Digit ISIC Manufacturing Sectors in Select Countries” (with A. Jalai-Naini, L. Abel-Latif and T. Roe).
**University of Wisconsin, Graduate School Research Committee Award: 1996-1997**

6. “Human Capital, Specialization and Growth”($10,000) (PI: Hamid Mohtadi)

This research was a continuation of the author’s work on endogenous growth that had led to the article, “Labor Specialization and Endogenous Growth,” American Economic Review Papers and Proceedings 1992, 82: 404-408 (with S. Kim). The grant led to two working papers and also financed one part-time graduate R.A. It later led to the thesis work by Anusua Datta under my supervision. (See section on Doctoral Student Advice.)

**USAID: 1992-94**

7. “Environmental & Natural Resources Policy & Training” (EPAT). $48,000 (PI: Hamid Mohtadi)


**University of Wisconsin, Graduate School Summer Research Award: 1986-87**

8. “The Macroeconomics of Stagflation in Developing Countries.” $7,500 (PI. Hamid Mohtadi)


**SELECT PUBLICATIONS**

In Refereed Journals


Chapters in Books, Proceedings, Published Reports


“Analyzing Catastrophic Terrorist Events with Applications to the Food Industry,” (with A. Murshid) in The Economic Costs and Consequences of Terrorism, Harry Richardson (ed), Edward Elgar 2006 (London, UK), ISBN #1845427343

“A Global Chronology of Incidents of Chemical, Biological, Radioactive and Nuclear Attacks: 1950-2005” (with A. Murshid) published at the website of the National Center for Food Protection and Defense (NCFPD) at http://www.fpd.umn.edu/


WORKING PAPERS

“Trade, Transparency and Corruption: an Information Signaling Game,” (with Steve Polasky and Terry Roe), under review.


"The Empirics of Information Sharing and IT Adoption in Food Supply Chains," working paper, TFIC, paper written under Sloan funded research, University of Minnesota, under review.

“How secure is our food? A Risk-Based Approach to Assessing Food Sector Vulnerability,” (with Antu Murshid), Under Review


“International Stock Market Interdependence” (with Sumit Agarwal & Magda Kandil).

“Estimates of Capital Stock and Total Factor Productivity for 3-Digit ISIC Productivity for 3-Digit ISIC Manufacturing Sectors in Select Countries” (with Ahmad Jalai-Naini, Lobna Abel-Latif, T. Roe)

STUDENT ADVISING

Ph.D. Theses Chaired/Chairing

“Stephan Rudiger “Technology Transfer and Economic Growth”

Swati Agiwal " Essays on Supply Chain Resiliency in response to Catastrophic Risks" (Swati is a current PhD student at the University of Minnesota)

“Three Essays on Trade, Economic Growth and Industrial Organization.” Anusua Datta. (Anusa is Associate Professor, Econ. Dept., Philadelphia University)

“Financial Intermediation and Capital Markets Interdependence in Emerging Markets.” Sumit Agarwal. (Sumit is Vice President for Credit Risk, Bank of America)
“A Panel Study of Entry Exit Behavior.” Romkaew Broehm (Romkaew is Consultant, Christenson Consulting, Madison, WI.)

“Multinational Corporations and Development.” Abera Gelan. (Abera is Associate Professor, University of Wisconsin-Milwaukee, WI)

“Biodiversity.” Yvonne Chen. (Yvonne is Assistant Professor, Econ. Dept. DePaul University in Chicago)

Master thesis and Master papers supervised: about 20

Doctoral Committee member: Numerous students at the University of Wisconsin, and University of Minnesota, notably Qizhi Dai, Carlson School of Management, Department of MIS, University of Minnesota (currently Assistant Prof. At Drexel U.), and Alina Chircu (currently Assistant Prof., U.T. Austin)

PRESENTATIONS


June, 2006 Econometric Society summer meetings, Minneapolis, MN, “Is the Tail Wagging the Dog? What is the Risk of Catastrophic Terrorism?”

Feb. 2006 University of Wisconsin, Economics Department, same as above

Nov. 2005 Annual Meeting of National Center for Food Protection and Defense (NCFPD) “Analyzing Catastrophic Terrorist Events with Applications to the Food Industry,” Atlanta

Nov. 2005 Institute of Food Technologists (IFT), Atlanta, Same title as above


July 2005 “University of Minnesota, National Center for Food Protection and Defense (NCFPD) Same title


Oct. 2003 University of Minnesota, Carlson School of Management, same as above.


March 2001 US Department of Agriculture (USDA): Economic Research Service
“Information Technology Adoption in Supply Chains: Trade and Global Implications,” (invited paper)

Feb. 2001 University of Minnesota (Dept. of Applied Econ.) “Information Technology Adoption in the Food Industry.


Jan. 1999 American Economic Association (Session Chair): “Innovation, Imitation and Trade in a North-South Model,” (with A. Datta, presenter and co-author)


Nov. 1997 University of Minnesota (Dept. of Applied Econ.) “Democracy, Rent Seeking and Growth."


April 1995 University of Wisconsin, Madison (Ag. Econ. Dept.) “Development, Environment & Growth."


Nov. 1990 University of Illinois, Urbana-Champaign (Econ. Dept.) Same.

Nov. 1990 University of Wisconsin, Madison (Econ. Dept.) “Sequential Optimal
Search under Job Queuing"  

July 1988 Western Economic Association, LA. Same title as above.
Mar. 1988 University of Colorado, Boulder (Economics Dept.). Same title as above.
Dec. 1986 Middle East Economic Association, New Orleans "Industrialization & Urban Inequality in LDCs: Case of pre-Revolutionary Iran."
Nov. 1986 U. of Wisconsin-Madison (Ag. Econ. Dept.) "Expropriation of Multinationals."
Oct. 1986 U. of Michigan, Ann Arbor (Special Conference) "Growth-Distribution Trade-Offs."

**TEACHING (List of courses taught)**

Columbia University, 1982-1983:
School of International and Public Affairs (SIPA): Graduate Development (MA)
Barnard College: Principles of Macroeconomics (undergraduate)
Columbia College: Undergraduate Statistics (undergraduate)

University of Denver: Graduate School of International Affairs (GSIS)1987-88:
Graduate International Monetary Relations (PhD/MA)
Graduate International Trade (PhD/MA)
Advanced Issues in Income Distribution (PhD)

University of Minnesota, 1991-92, 2002
Electronic Commerce, Carlson School of Management
Advances in the Theories of Endogenous Growth

University of Wisconsin, 1983-present
Graduate International Development Theory
Graduate International Development Policy
Doctoral Seminar in Development and Growth (Fall 05)
Graduate Micro Theory
Global Environment, joint with Chemistry Department
Undergraduate Environmental Economics and Policy
Undergraduate International Development Economics
International Economics
Intermediate Macroeconomics
CV FOR JEAN D. KINSEY

WORK: PROFESSOR
APPLIED ECONOMICS
UNIVERSITY OF MINNESOTA
1994 BUFORD AVENUE, 317 COB
ST. PAUL, MN 55108-6040
PHONE: (612) 625-2744/FAX: 625-2729
E-MAIL: jkinsey@umn.edu
http://foodindustrycenter.umn.edu

HOME:
2168 FERRIS LANE
ROSEVILLE, MN 55113
PHONE: (651) 636-8636
FAX: (651) 636-2108

EDUCATION:
Ph.D. - University of California, Davis - Agricultural Economics, 1976
M.S. - University of California, Davis - Consumer Economics, 1966
B.A. - (cum laude) St. Olaf College (Northfield, MN) - Home Economics, 1963
H.S. - (valedictorian) Bloomer High School (Bloomer, WI), 1959

EXPERIENCE:
2001-Present: Co-Director, The Food Industry Center (A Sloan Foundation Industry Center), University of Minnesota
1995 - 2000: Director, The Retail Food Industry Center (A Sloan Foundation Industry Center), University of Minnesota
1998 (1-6) Director of Graduate Studies, Master of Liberal Studies Program, University of Minnesota
1987 - Present: Full Professor, Consumption Economics, Department of Applied Economics, University of Minnesota
1989 - 1992: Director of Graduate Studies, Department of Agricultural and Applied Economics, University of Minnesota
1982 - 1987: Associate Professor, Consumption and Consumer Economics, Department of Agricultural and Applied Economics, University of Minnesota
1977 - 1982: Assistant Professor, Consumption and Consumer Economics, Department of Agricultural and Applied Economics, University of Minnesota
1975-76: Post Graduate Ag. Research Economist, Department of Agricultural Economics, University of California, Davis
1974-75: Lecturer, Department of Agricultural Economics, University of California, Davis (Consumer Economics, Consumer Protection)
1973-75: Teaching Assistant/Research Assistant, Department of Agricultural Economics, University of California, Davis
1972, 1975: Extension Instructor, University of California, Davis
1966-72: Teacher - Department Chair (Home Economics), Cordova High School, Rancho Cordova, CA
1964-66: Research Assistant, University of California, Davis
1963-64: Teacher (Home Economics), Glendora High School, Glendora, CA

At the University of Minnesota:

At the University of California, Davis:

13
Courses Taught:

- Economic Organization of the Household (graduate-M.S.) 1978 - 1988
- Economics of Consumer Policy (graduate-Ph.D.) 1978 - 1986
- Consumption Economics Seminar (graduate-Ph.D.) 1978 - 1986
- Welfare Economics (graduate - Ph.D.) 1992
- Honors Seminar (Senior) 1992, 1993
- Intermediate Microeconomics (undergraduate) 1993
- Economics of Food & Consumer Policy (graduate-Ph.D.) 1988 - 1998
- Human Capital and Household Economics (graduate/undergrad) 1990 - 1998
- Ph.D. Seminar 1999
- Consumption Economics (graduate - Ph.D.) 1980, 1999 -2001
- Food Marketing Economics 2001 – Present
- Information and Behavioral Economics (Ph.D.) 2002 – Present
- Honors Class on Food.com.org.ed 2006 fall

Research Projects:

- Consumer Credit Card Use 1976 - 1979
- Consumer Credit Law and Education 1976 - 1980
- Housing Satisfaction 1977 - 1980
- Economics of Information 1979 - 1986
- Food Away-From-Home Consumption 1980 - 1986
- NC-169 Food and Agricultural Policy 1983 - 1986
- Local Crop Storage/Food Storage Marketing II
  - USAID/MN Project in Rwanda 1984 - 1986
- Food Prices and the Consumer Sentiment Index 1984 - 1993
- Food Consumption Patterns and Demographics 1984 – 2004
- Expenditures and Resources of the Elderly 1985 - 1992
- Impacts of Food Consumption Patterns on Agricultural Production, Price and Policy 1987 - 1989
- Food Safety and Nontariff Trade Barriers 1990 - 1995
- Desirable Attributes for Value Added Meats 1992 - 1993
- Economic Impact of Indian Casinos 1992 - 1994
- Consumer Buying Patterns in Retail Food 1996 - Present
- Food Demand Chain Structure 2001-Present
- Food Accessibility in Urban Neighborhoods 2004-Present
- Department of Homeland Security Projects 2004-Present
- Consumer/Citizen Survey Project
- Benchmarking Survey Project
- Agricultural Conversion Project – ERS 2004-Present
- Predicting Energy Balance in Midlife Women 2004 - Present

GRADUATE THESES OR PROJECTS SUPERVISED:


M.S. Shelly Hendrickson, "Demand for Beef at Home and Away From Home" (1982) (Worked in marketing for General Mills.)

M.S. Ronald Larson, "Economics of Food Coupons" (1985) (Ph.D. Purdue, Assistant Professor NC State, Associate Director The Retail Food Industry Center, UM, Assistant Professor, Western Michigan University.)

M.S. Lorna Vink, "Economics of Senior Citizen Discounts" (1988) (Worked for government planners in Pittsburgh.)

M.S. Todd Gabe, "The Economic Effects of Tribal Gambling on Rural Minnesota Counties" (1994) (Ph.D. from The Ohio State University.)


Ph.D. Fahima Aziz, "Nutrition and Productivity Analysis: The Efficiency Wage Hypothesis" (1994) (Professor & Department Head, Economics, Hemline University, St. Paul, MN.)

Ph.D. Fidele Ndayisenga, "The Impact of Farm and Food Firms' Lobbying Expenditures on Transfers to Agriculture" (1994) (Research Associate, Humphry Institute, School of Public Affairs.)


M.S. Ming Chen, "A Comparison Study of the Two Most Important Directions of Intergenerational Transfers: From Parents to Adult Children and From Adult Children to Parents" (1996) (Working on Ph.D. at Berkeley.)


Ph.D. Sara Ashman, "Consumer Choice Models with Customer Loyalty Programs in Retail Food Stores" (2001) (Working for SimonDelivers.com - Minneapolis)


Ph.D. Brian Dietz, "The Information Effect and Uncertainty on Smoking Behavior" (in progress)


Ph.D. Ya-Ming Liu, "Market Structure and the Practice of Hospital Outpatient Department for Diabetes Patients under Single-Payer-System in Taiwan" (2003) (Associate Professor, Economics, National Taipei University, Taiwan)


STUDENTS ADVISED:

Undergraduates:  201 (Sum of number each year since 1977/78.)
Masters students:  43  (Sum of number each year since 1980.)
Ph.D. students:  44 (Sum of number each year since 1982.)

As Director of Graduate Studies I provided program and administrative advice to around 80 students each year between 1989 and 1992.

Graduate Oral Examination Committees since 1980: (11 outside Applied Economics)
M.S. 18, Ph.D. 57

PUBLIC SERVICE:

1975-76   Member of Consumer Advisory Committee to the Director of the Department of Food and Agriculture, State of California.
1976      Member of California Fresh Bartlett Pear Marketing Order Board.
Nov. 1978 Presented paper on "Direct Marketing" to Minnesota Governor's Food Conference on Food and Nutrition.
1978-80   Presented several talks about consumer credit or food costs at extension meetings.
1983-84   Board Member - Consumer Appeals Board, Ford Motor Company.
1985      Faculty Mentor for University of Minnesota's Women in Development Graduate Student Fellowship Program (included travel with a student to Barbados).
1987-88   Credit Committee Chair - University of Minnesota Credit Union.
1995      Member of Food and Consumer Issues Working Group, 1995 Farm Bill Project, National Center for Food and Agricultural Policy and the HH Institute of Public Affairs.
1994-1997 Member of Data Task Force of the American Agricultural Economics Association.
1991-1997 Board Member - Federal Reserve Bank of Minneapolis (Chair, 1996,1997).
1995-2000 Member of the Board of Advisors to the Strategic Management Research Center, Carlson School of Management.
1998-2000 Editorial Board, CHOICES
1999-2004 Trustee, Board of Trustees, National Center for Food and Agricultural Policy, Washington, D.C.
2001-present Editorial Council, Journal of Agribusiness
2004-2005 National Academy, Institute of Medicine Committee to Review the WIC Food Packages

ORGANIZATIONAL MEMBERSHIP:

International Food and Agribusiness Management Association (IAMA)
International Association of Agricultural Economists
American Economics Association
Committee on the Status of Women in the Economics Profession
Association for Comparative Economics
Food Distribution Research Society
American Council for Consumer Interests
1. President - 1983.
4. Named Distinguished Fellow - 1997

**American Agricultural Economics Association**
2. Nomination Committee - 1984-86.
4. Elected to the Foundation Board - 1987; (Vice President for Projects - 1988-90).
5. Elected Director on Executive Board, 1992-95. (Committee Representative to AAEA Committee(s) on the Status and Opportunities for Blacks; Economics, Statistics and Information; and Finance).
7. President-elect; President, Past President, AAEA - 2000-2002.

**North Central Regional Committee - 151 (Vice President, 1987-89).**

**HONORS:**

- Elected offices:
  - President and Board, ACCI, 1982-85
  - Foundation Board of AAEA, 1987-89;
- Faculty Consultative Committee to the Dean of the College of Agriculture, University of Minnesota, 1988-90;
- Director on Executive Board of AAEA, 1992-95.
- Member of the Minneapolis Committee on Foreign Relations, 1993 - Present.
- Appointed to Expert Panel of Institute of Medicine under The National Academies for a study of policies related to the federal food program for Women Infants and Children (WIC). 2004

**PROFESSIONAL FOREIGN TRAVEL:**

- Rwanda, Africa, 1984
- Barbados, Caribbean, 1985
- Australia (Perth), 1987
- Italy 1992; 1996; 1997; 2000
- Germany; Austria; 2006
- France, 1997
- Spain, 1999
- Russia, 2000
- South Africa, 2003
- Senegal, 2003

**PUBLICATIONS:**


Kinsey, Jean. 1999. “The Big Shift from a Food Supply to a Food Demand Chain.” Minnesota Agricultural Economist 698 (Fall). (Reprinted in Ag Decision Maker 4 (6, April 2000), Iowa State University Extension.)


Daines, Jeanette, Lai-Chun Kan, Jean Kinsey and Jane Plihal, Just Listen Awhile: Voices From a Developing Country, University of Minnesota, Office of International Agricultural Programs and Women in International Development/Research Information Center (Monograph from Women in Developing Fellowship Program in Barbados), 1986, 28 pp.


Kinsey, Jean (ed.), Consumer Demand and Welfare: Implications for Food and Agriculture Policy, University of Minnesota, Agricultural Experiment Station (Monograph for NC 169), March 1986, 72 pp.


**Book Reviews:**


**Grants:**

1985-Present  “Consumer Behavior and Food Consumption Trends," (revised periodically) UM Experiment Station - Base support


1994-1997  “The Retail Food Industry Center,” one of 12 industry study centers in the U.S. funded by the Alfred P. Sloan Foundation, $1.633 million for three years.


1998-2001  “The Retail Food Industry Center,” one of 15 industry study centers in the U.S. funded by the Alfred P. Sloan Foundation, $1.5 million for three years.

2002-2004  “The Food Industry Center,” one of 19 industry study centers in the U.S. funded by the Alfred P. Sloan Foundation, $1.2 million for three years.

2003-2004  “Building Senegal’s Trade in Horticultural Commodities with the U.S.” Through the Office of Agricultural International Programs, University of MN, funded by USAID and ATRIP. My portion of this $700,000 grant is about $210,000.


2004 – 2007  Supermarket Characteristics and Operating Costs in Low-Income Areas, funded by the Economic Research Service. Grant Award $50,000.


2004- 2008  Agricultural Conversion Factors Revisions, funded by the Economic Research Service. Grant Award $250,000.

CONSULTING: Jean Kinsey
Consultant, analyst or expert witness regarding the economic value of lost household services and wages in cases of wrongful death or injury, 1986 – 2003.

- Conducted research on consumer demand for particular types of food and their substitutes.
- AT&T 1987-1990  Consumer Advisory Panel, Moderator, North Central Region
- University Research Consortium, Minneapolis, MN 1988-present (Study of consumer choice of snack foods away from home for Briggs and Morgan P.A. in Minneapolis, MN and Pillsbury, Madison and Sutro in San Francisco.)
- Director, Board of Directors, Federal Reserve Bank, Minneapolis, 1991-present. (Deputy Chair, 1994, 1995, Chair, 1996, 1997)
- Board of Managers, PJM, LLC. 2003-present
- Board of Trustees, International Food Policy Research Institute
III. Equipment and Facilities

Adequate space is available at the Classroom Office Building (1994, Buford Avenue, St. Paul, MN) which houses the Department of Applied Economics and The Food Industry Center at the University of Minnesota. Also, for use by PI, Hamid Mohtadi, adequate space is available in the Department of Economics at the University of Wisconsin-Milwaukee. When Mohtadi needs to travel to Minnesota, there will be an office space available for him in the Classroom Office Building, (address above) in room 332F.

Desktop computers are available for the investigators at the University of Minnesota and Wisconsin-Milwaukee, supporting Microsoft Office (Word, Excel, Power Point, etc.) and statistical packages, including SAS, STATA, Gauss, R, Mathematica, and others. An additional laptop computer will be purchased for a graduate student assistant to compile and analyze the probability data. The University of Minnesota has excellent library and extensive database with searching capabilities via online library catalogue and web browsers. Biostatistical consulting is also available at this institution. Administrative staff support is also available from the Department of Applied Economics and The Food Industry Center (TFIC) at the University of Minnesota. In addition, the National Center for Food Protection and Defense (NCFPD) will provide expertise, suggestions, and advice, and, if necessary, administrative assistance. Any symposiums to be organized can be carried out with the aid of this center.

The University of Wisconsin-Milwaukee maintains a very large library and online database, with searching capabilities that are exceptional and easily accessible; it also has computer facilities and services that parallel those of Minnesota and the University of Wisconsin-Madison. The faculty of both Economics departments and those in the departments of Statistics and Operation Research are exceptionally talented and can be consulted if the need for statistical help arises (for example Markov Chain Monte Carlo).

Because of his special relations to both Universities (see the section on location), the project PI, Hamid Mohtadi, will have access to the full range of library facilities at both Universities, as described earlier.