HACCP: A Quest for Quality as a Competitive Strategy for Agribusiness

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Satish Y. Deodhar*

satish@iimahd.ernet.in

* Assistant Professor, Centre for Management in Agriculture, Indian Institute of Management, Ahmedabad, India

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ABSTRACT

While consumption of food gives material pleasure and a healthy life, contaminated food can be dangerous to health. Therefore, quality of food is very important. Even from the producers' point of view, selling high quality food can be viewed as a competitive strategy to overcome competition. With the recent agreement on Sanitary and Phytosanitary (SPS) measures, World Trade Organization (WTO) has made it mandatory for all member states to follow international food standards guidelines in the sphere of foreign trade. An important element of these guidelines is the compliance with Hazard Analysis and Critical Control Points (HACCP), a management system for food safety. Indian firms will have to adopt these guidelines, else they will have to face non-trade-barriers in the export market. In this paper, I try to give a comprehensive treatment to HACCP and related food safety issues. I present the historical development of the system, give a theoretical background, and describe the actual procedure for implementing HACCP. It is hoped that food processing industry takes a lead in developing HACCP plans for the diverse range of domestic food products. This has a potential not only to improve food quality but also to give Indian firms a competitive advantage over others both in the domestic and export market.

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1. Introduction

A unique feature of food products is that their consumption gives material pleasure and they directly contribute to the sustained healthy life as well. However, spoiled, contaminated, adulterated, irradiated and inferior quality food can be harmful to one's health irrespective of its taste, and, at times can have fatal effects. The lethal contamination of edible oils with argemone oil that led to more than fifty dropsy related deaths in August-September 1998 is a case in point (IE, 1998). Similarly, high levels of pesticide residues in food are carcinogenic. Therefore, food industry is perhaps the only industry where the age-old warning, *Caveat Emptor* is just not enough. *Shabri* might have offered tasted/tested berries to a King out of sheer devotion, however, sheer market-sense should compel agribusiness to realise that in modern times, consumer is king[1], and maintaining high food quality becomes a part of their competitive strategy[2].

Consumer concerns about food quality world-wide have found expression in the objectives of quite a few international institutions. Food and Agriculture Organization (FAO) and World Health Organization (WHO) jointly established Codex Alimentarious Commission (CAC) in 1962 with the aim to protect consumer health, harmonize food standards, and promote international trade (CAC, 1996). Realizing that mere *ex-post* inspection methods of processed foods does not guarantee safety to consumers, in 1993, CAC recommended adoption of a food safety management system: Hazard Analysis and Critical Control Points (HACCP). The recommendations of CAC had no legal backing of any international law. However, the CAC recommendations have been

endorsed and made mandatory by virtue of the 1995 agreement on Sanitary and Phytosanitary measures (SPS) reached by the member countries of the World Trade Organization (WTO, 1995).

Since then, there has been a spurt of news reports regarding HACCP in the Indian context. Multinational companies like Nestle India, have planned to implement HACCP in their plants (ET, 1997). Indian seafood processing companies, in their bid to remain competitive in the US market, are taking help from foreign consultants to implement HACCP in their production units (CP, 1997). Recently, about 100 crores of herbal product exports targeted for 1997-98 were severely affected as the United States (US) planned to impose ban on imports of these products from India if they did not confirm to HACCP (EFP, 1997). These events show that the WTO agreements and its implications for food quality are a *fait accompli*. Multinational companies are gearing up for it already. However, if the domestic companies do not get their act together fast, then the Indian food products will face severe non-trade-barriers in the global trade. Further, one need not focus on export markets alone. The edible oil episode of 1998 is just an indication that Indian domestic food processing industry has a lot of room to improve their food processing and food quality.

While HACCP will be the upcoming management system for food processing, a comprehensive treatment of this system is not available. We need to inform the domestic industry about HACCP, and do the groundwork for developing Indian product specific HACCP plans for which one need not have to depend on foreign consultants or certifiers[3]. This paper is an attempt to bring out the historical development, theoretical background, the actual HACCP procedure; and draw policy implications that are important for both industry and academicians. The paper is organized as follows. The second section discusses the historical development of HACCP, third section gives the theoretical underpinnings of the system, and the fourth section discusses the actual

procedure of the HACCP system. Finally, the fifth section summarises and draws policy implications.

2. Historical Development

Food quality issues have a long tradition. It is claimed that one of the reasons for the downfall of the Roman empire was the deteriorating health of the populace due to lead poisoning. The water flowing through the newly innovated lead pipes was getting contaminated with lead! The first account of massive food spoilage was recorded in 1845-46 when a fungal disease afflicting potatoes ravaged Ireland's potato crop. More than a million Irish died in the infamous potato famine. Food spoilage was a common problem, and people had no solution to it until Louis Pasteur came on the scene. In 1861, this French scientist, developed his technique of *pasteurization*, in which he found a way to protect food by heating it to kill dangerous microbes, removing the air from a container and sealing the food product in the it. Since then, food technology has made tremendous progress. However, the feats of food technology also had its negative effects.

Publication of the book, *Silent Spring* by Rachael Carson (1962) was a wake up call to all who did not foresee negative effects of pesticide residues in foods on human health. Though foods were being irradiated to increase its shelf life, soon it was discovered that irradiation may have bad effects on human health. Laxity of proper quality controls in processed foods and the problem of adulteration were noticed quite frequently. Reported cases in US, suggest that presence of *Salmonella* bacteria in chicken products caused food poisoning on a number of occasions. Statistics would tells us that about 9000 people die of food related illnesses in the US despite their stringent food laws. The reported and unreported cases of food poisoning in India would certainly be quite large. Nutrition awareness is an another dimension to the food we eat. While excessive

consumption of fatty foods can leads to obesity and heart related problems, foods low on fibre-content reduce the body's ability to flush out unwanted fat from the body, and can cause constipation. Moreover, there are many other nutrients that one needs to consume for a balanced physical and mental growth of a person[4]. Taking these things into account, a need was felt that proper food laws be enacted that guarantee production and packaging of safe and nutritious foods.

A real boost to address these concerns was received from quite unlikely quarters. In the 1960's, National Aeronautical and Space Application (NASA) Center was looking for a way to guarantee that the food for astronauts on space flights was totally safe. The prospect of astronauts suffering from food poisoning during a mission was just unthinkable. They gave the task of producing Zero-Defect food to the Pillsbury Corporation who responded by developing the HACCP system. Within two years of the first moon landing, Pillsbury corporation started implementing HACCP concept in its food processing plants. From this original model has sprung most of the modern thinking about food safety, whereby one systematically looks for potential risks and then identify appropriate control and monitoring systems, concentrating on those deemed critical to the safety of the product. Advantage in doing this is that control is transferred from end product testing (i.e. testing for failure) to monitoring the design and manufacturing of foods (i.e. preventing failure). There will, however, always be a need for some end product testing, particularly for on-going verification of the HACCP process.

Lately, realizing the importance and usefulness of quality control in the food manufacturing process itself, in 1993, CAC recommended adoption of HACCP guidelines to food manufacturing processes. The recently signed WTO agreement on SPS makes it mandatory to for all to implement the CAC guidelines in order to protect their human, animal and plant life or health, which may directly or indirectly affect international trade. It must be remembered that while CAC

recommendations are only suggestions, WTO agreement guidelines are mandatory. Taking the cue from CAC and WTO, both US and the European Community (EC) have incorporated HACCP implementation in their domestic food laws.

3. Theoretical Background

There has been a considerable interest in quality management since the 1980s. And, despite the voluminous writing on quality management, only limited attention is paid to defining exactly what is meant by the term *quality*. Garvin (1988) admits, "Quality is an unusually slippery concept, easy to visualise and yet exasperatingly difficult to define." He has identified five major approaches to the definition of quality. Among them, the two important ones are the user-based approach and the manufacturing-based approach. User-based approach, expressed in terms of *ideal points* in marketing literature, defines quality as the precise combinations of product attributes that provide the greatest satisfaction to a specified consumer (Kotler, 1971). However, this view is an idiosyncratic and personal view of quality that is highly subjective (Garvin, 1984). The manufacturing-based definitions, however, emphasize more on the supply side. For example, Crosby (1979) identifies quality as conformance to standards and specifications, and Juran (1989) defines it as fitness to use. Conformance to requirements is of prime concern in these definitions.

HACCP system, is in conformity with the manufacturing-based definitions, in that a 'well-made' Baskin Robbins ice-cream is a high quality dissert, as is a 'well-made' kulfi sold at a street corner. While in Juran's definition, safety is the one of the important dimensions of quality, safety is the overriding consideration in the HACCP system. Therefore, Juran's concept of quality comes closest to the meaning of quality implied in the HACCP system. An immediate question that may come in the minds of Indian food processors is: 'Is the investment in HACCP worth it?' Mazzocco (1996) endorses the cost-of-quality (COC) and Quality is free notions of Juran and Crosby

respectively for the food processing industry. One such study has been carried out by Sonka, Doehring and Hofing (1994). The essence of the argument is that cost of lost sales, inspection, rework and disposal usually exceeds the cost of establishing a quality management system. In economics literature, the problem is addressed in terms of incentive-compatibility constraint (Tirole, 1990). In equilibrium, one time profits earned by producing low quality and losing sales thereafter would be less than the present discounted value of producing high quality product all the time.

Mazzocco argues that HACCP system applied in a framework of continuous improvement can reduce both the common causes and the special causes of quality variation as propounded by Deming (1982, 1986). Deming used statistical process control to distinguish between special and common causes of quality variation. Though the statistical process control concept need not apply to all food manufacturing processes, the essence of the concept is very much applicable[5]. The special causes of variation, also referred to as systemic variation, can be controlled through process control by methods such as imparting training to the workers and checking for poor lot of incoming materials. The common causes of variation, also referred to as random variation, can be controlled by process improvement, ergonomics, and management's long-term interaction with inbound and outbound logistics in communicating quality requirements to suppliers and quality features to immediate customers. The benefits of communicating quality management practices to suppliers and customers were recognized by International Organization of Standards (ISO). In 1987, it promulgated a series of ISO 9000 standards certification to enhance trade between EC members and those wishing to do business with them. Such certification mechanism lowers search costs for purchasing materials and services as well as lowers marketing/sales costs in communicating the nature of the quality management system in place. HACCP does exactly that for food safety assurance. The difference is that getting ISO certification is voluntary, whereas HACCP certification

has become mandatory for international trade in food products. The HACCP certification programme has been developed in 1995, by US based National Sanitary Foundation (NFS), one of the oldest organizations with experience in public health, and its network members such as Quality Assurance Services (QAS) in Australia (Dougherty, 1999). Apart from this there are private HACCP consultants which help food processing firms chalk out their HACCP system to receive certification.

4. The HACCP System

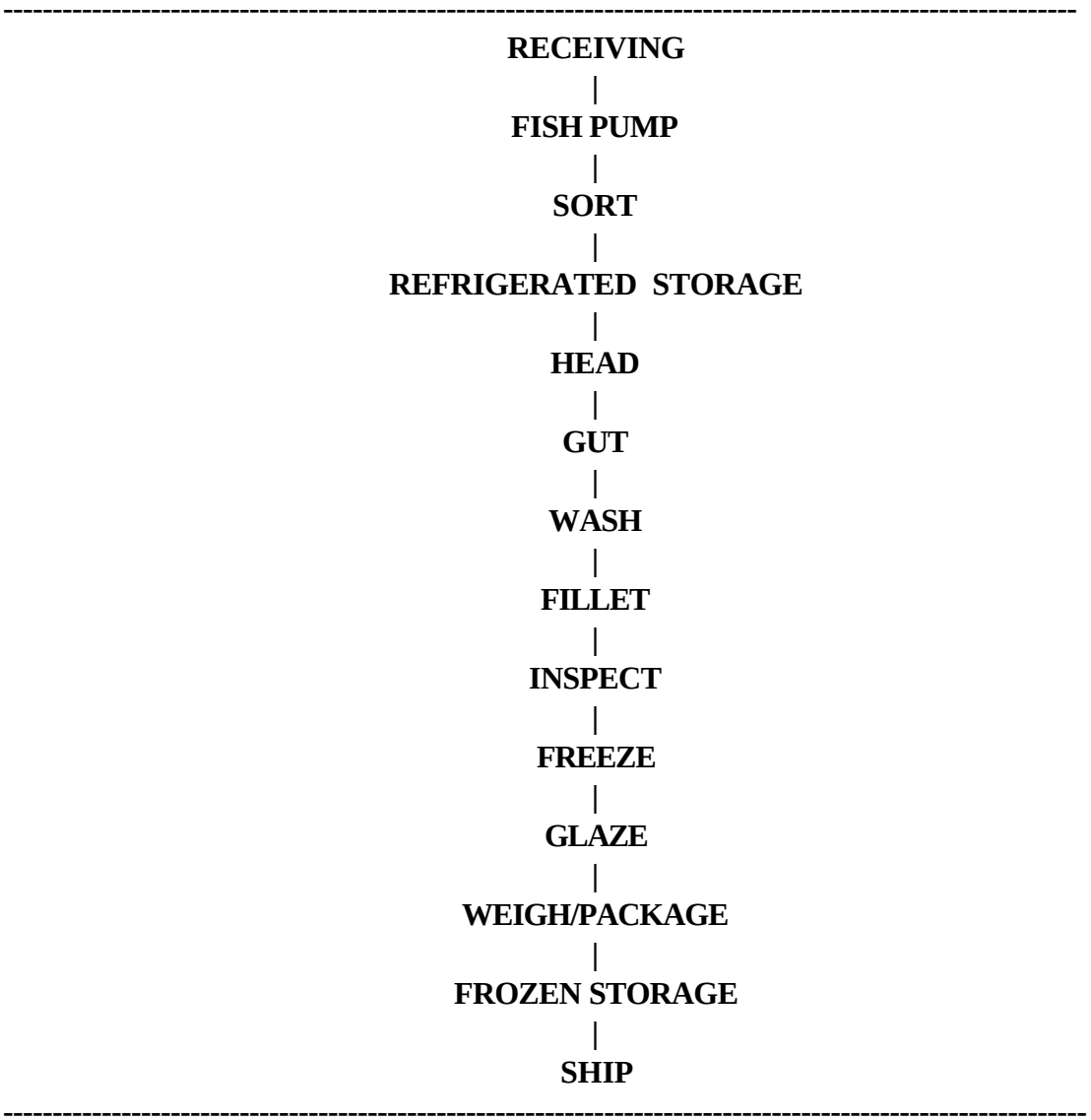
HACCP is a management system based on logical, scientific approach to controlling safety problems in food processing in a timely manner. By using HACCP, control is transferred from end product testing (i.e. testing for failure) to the design and manufacturing of foods (i.e. preventing failures). HACCP is product specific and plant specific, and therefore, a unique plan has to be chalked out for each product and/or process. In Principle, HACCP can be applied throughout the food chain, starting from the primary producer to final consumer. Here, I present a generic plan for a typical food processing plant (USDA, 1997 and FDA, 1997). There are five preliminary steps and 7 HACCP principles that completely describe this system.

Preliminary Steps

First step is to have full commitment and involvement of management and the workforce. Management must form an active team of managers, microbiologist, agronomists, public health scientist, food technologist, veterinarians, production personnel, and/or medical experts depending upon the complexity of processing. Second, the HACCP team must specify the name of the product, how it is to be used, the type of packaging it requires, what is its expected shelf life, what are its labelling instructions, where will it be sold, and how is the product to be distributed[6]. Third, a

complete list of ingredients used must be made, and a process flow diagram be prepared that identifies all the steps under the control of the establishment. A sample flow diagram for salmon processing is given in Figure 1. Finally, the team must ensure that regulatory requirements for sanitation standards, and good management practices (GMP) covering operating procedures and equipment maintenance are adhered to.

Figure 1: Flow Diagram for Salmon Fillets Processing*



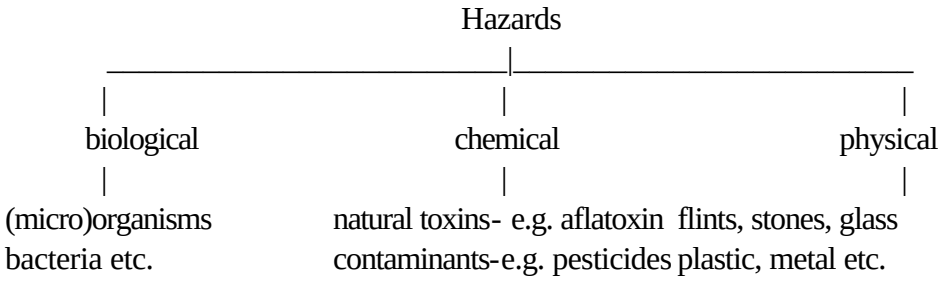
* Figure adapted from FDA (1998)

The Seven Principles

Having taken the preliminary steps, the team is ready to apply the seven principles that produce the HACCP plan best suited to a plant or a process.

Principle 1: Conduct Hazard Analysis

A food safety hazard is a property that may cause a food to be unsafe for human consumption. Essentially, there are three types of hazards in food:

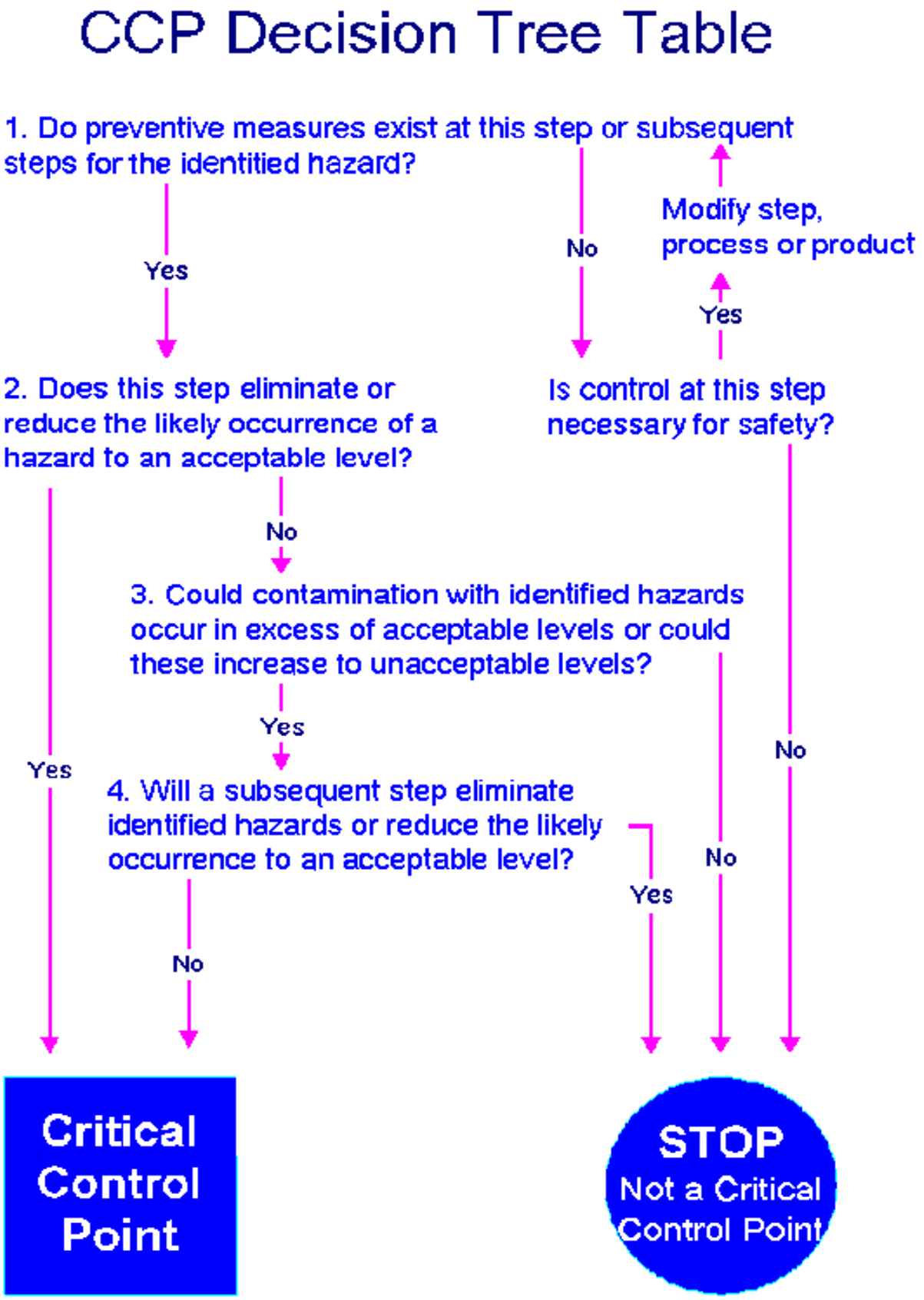


The HACCP team will at this stage, identify the potential hazards at each step in the process flow diagram, and, identify any preventive measures available. For example, any product that uses groundnuts, it is necessary to check for naturally occurring aflatoxin[7].

Principle 2: Identify Critical Control Points

A critical control point (CCP) is defined as a point, step or procedure at which control can be applied and a food safety hazard can be prevented, eliminated or reduced to acceptable levels. A CCP decision tree is used to assess each step in the process to determine whether it is a critical control point. Figure 2 shows a typical CCP decision tree (FDA, 1998). The decision tree is derived from that developed by the National Advisory Committee on Microbiological Criteria for Foods (NACMCF, 1992). Using the decision tree for each step in the process, the team would write down the hazards, the preventive measures available, and the critical control points.

Figure 2: CCP Decision Tree, adopted from NACMCF (FDA, 1998)



Principle 3: Set Critical Limits for Preventive Measures Associated with Each CCP

The critical limits are the maximum and minimum values within which a physical, biological or chemical hazard must be controlled at a CCP to prevent, eliminate or reduce the occurrence of an identified safety hazard to an acceptable level. The HACCP team has to come up with such limits based on regulatory requirements, scientific literature, experimental studies and/or expert opinion, and prepare a chart for the critical limits[8] Depending upon the product and the process, the critical limits will be based on parameters such as:

- Time/temperature
- Humidity
- Water Activity
- pH levels
- salt concentration
- Chlorine level

Principle 4: Establish Monitoring Procedures

Monitoring is a sequence of measurements to assess whether a CCP is under control and to produce an accurate record for future use and verification. Monitoring can give signals as to whether or not system is losing control. E.g., if the pH levels in milk are steadily rising though within the critical limits, action has to be initiated to prevent this trend from exceeding the critical limit. Monitoring can be continuous or discrete. Automatic time/temperature gauges can facilitate continuous monitoring, however, the gauge itself should be checked for accuracy at fixed time intervals. For non-continuous monitoring such as visual examinations, ingredient specifications etc., the HACCP team must ensure that frequency of monitoring is enough and random to ensure that hazard is under control. For some processes, statistically based sampling may be used here. Monitoring cannot take place efficiently unless the team clearly identifies the persons responsible for

monitoring. Further, team should ensure that the persons at the job understand the importance of monitoring.

Principle 5 Establish Corrective Actions

Corrective actions are the procedures to be followed when a deviation occurs, where deviation is a failure to meet the critical limits. HACCP is a pro-active system, in that the team should determine in advance what it will do when the critical limits are not met at a CCP. The employees must be trained to take timely corrective actions, and they must sign the corrective action documentation. All corrective actions cannot be anticipated. An unlisted corrective action should be incorporated into the corrective action document. The corrective action will consist of: decision regarding disposal of non-complying material, correcting the cause of deviation, demonstrating that CCP is once again in control, and, finally, maintain record of the corrective action.

Principle 6: Establish Record Keeping Procedure

HACCP attached great importance to record keeping. The records must be kept in an orderly manner which will include information on title and date of record, product identification, critical limits, time of observation, and, finally, the records must be signed by the monitoring employee and the reviewer to maintain accountability. Such a complete and accurate record keeping is helpful in more than one ways: First, records serve as a documentation of a firm's compliance with HACCP plan. Second, it allows to trace history of an ingredient, a process or a product if there is a problem., and, third, well-maintained records are good source of evidence against potential lawsuits against the firm.

Principle 7: Verification and Validation of the System

After the HACCP plan is put in place, the team should verify if it is working the way it was expected to. The HACCP team should check for calibration of process monitoring instruments, and

make sure that employees are keeping specific, accurate and timely records. Internal auditing must be conducted once every six months. Moreover, the team has to validate the norms set in the HACCP plan by referring to scientific literature, product testing results, experimental research results, and, of course, regulatory requirements. This completes the HACCP system plan. A HACCP plan developed in this manner, has to be audited by a certifying agency before and after its completion. A firm will receive HACCP certification only upon successful completion of the audit. Thereafter, the certifiers will do auditing of the HACCP plan every six months.

5. Concluding Remarks

To recapitulate, food products form an important component of consumers' basket. Food is important for material pleasure as well as for sustained healthy life. Poor food quality affects one's health, and, at times, the effects could be fatal. Therefore, maintaining high food quality is very important. This fact has been recognized internationally by organizations such as CAC and WTO. Even from producers' point of view, maintaining high quality can be viewed as a competitive strategy to stay ahead of others in the marketplace. With the signing of WTO agreement on SPS measures, this has become even more evident for export competitiveness. In this context, employing HACCP, a management system for food safety, becomes essential for improving quality of domestically produced food products, and stay competitive both in the domestic and export market. At this time, only a handful of food processing companies are employing HACCP in their plants. Most of them are taking help of foreign consultants to set up their HACCP plans, and, their HACCP plans are also being certified by foreign agencies.

Therefore, there is a need to understand the HACCP system, indigenise it, and develop HACCP plans to suit the diverse range of domestically produced food products. Also, majority of

the food processing firms need to be educated about HACCP certification, and its potential as a competitive strategy. This paper is an attempt to initiate this process. Here, I have made an effort to give a comprehensive view of the issues related to food safety and HACCP. The historical development in food safety issues and its culmination in HACCP system provides a milieu in which food processing firms will have to operate. The actual description of the system shows that it is a practical, science-based, and logical system; once it is in place it is not difficult to maintain. The theoretical background would assure the industry of the soundness of the HACCP system. Moreover, it provides support, albeit theoretical, to the claim that HACCP need not be a costly affair. In this regard, enterprise level case-studies may be conducted to understand the effectiveness and potential of HACCP as a competitive strategy.

Footnotes

1. As a result of the Dropsy cases, fall in sales of mustard oil was of the magnitude of several crores of rupees (FE, 1998).

2. While Oakland (1993) claims that quality is the most important of the competitive weapons, Wilkinson (1998) regards 'quest of quality as essentially a search for competitive advantage.'

3. A modest beginning to introduce HACCP in the food processing industries has been made by Bureau of Indian Standards (BIS) in January 1998. It still depends on foreign certifying bodies for assistance.

4. Even for a developing country, apart from food security, nutritional security is also very important, for lack balanced diet too can cause permanent physical or mental disabilities, particularly in the early years of a person's development.

5. For example, if the moisture content in butter exceeds the minimum and maximum tolerance levels, this special cause for variation could be due to worker's oversight or lack of training. However, the variability within the tolerance levels can be reduced if moisture content was controlled to a large extent in the previous stage or there is some improvement in the machine itself.

6. For example, milk in polythene bags has to be stored at certain temperature all along in the distribution chain, a factor many times forgotten in India. If not stored at proper temperature, microbe levels in milk rise to dangerous levels. And, if temperatures cannot be maintained at a certain level, clear labelling instruction to boil the milk before use must be given..

7. The US requirement for aflatoxin presence in groundnut is much stricter than the levels occurring in Indian groundnut. This can be a potential non-trade-barrier, unless our scientists are able to show that the aflatoxin levels occurring in Indian groundnut are safe.

8. A firm/HACCP team may decide on critical limits that are different than the regulatory requirements. According to SPS agreement, if the regulations of the importing country are stricter, then the exporting firm will have to assure, based on sound scientific data, that the result produces safe food product. This has the potential for creating non-trade-barrier.

References

CAC (1996). *FAO/WHO Food Standards*, Rome, Italy: FAO

CP (1997). "Sudesh Seafoods," Capital Market, June 29, 1997, p. 70

Carson, R. (1962). *Silent Spring* Boston, MA: Houghton Mifflin Company.

Crosby, P. B. (1979). *Quality is Free,* New York: McGraw-Hill.

Dougherty, R.A. (1999). "The Systems Approach and its Increasing Importance to Food Production, Processing and Trade," paper presented at the *National Seminar on Quality for Leadership: Challenges Before Indian Food Processing Industry,* New Delhi, India, January 28.

Deming, W.E. (1982). *Quality, Productivity and Competitive Position*, Centre of Advanced Engineering Study, Cambridge, MA: MIT.

Deming, W.E. (1986). *Out of the Crisis*, Cambridge: Cambridge University Press.

EFP (1997). "US to Impose HACCP Norms on Indian Herbal Products," Express Farma Pulse, November 27, p.1.

ET (1997). "Nestl.e India Plans Overhaul of Quality Management System," Economic Times, April 26, 1997, p. 8

FDA (1997). *HACCP: A State-of-the-Art Approach to Food Safety*, U.S. Food and Drug Administration, FDA Backgrounder, August 17.

FDA (1998). Fish and Fishery Products hazards and Controls Guide, Center for Food Safety and Applied Nutrition, U.S. Food and Drug Administration, January. Available at the internet site- http://vm.cfsan.fda.gov/~dms/haccp-2v.html

FE (1998). "Rajasthan's Mustard Oil Trade Comes to a Grinding Halt," Financial Express, Sept. 7.

Garvin, D. (1984). "What Does Product Quality Really Mean?" *Sloan Management Review*, Fall, pp. 25-43.

Garvin, D. (1988). *Managing Quality,* New York: Free Press.

IE (1998). "HC Judge to probe dropsy cases," Indian Express, September 10, 1998.

Juran, J.M. (1989). *Juran on Leadership for Quality,* New York: Free Press.

Kotler, P. (1971). *Marketing Decision Making: A Model Building Approach*, pp. 491-497, New York: Holt, Rinehart and Winston.

Mazzocco, M.A. (1996). "HACCP as a Business Management tool," *Amer. J. of Agr. Econ.*, August, pp. 770-774.

NACMCF (1992). "Hazard Analysis and Critical Control Points System," *Intl. J. of Food Micr.*, Vol 16, March 20, pp. 1-23.

Oakland, J.S. (1993). *Total Quality Management: The Route to Improving Performance*, 2nd edition, London: Butterworth-Heinemann.

Sonka, S.T., T. Doehring, and S. Fofing (1994). "An Economic Assessment of Enhansing Quality Managementin the Pork Industry," *Pork Chain Quality Audit*, Des Moines, IA: National Pork Producers Council, April, pp. 170-223.

Tirole, J. (1990). *The Theory of Industrial Organization*, Cambridge, MA: MIT press, ch 2.

USDA (1997). *Guidebook for the Preparation of HACCP Plans*, Food Safety and Inspection Service, Washington, D.C., USA: United States Department of Agriculture, April.

Wilkinson, A., T. Redman, E. Snape and M. Marchington (1998). *Managing with Total Quality Management: Theory and Practice*, London: Macmillan Press Ltd.

WTO (1995). *The Results of the Uruguay Round of Multilateral Trade Negotiations - The Legal Texts*, reprint, Geneva: WTO.