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# **Survey Instrument for Case Studies of Food Safety Innovation**

**Elisabete Salay<sup>1</sup>, Julie A. Caswell<sup>2</sup>, and Tanya Roberts<sup>3</sup>**

**Abstract:**

Firms innovate to prevent the presence of microbial pathogens in foods and to address other safety problems. To date, studies on the economics of food safety innovation are relatively rare. We designed a series of case studies of such innovation in the meat industry. Our objectives were to identify and analyze different types of innovation, the drivers of innovation, the mode of innovation development, and the impact of innovation on food safety and firm performance. Here we present the survey instrument developed to conduct the case studies. This instrument can be applied, with minor modifications to reflect research objectives, to a wide variety of innovations and adaptations of innovations in the food industry.

**Keywords:** Innovation, food safety, survey instrument

**JEL Classification:** L6, O3

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## **Survey Instrument for Case Studies of Food Safety Innovation**

Elisabete Salay, Julie A. Caswell, and Tanya Roberts<sup>1</sup>

Food safety is an important public and private concern. In the United States it is estimated that microbial pathogens are related to 76 million cases of foodborne disease, including 5,200 deaths per year (Mead et al. 1999). Firms innovate to prevent the presence of microbial pathogens in foods and to address other safety problems. To date, studies on the economics of food safety innovation are relatively rare.

We designed a series of case studies of food safety innovation in the meat industry. Our objectives were to identify and analyze different types of innovation, the drivers of innovation, the mode of innovation development, and the impact of innovation on food safety and firm performance. Here we present the survey instrument developed to conduct the case studies. This instrument can be applied, with minor modifications to reflect research objectives, to a wide variety of innovations and adaptations of innovations in the food industry.

The survey was prepared in accordance with the object approach that focuses on collecting information about specific innovations.<sup>2</sup> Since our case studies were exploratory, the survey instrument includes mostly open-ended questions. Personal interviews were conducted with personnel at the innovating firms in order to capture the complexity of the innovation and to allow the respondents to clarify questions asked and concepts used in the survey instrument.

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<sup>2</sup> An alternative approach is the subject approach. It requires data collection from innovating and non-innovating companies (OECD, Oslo Manual, 1997). According to the Oslo Manual, the subject approach starts from the innovative behavior and activities of the enterprise as a whole and the object approach concentrates on the number and characteristics of individual innovations.

The majority of the survey questions were developed based on the Oslo Manual that has been widely accepted for use in studies of innovation (Organization for Economic Co-operation and Development, Oslo Manual, 1997). However, other references (Hoffman, 2000; National Science Foundation, 2000; Statistics Canada, 1999) related to innovation and the market environment were used in developing some questions. Qualitative and quantitative data were collected depending on the nature of the questions. We chose 1990 as the starting point for some questions because it was prior to the 1993 *E. coli* hamburger patty outbreak that we expected to be a major motivator for meat companies to pursue food safety innovation. In practice, the start year varied among the respondents depending upon the information they had available. For other questions, such as those related to the economic impacts of innovation for the firm (e.g., impact on sales), we collected data for a 3-year period prior to the date of the interview as recommended by the Oslo Manual (OECD, 1997).

The survey instrument is divided into three parts:

**1. *General Characterization of the Firm***

This section includes general questions about the firm, such as its main products, main activities, size, and market segments served. This information is essential to characterize the innovation, since many of the factors studied may be related to firm innovative activity (OECD, 2001).

**2. *General Information on Firm Innovation***

This section includes questions on the general innovation activity of the firm, such as the number of research and development (R&D) projects and personnel, R&D expenditures, and the types and number of important innovations developed. There are also questions focused on the means (e.g., patents, secrecy) used by the company to appropriate the benefits of innovation.

These questions are important in order to characterize the firm based on criteria for innovation activity (OECD, 2001), as well as to understanding how food safety innovation fits into the overall innovation activity of the firm.

### **3. *Case Study of an Innovation***

The final section focuses on the individual innovation. These questions provide data on the exact nature of the innovation, its benefits and costs to the firm, the impact of public policy on innovation activity, and the role of innovation in the firm's overall strategy. This section is in three parts:

- 3.1. *Innovation Identification*: description of the innovation, its novelty (technological and market), and the costs of innovation.
- 3.2. *Innovation Development*: description of innovation activities including cooperative arrangements, sources of information for the innovation, and innovation drivers.
- 3.3. *Impact of Innovation on Food Safety and Firm Performance*: description of the impact of innovation on product outcomes (e.g., pathogen reduction, minimum levels of pathogens, product shelf life) and on firm performance outcomes (e.g., use of factors of production, production costs, sales increases). Questions also explore how (e.g., patents, secrecy, lead time) firms maintain competitiveness for the specific innovation.

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# **Innovation Survey**

## **I. General Characterization of the Firm**

1. General information about the enterprise (at present and please describe significant changes in these variables since 1990).
  - 1.1. Main activity
  - 1.2. Main products
  - 1.2. Independent or part of a group
  - 1.3. Country of the head office
  - 1.4. Number of employees
  - 1.5. Turnover
  - 1.6. Exports (if yes, to which countries?)
  - 1.7. Market segments and importance (business customers, consumers, etc.)

## **II. General Information on Firm Innovation**

1. General information on innovation (products and process) of the firm since 1990.
  - 1.1. Has research and development (R&D) activity been performed on a continuous or an occasional basis since 1990?
  - 1.2. Number of research and experimental development projects
    - 1.2.1. Completed
    - 1.2.2. Aborted or unsuccessful
    - 1.2.3. Ongoing
  - 1.3. Number of patents
  - 1.4. R&D expenditures
    - 1.4.1. Product
    - 1.4.2. Process
  - 1.5. Number and types of technical staff
2. Please explain the most important factors in the success of your company's strategy since 1990. In addition, describe the role that innovation in general and innovation in food safety plays in your company's strategy.
3. Explain the effectiveness for your firm of the following methods of maintaining and increasing competitiveness through innovation in general and innovation in food safety since 1990:
  - 3.1. Patents
  - 3.2. Secrecy
  - 3.3. Having a lead time advantage over competitors
  - 3.4. Complexity of product designs
  - 3.5. Other(s). Please describe and explain.

4. Identify the company's most important innovations (product and process) in general and in food safety since 1990.
  - 4.1. Innovations in general
  - 4.2. Innovations in food safety
5. Please describe what kinds of research and technology in food safety you think could be developed to increase the present competitiveness of your company.
6. Related to the hiring practices of your company: What kinds of new skills related to food safety is your company looking for? How have these skills changed since 1990?

### **III. Case Study of an Innovation**

#### ***A. Innovation Identification***

1. Please describe the innovation.
2. Please identify and explain the main economic objectives of the innovation.
3. Classification by the type of innovation
  - 3.1. Novelty of innovation
    - 3.1.1. Classification by type of novelty using technical variables (known in the meat processing industry; new in meat processing industry; new in food science/technology; new in other technology areas).
    - 3.1.2. Classification by type of novelty in terms of the market (world first; USA first; or first for your firm).
  - 3.2. How high were the following risks related to the innovation perceived to be by your company? Use the scale:
    - 1 Low
    - 2 Moderate
    - 3 High
    - 3.2.1. Risk related to technological feasibility \_\_\_\_\_
    - 3.2.2. Risk related to market success \_\_\_\_\_
    - 3.2.3. Innovation easily imitated \_\_\_\_\_
    - 3.2.4. Organizational structures and processes to manage innovation \_\_\_\_\_
4. Expenditure on innovation.
  - 4.1. Current and capital costs
  - 4.2. Intramural and extramural expenditure
  - 4.3. Life cycle of the innovation: (time from the idea to implementation, time to reach the commercialization phase or the expected cost recovery or payback)



**B. Innovation Development**

5. Which of the following innovation activities did your firm carry out for this particular food safety innovation?
- 5.1. Acquisition and generation of relevant knowledge new to the firm:
- 5.1.1. Research and experimental development (R&D)  
No \_\_\_\_\_  
Yes \_\_\_\_\_ If yes, please describe.
- 5.1.2. Acquisition of disembodied technology and know-how  
No \_\_\_\_\_  
Yes \_\_\_\_\_ If yes, please describe.
- 5.1.3. Acquisition of embodied technology  
No \_\_\_\_\_  
Yes \_\_\_\_\_ If yes, please describe.
- 5.2. Other preparation for production:
- 5.2.1. Tooling up and industrial engineering  
No \_\_\_\_\_  
Yes \_\_\_\_\_ If yes, please describe.
- 5.2.2. Industrial design not elsewhere classified (n.e.c.)  
No \_\_\_\_\_  
Yes \_\_\_\_\_ If yes, please describe.
- 5.2.3. Training  
No \_\_\_\_\_  
Yes \_\_\_\_\_ If yes, please describe.
- 5.2.4. Other capital acquisition  
No \_\_\_\_\_  
Yes \_\_\_\_\_ If yes, please describe.
- 5.2.5. Production startup  
No \_\_\_\_\_  
Yes \_\_\_\_\_ If yes, please describe.
- 5.3. Marketing for new or improved products  
No \_\_\_\_\_  
Yes \_\_\_\_\_ If yes, please describe.
- 5.4. Other activity. Please describe.
6. Was your firm involved in cooperative and collaborative arrangements with others firms and organizations (excluding contract R&D)?  
No \_\_\_\_\_  
Yes \_\_\_\_\_ If yes, please:
- 6.1. Indicate the important reasons for being involved in cooperative and collaborative arrangements.
- 6.2. Describe your partner(s) and its (their) country(ies).

7. Identify the sources of information that played an important role in suggesting or contributing to the innovation. Please use the scale of importance:
  - 1 Not important
  - 2 Slightly important
  - 3 Moderately important
  - 4 Very important
  - 5 Extremely important
  - 7.1. Internal sources within the firm or business group:
    - 7.1.1. In- house R&D \_\_\_\_\_
    - 7.1.2. Marketing staff \_\_\_\_\_
    - 7.1.3. Production staff \_\_\_\_\_
    - 7.1.4. Management staff \_\_\_\_\_
  - 7.2. External sources:
    - 7.2.1. Competitors \_\_\_\_\_
    - 7.2.2. Suppliers of equipment, materials, and components \_\_\_\_\_
    - 7.2.3. Clients or customers \_\_\_\_\_
    - 7.2.4. Consultancy firms \_\_\_\_\_
    - 7.2.5. Higher education institutions \_\_\_\_\_
    - 7.2.6. Government research institutes \_\_\_\_\_
    - 7.2.7. Private research institutes \_\_\_\_\_
  - 7.3. Generally available information
    - 7.3.1. Professional conferences, meetings, and publications \_\_\_\_\_
    - 7.3.2. Fairs and exhibitions \_\_\_\_\_
    - 7.3.3. Patent disclosures \_\_\_\_\_
    - 7.3.4. Internet or computer based information networks \_\_\_\_\_
  - 7.4. Other sources of information. Please specify.
8. Identify and explain the important factors that influenced your company's decision to develop this innovation. Please use the scale of importance:
  - 1 Not important
  - 2 Slightly important
  - 3 Moderately important
  - 4 Very important
  - 5 Extremely important
  - 8.1. Technical or organizational competencies the firm accumulated over time \_\_\_\_\_
  - 8.2. Firm's linkage to external sources of expertise for learning about new technological development \_\_\_\_\_
  - 8.3. Management/organizational structures and strategy \_\_\_\_\_
  - 8.4. Market
    - 8.4.1. Consumers/clients \_\_\_\_\_
    - 8.4.2. Trade associations \_\_\_\_\_
    - 8.4.3. Competitors \_\_\_\_\_
    - 8.4.4. Consultants \_\_\_\_\_
  - 8.5. Suppliers \_\_\_\_\_

- 8.6. Other company(ies) in the supply chain \_\_\_\_ Please describe.
  - 8.7. Financial links:
    - 8.7.1. Shareholders/investors \_\_\_\_
    - 8.7.2. Insurance companies \_\_\_\_
    - 8.7.3. Banks \_\_\_\_
  - 8.8. Coercive:
    - 8.8.1. Domestic regulation \_\_\_\_
    - 8.8.2. Regulatory regimes in other countries \_\_\_\_
  - 8.9. Social drivers:
    - 8.9.1. Civil/consumer organizations \_\_\_\_
    - 8.9.2. The press \_\_\_\_
    - 8.9.3. The courts \_\_\_\_
    - 8.9.4. Religious institutions \_\_\_\_
    - 8.9.5. Academia \_\_\_\_
    - 8.9.6. Other \_\_\_\_ Please describe.
  - 8.10. Food safety problems:
    - 8.10.1. Outbreaks \_\_\_\_ Please specify the outbreaks.
    - 8.10.2. Product recalls \_\_\_\_
    - 8.10.3. Other \_\_\_\_ Please describe.
  - 8.11. Other drivers. Please describe.
9. Describe and explain the internal and external factors for your company that were problems or slowed down the innovation process.

**C. *Impact of Innovation on Food Safety and Firm Performance***

- 10. What was the impact of the technological innovation on product safety?
  - 10.1. % pathogen reduction
  - 10.2. Minimum level of pathogens
  - 10.3. Shelf life of products
  - 10.4. Others benefits. Please list.
- 11. What proportion of your sales are due to the technology innovation?
  - 11.1. % increase in sales in last three years in domestic market
  - 11.2. % increase in sales in last three years in international market
- 12. How has the innovation influenced the use of factors of production, i.e., labor use, material consumption, energy consumption, and utilization of fixed capital (in the last three years)?
- 13. What was the average cost reduction or increase due to technological process innovation?

14. Explain the effectiveness for your firm of the following methods of maintaining innovation competitiveness:
  - 14.1. Patents
  - 14.2. Secrecy
  - 14.3. Having a lead time advantage over competitors
  - 14.4. Complexity of product designs
  - 14.5. Other(s). Please describe and explain.
15. Please specify any other important economic impacts of this innovation for the firm.
16. Please make any comments you think are important about the innovation that were not discussed in the questions above. Please also elaborate on any important points discussed above.