

**61<sup>st</sup> EAAE SEMINAR**  
**WARSAW, OCTOBER 22- 24, 1998**  
**Warsaw Agricultural University, Department of Agrarian Policy and Marketing**  
**Warsaw Agricultural University Press, pp. 198-211**

**HACCP SYSTEM AND ITS FEASIBILITY IN DEVELOPING COUNTRIES:**

**A Cost-Benefit Analysis Approach**

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**Abstract**

The constant request for product and service quality is the major challenge of the 1990s for the food industry. Both developed and developing countries have faced food quality, safety, and nutrition issues to some extent. Everyone in the world deserves the right to have enough and safe food. Food safety and nutrition concerns have gained importance, with an international project initiated in 1997 by FAO called " Food for All".

In the developed world, progress can be achieved in the control of food quality through new systems such as HACCP, despite the existence of technical and economic problems. In contrast in developing countries, and especially in the least developed ones, having enough and safe food for ordinary citizens is a distant target to attain, as they try to meet the essential needs of their citizens.

Despite differences between the food safety issues of the developed and developing world, such as in infrastructure, the structure of the food industry, the awareness of consumers, and income level and distribution, developing countries have to improve their food safety not only in order to supply safe food to domestic consumers but also to be viable in the international food market.

From the point of view of the costs and benefits of the control systems, firms have often faced high financial burdens in implementation of quality control systems. In the developing countries, it is often impossible to enforce a food safety regulation such as HACCP.

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Mandated food safety regulation without any strict control (as in the situation in the developing countries) may give rise to a kind of black market. Unqualified or uncontrolled foods are sold at a cheaper price to consumers who cannot afford to buy at high prices. This kind of market can be called an **inverse or dual black market**. Especially in a market structure where small firms selling their product at the retail level dominate, the opportunity for an inverse black market arises because consumers who cannot afford to pay a high price for the qualified food have tended to buy lower quality and cheaper foods. Therefore it may often be infeasible to apply these sophisticated control systems in developing countries without any governmental intervention and financial support. It may be expected that the aggregate net benefits to society may be great and positive. However, in practice it is not only a question of benefit. Especially in the developing world, the low level of income and its unequal distribution, inadequate infrastructure, low education level and fragmented structure of the market are also important determinants of implementation.

International food aid programs should be changed to assist in developing a sound food industry, including quality control systems.

## **Introduction**

The constant request for product and service quality is the major challenge of the 1990s for the food industry (Alvarez 1994). Food safety and nutrition are pivotal issues in the food system today because debate over them articulates values associated with the environment, agricultural production, and government restrictions on private business operations, the role of government as protector and consumer choice (Caswell 1990).

In the last decade, both developed and developing countries have faced food quality, safety, and nutrition issues to some extent. A deficiency in the quality control in the chain of food production from raw materials to finished products could result in an unacceptable food safety risk. The safety of the food supply has been increasingly questioned because of a rise in outbreaks of food-borne illnesses, the presence of natural contaminants such as aflatoxin, and the use of chemicals (pesticides, fertilizer, growth regulators) in farming (Sperber 1991).

On the other hand, worldwide, a dual structure of the food industry has been developing. Developed countries are experiencing rapid and tremendous changes in processing facilities

and consumption patterns. Developing countries, in contrast, have a rather backward industry structure and are experiencing a lack of food and even hunger. Thus, food issues worldwide are complicated, and it is difficult find a common answer.

Food safety and nutrition policies reflect dramatic changes in food production, marketing, distribution and consumption practices in recent years. These changes include globalization of food markets and the growing affluence of consumers in developed countries. Most regulators and industry officials agree that the most effective and economical way to combat food safety problems is the use of HACCP. This new approach relies on scientifically based risk assessment and prevention rather than on detection of hazards (Unnevehr and Jensen 1996). It is widely recognized in the food industry as an effective way of establishing production, sanitation and processing practices to produce safe foods.

The attitudes, cultural practices, technology and other circumstances of a country define the numerous dimensions of food quality. There are significant differences among countries in food production, transportation, marketing, storage, food preparation and consumption (Steahr and McMulling 1991). While the implementation of a food quality assurance system in a country is affected by the issues mentioned above, the cost-benefit structure of the system is also very important.

In this article, the main differences between the developed and developing world will be discussed from the points of the feasibility of implementing a quality control system such as HACCP. A cost-benefit approach, to the evaluation of such systems is also discussed.

### **Food Safety in the Developed and Developing World**

All potential food hazards may occur in both developed and developing countries, although perhaps with differing severity levels. In the developed western world, food safety and nutrition concerns have grown in importance. Under the globalization of food markets and in the light of the new WTO order, indeed, these issues have become an international concern. However, the problems are different depending on a country's development level. While over-consumption and dangers related to ready made food consumption are the main problems in the developed world, malnutrition and even hunger are the major problems of less developed and developing countries. In the developing and less-developed countries, the main question

for most of the people is to meet their needs with a rather limited income. According to a recent FAO report more than 800 million people still suffer from chronic under-nutrition in developing countries (Anonymous 1997).

Food safety is going to be a tremendous challenge for the Codex Alimentarius Commission (Espy 1994). The recent GATT/WTO agreement has been reducing tariff levels on agri-food products and initiated some non-tariff barriers to trade. Sanitary and phytosanitary regulations have been given added importance. But the Codex/WTO approach to regulatory rapprochement is still weak, reflecting the vast differences in regulatory regimes around the world. However, all countries will have strong incentives to adopt HACCP approaches so their companies can compete effectively in international markets. HACCP is frequently implemented as an additional layer of regulation while existing process and performance standards are still in place (Caswell and Hooker 1996).

HACCP has a bright future internationally, as more countries adopt it as a regulatory standard for improving food safety. On the other hand, economic incentives have been fostering HACCP programs in the domestic and international market places. HACCP could be used with interaction and interdependency as an international regulatory standard and as a private standard in industry assurance programs. For example the ISO 9000 certification series for food companies could be used with HACCP principles. HACCP's private and public efficacy in trade, ultimately will depend on the ability and willingness of governments to engage in regulatory rapprochement (Roberts et al. 1996).

There is a great effort in the United States to establish the HACCP system as the prevailing approach to food safety. But in some segments of the United States food industry, foods are still being produced which are recognized to have insufficient barriers to microbial contamination and growth. Although certain of these are ethnic foods with a long history of consumption, and it is argued that they are not always safely consumed from the modern epidemiology techniques point of views (Archer 1990).

All food companies were required to apply HACCP principles in the EU, by December 14, 1995. This was the result of the directive concerning food product hygiene (EEC directive 93/43) which was passed in June 14, 1993, by the Council of Europe. In concrete terms, this means that every food company in the EU, not only the international food product concerns

and medium-size companies, but also the bakeries around the corner and other small businesses, including catering establishments are being required to apply HACCP principles. This law has led to a great deal of commotion. The introduction of HACCP requires clarification, coaching and advice. Generally speaking, among EU companies, those in the United Kingdom and Ireland have gone the furthest towards adopting the HACCP system. Belgium, the Netherlands and Scandinavia have made a start, while companies in Germany and France have not yet reached this level (Grijspaardtink 1994).

In Canada, government agencies have undertaken various programs involving HACCP systems to improve the safety of foods. Agriculture Canada has reorganized to meet consumer concerns and has formed a new Agri-Foods Safety Division to work with other federal food inspection agencies, the provinces and the agri-food industry. Agriculture Canada has written a Canadian Code of recommended manufacturing practices for pasteurized, modified atmosphere packaged, refrigerated food in consultation with industry, academia and research advisors. This division is responsible to initiate preventive, proactive measures for approaching food safety problems (Dean 1990).

Canada and the US are pursuing HACCP plans in parallel. Canada's adoption is the most advanced with a planned implementation of April 1996 for all the agri-food sectors (Caswell and Hooker 1996).

Despite the main differences between the food safety issues of the developed and developing world, such as in infrastructure, the structure of the food industry, the awareness of consumers, and income level and distribution, developing countries also have to improve their food safety to be viable in the international food market.

Developing countries have just recognized the HACCP system and have been trying to adapt their modern plants to some level. But there are some restrictive factors to the use of HACCP in the food industry. Historically, there have been eight regulatory pitfalls in trying to implement HACCP in food control systems (Garrett and Hudak-Roos 1991):

- i. The understanding of HACCP
- ii. Choosing a definition for the critical control points
- iii. Incorporation of sanitation controls in the HACCP system
- iv. The agency resource commitment

- v. Inspector acceptance
- vi. Consumer acceptance
- vii. The regulatory approach to the industry
- viii. Training

It can be said that all of these are current pitfalls in developing countries. The food industry in the developing countries is diverse and complex. In some industry segments, processing facilities are modern and well designed. In others, the facilities have primitive designs and the food is often produced in the same way as it was decades ago. In such a structure, HACCP must obviously be flexible to accommodate this diversity (Archer 1990).

The assurance of food safety and the supply of qualified foods are closely related to the information systems under different market conditions. The establishment of a food quality control system and having a quality reputation through advertising and other means depends on the existence of a sufficient number of knowledgeable consumers who demand a high-quality product and are ready to pay more for quality. It is not easy to be successful in implementation of a quality assurance system such as HACCP, when the consumer knowledge is inadequate, information costs are sufficiently high for consumers, firms or both, so that adequate information is not available about product safety to achieve an efficient market outcome, in short, there is true uncertainty about food safety.

When information about product quality before purchase is imperfect, consumers are put in the position of buying a product whose quality is uncertain. But consumers can judge the quality of the product after purchase. Product quality reputation may serve to achieve the efficient provision of safety. If consumers buy the product repeatedly, firms that provide a higher-quality (safer) product can charge a higher price for it. Thus the market with imperfect pre-purchase information can achieve the same outcome as the market with perfect information. Under the conditions of asymmetric information, sellers know product quality and can make that information available to consumers through product certification or labeling as sometimes occurs in the developing world (Caswell 1992).

The establishment of an efficient, symmetric information system is not easy even in a developed country because of the peculiarities inherent in the food processing, which include rather high risk and uncertainties when compared with the other sectors. It is very difficult to

have a perfect information system in developing countries not only because of the structure of industry itself but also because of the structure of the profile of consumers. Most of them have rather low income and are interested in quantity rather than quality. In such a structure, it may be better to train consumers and produce credible products through certification and labeling instead of using only the price system in communication. The role of the government in this issue is very crucial.

One of the principle issues in the food industry is to provide a sufficient quantity and quality of raw materials. In contrast to developed countries, developing countries not only use rather insufficient technologies but also have inefficient raw material procurement systems. In raw material procurement, vertical coordination is widely used in the developed world. Contract farming has only been recently recognized by the food industry in the developing countries (Rehber 1997). A well-functioning vertical coordination will contribute to establishment of information symmetry between processor and the producers who supply raw materials.

One of the main characteristics of the developing countries' control and regulation policies is that food safety and nutritional risks have been treated in a fragmented manner. In addition, the efficiency of the systems is arguable. Often several organizational bodies are involved in the system. This structure results in an inefficient use of time, effort, and money. On the other hand, a lion's share of the food items are consumed in an unprocessed form as household production. Thus there is a dual structure in the food industries of developing countries. There are plants that are large in size, more modern in technology, sometimes integrated with international companies, that are oriented mainly for export. However a big share of the food handling is done by small and medium size processing units which have rather backward technologies. The feasibility of total quality management and implementation of a sophisticated system of HACCP must be evaluated taking into consideration this dual system.

### **Cost-Benefit Analysis**

Food safety is a classical example of a market failure due to imperfect information. Consumers become ill but producers do not always see a fall in purchases. Consequently, producers may not change their practices and food-borne disease is not reduced. This market imperfection requires government interventions. Government interventions can take many

forms. We distinguish between direct command and control (CAC) interventions (banning or a minimum standard approach) and information based interventions (information approach) that provide incentives for private market solutions (Kramer and Caswell 1993; Unnevehr and Jensen 1996). Currently, high information costs prevent food safety from being directly traded in markets. Like other non-market goods, such as the environment, food safety has been valued indirectly by estimating consumer's willingness to pay, averting behavior costs, resource expenditures on medical care and labor productivity losses (Roberts et. al 1996).

The costs and benefits of food safety can be evaluated at different levels, from the financial point of view for the firms in the food industry and from the economic point of view of the whole society. For the evaluation methodology, many previous studies have estimated the costs from exposure to food-borne diseases (Roberts and Pinner 1990; Roberts 1987). In this article **the with and without of any regulatory interventions approach** is the preferred approach.

Without any intervention activities, the social costs of food risks can be summed up in four groups (Figure 1).

- i. Industry costs (I)
- ii. Consumer costs (C)
- iii. Public sector costs (P)
- iv. Externalities (E)

The total costs of food-borne losses and diseases can be written as:

$$(1) TC = I + C + P + E$$

Some of the cost items can be estimated directly from conventional market data such as changes in productivity, loss-of earnings (human capital), defensive expenditures etc. In estimating others, implicit or constructed market approaches must be used such as artificial markets or contingent valuation (Munasingle and Lutz 1993).



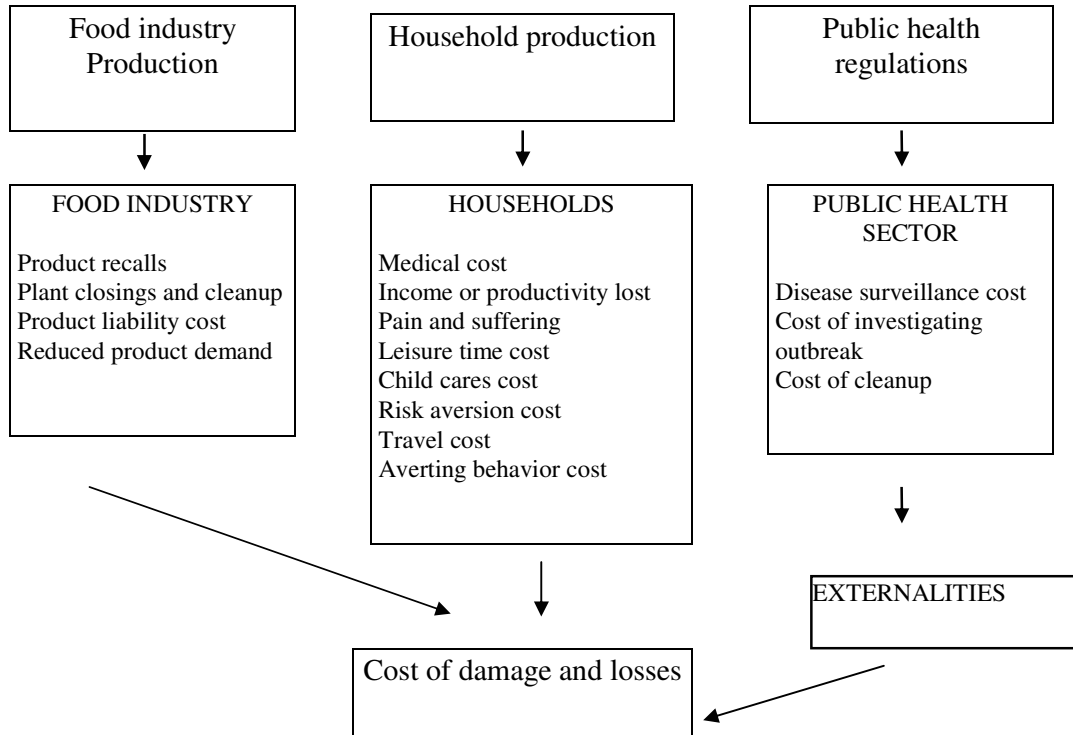


Figure 1. Economic costs from exposure to food-borne diseases and other losses (Adopted from Roberts and Pinner 1990)

For the developing world, it is often necessary to use shadow or accounting prices for social or economic evaluations because of market distortions.

People generally recognize the human illness costs due to food-borne diseases but often do not realize that food contamination causes economic losses in industry and public health. Hence, it could not be expected that they realize all the other externalities.

Industry costs can include the cost of recalling and destroying product, reduced consumer demand, investigating the source of contamination, cleaning up, changes in production within the plant to reduce future contamination, and the possibility of liability suits from consumers or other food buyers, product spoilage and disrupted work schedules (Robert and Pinner 1990).

For the consumer, the costs could be identified as human illness costs, which include; medical costs, productivity loss, etc.

Public health sector costs are the surveillance activities to monitor for the occurrence of food borne disease including maintaining laboratory facilities and data series.

From equation (1); the TC from the exposure to food-borne diseases and other losses can be accepted as equal to total benefit (TB) to society as opportunity cost, if all losses could be avoided by prevention measures. That is  $TC = TB$ . In order to estimate the Net Benefit (NB), we should take into consideration the total prevention costs (PC) both for private firms and public sector and also the unavoidable part of the losses (AC).

Prevention costs include the costs of developing a product design and product specifications, setting up and maintaining effective purchasing procedures, establishing a structure for quality planning and administration, training and implementing a program of quality auditing (Anonymous 1991). Regulatory economists' approach for the prevention costs is that, the costs are the opportunity costs to society; that is, what society gives up by applying resources to meet a regulation (MacDonald and Crutchfield 1996).

For the firms, conforming to designed standards is meant that a fixed cost independent of plant size. It may tend to put small firms at a competitive disadvantage. Moreover, because compliance with complex HACCP regulations involves a significant start-up cost that is independent of size of operation, this form of regulation may threaten the economic survival of smaller firms (Antle 1996). It was also argued that, HACCP is more costly for small plants than large ones (Roberts et al 1996).

On the other hand, it is assumed that it is not possible to avoid all expected hazards by using the prevention measures. That is why always there is an unavoidable part of the food quality risks (AC). Then net benefit to society can be written as

$$NB = TC - AC - PC \text{ or } NB = TC - (AC + PC)$$

It may be expected that the aggregate net benefits to society may be great and positive. However, in practice, from the implementation point of view of an quality assurance system, it is not only a question of benefit. Especially in the developing world, the low level of income and its unequal distribution, infrastructure, education and structure of the firms are also important determinants of implementation.

If we try to analyze costs and benefits from the financial point of view for an individual firm, we will be faced with different circumstances. Every firm, wants to make safe, wholesome and nutritious food product, but they also want to be able to sell it at a price to people who can afford to buy it. For example, assume that a firm is operating in a competitive market condition. The firm faces a demand line with a zero price elasticity ( $p_1$ ) (Figure 2). Without any interventions, in the long run the market equilibrium would occur where  $MC_1 = p_1$  with an amount of  $q_1$ . Implementation of a food assurance system such as HACCP will cause an increase in the firm's costs and the marginal cost curve of the firm will shift up to  $MC_2$ . With a given amount of demand at  $p_1$  price level in order to maximize profit, the firm decreases the amount of production to  $q_2$  level (Figure 2). Here, however, it is making losses. In doing so, it causes quantity demanded to exceed quantity supplied, creating shortages.

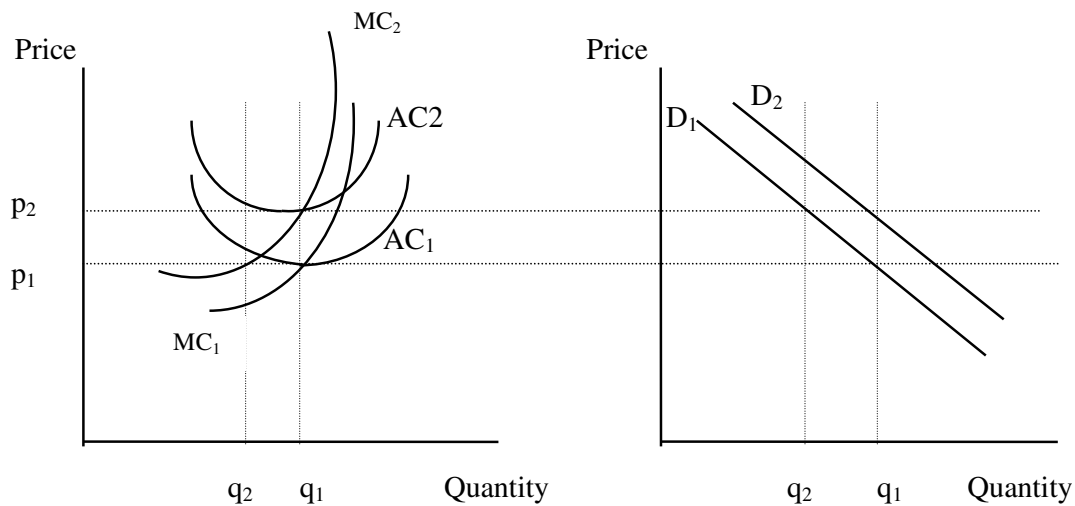


Figure 2. Market equilibrium

In this circumstance, the firm making losses will be forced to leave the industry. There would be two ways to keep the firm in the industry. Either the amount of increase in the firm cost has to be compensated or the willingness of the consumers to pay must increase causing a shift in the demand curve to  $D_2$  by some incentives (information, training etc.). The free market eliminates the demand shortage by allowing prices to rise, if there is available potential of

consumers to pay more for quality. Otherwise, mandated food safety regulation without any strict control (as in the situation in the developing countries) gives rise to a kind of black market. Unqualified or uncontrolled foods are sold at a cheaper price to consumers who can not afford to buy at high prices who do not care about food safety. In the developing countries, it is often impossible to enforce a food safety regulation such as HACCP. A certain amount of supply would be remain uncontrolled and sold in the market, which is named for the sake of argument as the **inverse or dual black market**. Especially in a market structure when small firms selling their product at the retail level dominate, the opportunity for an inverse black market arises because consumers who can not afford to pay a high price for the qualified food have tended to buy lower quality and cheaper foods. This situation was explained by Antle (1996) in his article that imperfect information is likely to cause the unregulated market to achieve an inefficient level of safety. Consequently a “Gresham’s law” of product quality applies, with “bad” (low-quality, low cost) products chasing “good” (high-quality, high-cost) products out of market (Antle 1996).

It is a fact that consumers will differ in terms of the extent of their risk perceptions and their responsiveness to changes in safety versus price. And the cost of various safety improvements will vary for different kinds of goods (Kramer and Rawenswaay 1989).

The central underlying food quality issues is that consumers are able to purchase acceptably safe and nutritious foods. In the developed world, a relevant policy may be a necessary condition for achieving a safe food supply. In the developing countries, the growth of national income and equality of the income distribution are more important as a means of improving the quality of foods which consumers are able to purchase.

## **Conclusions**

Everyone in the world deserves the right to have enough safe foods. In recent years, food safety and nutrition concerns have gained importance, and an international project was initiated in 1997 by FAO named called " Food for All".

In the developed world, progress can be achieved in the control of food quality through new systems such as HACCP, despite the existence of technical and economic problems. In contrast, in developing countries, and especially in the least developed ones, having enough and safe food for ordinary citizens is a distant target to attain, as they try to meet the essential needs with low-incomes.

We conclude that, from the point of view of the costs and benefits of the control systems, the firms have faced high financial burdens in implementation of quality control systems such as HACCP in the developed world. Therefore it seems infeasible to apply these sophisticated control systems in the developing countries without any governmental intervention and financial support. This is especially the case in infant food industries. International food aid programs should be changed to assist in developing a sound food industry, including quality control systems.

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