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Food safety control system in Taiwan—the example of food service sector

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Abstract

The World Trade Organization's Sanitary Phytosanitary Agreement facilitates the scrutiny of the benefits and costs of country-level regulatory programs and encourages regulatory rapprochement on food safety issues. In Taiwan, food safety control system (FSCS), which includes good hygienic practice (GHP) and hazard analysis critical control point (HACCP), has been developed to embody principles of safe food processing. From 1998 to 2001, the total number of factories that supply box meals and food service sectors that implemented HACCP was 139 and 46, respectively. Taiwan's FSCS is fully compatible with international codes adopted by CODEX alimentarius and will play an important role in maintaining the safety of foods not only in domestic market but also in international trade. This paper illustrates the development and implementation of FSCS system for the food service sector in Taiwan, which sets a good example for the country-level regulation on food-safety system, especially for those factories that export their agricultural products.
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1. Introduction

For making quality food products, food safety is the major concern besides sensory properties of that product. Food-borne outbreaks have been a serious problem in many countries. In Taiwan, for instance, data from incidences of food-borne disease outbreaks have been collected since 1981 by the Department of Health, The Executive Yuan (http://www.doh.gov.tw). From 1981 to 2000, a total of 2112 outbreaks have been reported. In these outbreaks, *Vibrio paraheamolyticus* (664 cases) was the main cause, followed by *Staphyloccocus aureus* (142 cases) and *Bacillus cereus* (114 cases) (http://www.doh.gov.tw). The data also showed that the main food products and places that caused the outbreaks were cooked foods (including box meals) and restaurants with 137 and 452 outbreaks, respectively (http://www.doh.gov.tw). In the processing and food handling point of view, the top five causes for food poisoning in

Taiwan are: (1) cross-contamination between raw materials and cooked foods; (2) insufficient cooking treatment; (3) keeping foods too long at room temperature; (4) contaminated by infected food handlers; and (5) insufficient equipment cleaning (http://www.doh.gov.tw). The foods that most involved in the food-borne disease outbreaks is cooked foods (including box meals) (http://www.doh.gov.tw). Box meals are a very common type of lunch in Taiwan, which consist of cooked rice, meats and vegetables, and are convenient sources for student and customers as lunches. To lower the risk of food-borne outbreaks associated with box meals and restaurants, hazard analysis critical control point (HACCP) system was introduced to the factories making box meals and food service sector by the Health Department (Taiwan Provincial Government) since 1997. The HACCP is now firmly established worldwide as the means to insure food safety. For international trade, implementation of HACCP systems is becoming an important component of safety assurances for food products sold in the worldwide market. Several countries, including Taiwan, are considering mandating or have mandated HACCP requirements into their national legislation with particular sectors that need to be implemented with

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the HACCP system (Fang & Jeng, 2002). In this context, we use box meal factories and food service sectors as examples to discuss the development and implementation of FSCS in Taiwan.

2. Government activities and recent regulatory actions

The Health Department of Taiwan Provincial Government (HDTPG) has begun HACCP implementation works in box meal factories and food service sectors since 1997. Although HACCP is a worldwide recognized food safety management system, it is voluntary for the food industries in Taiwan. To introduce the HACCP system to Taiwan's food industries, free implementation was provided by HDTPG in 1997 to certain qualified meal box factories that are willing to participate in the program. HDTPG provides not only the funding for HACCP implementation, but also organized guidance teams that includes members from government, universities, research institutes and industries. In July 1997, HDTPG published the first version of "guidance guidelines for implementation of HACCP system in food services industries of Taiwan province" which became the main foundation for the whole guidance procedures. Since the reorganization of Taiwan government structure in October 1998, the HDTPG was integrated in to the Department of Health (DOH), The Executive Yuan, Republic of China. From 1999 to 2001, free guidance and implementation of HACCP program was also provided by the Department of Health (The Executive Yuan) and the basis of the HACCP implementation procedure was amended to "guidance guidelines for implementation of HACCP system in food services industries". From 1998 to 2001, the total number of box meal factories and food service sectors that implemented HACCP was 139 and 46, respectively (Table 1). The DOH will provide, beginning 2001, no free guidance and implementation of HACCP system. Food sectors will have to pay for their implementation and auditing of the HACCP system (Fang & Jeng, 2002).

On February 9, 2000, the latest version of "law governing food sanitation" was amended and promulgated. The major change in the law regarding food safety in article 20, which stipulates: *The operation sites, facilities or quality assurance system used by a food business for manufacturing, processing, preparing, pack-aging, transporting, storing, and selling foods or food additives shall meet the food good hygienic practices (GHPs) code prescribed by the central competent authority; where the food business belongs to a designated category designated by the central competent authority in a public notice, the food safety control system (FSCS) prescribed by the central competent authority shall also be observed*, which means that after February 9, 2000, GHP becomes mandatory for food industries in Taiwan. In addition, FSCS, which includes GHP and HACCP, will become mandatory for food industries that belong to a particular category designated by the central competent authority. On September 7, 2000, Department of Health published the final rule of "food GHP". In order to follow the requirement in the law, the "guidance guidelines for implementation of HACCP system in food services industries" was mandated to "guidance norms for implementation of FSCS in food services industries" in February 2001.

3. Food safety control system

3.1. Food good hygienic practice

Before the "law governing food sanitation" was promulgated on February 9, 2000, the prerequisite programmes for implementation of HACCP plan in food factories such as box meal factories and food service sectors were sanitation standard operating procedures (SSOP) and standard operating procedures (SOP), respectively. Current "law governing food sanitation" requires that food GHP must be implemented in food industries and food service sectors. Based on the "guidance norms for implementation of FSCS in food services industries", there are nine SOP for food manufactures and food service sectors. Most of the SOPs are similar between these two food sectors, except in the SOP for processing and quality control (Table 2) (DOH, 2001). These SOPs must be written and must describe daily procedures that will be conducted before and during operations to prevent direct product contamination or adulteration. In addition, the SOPs also include the frequency at which each procedure will be done. The SOPs in GHP must be signed and dated by an official with overall authority on-site or a higher-level official of the plant. For initiation and modification, the SOPs must be signed and dated. Microbiological testing, including total aerobic count, coliform and *E. coli*, is often be done to ensure that each particular SOPs achieve an acceptable level of performance in controlling microbial hazard.

3.2. HACCP program

HACCP is a comprehensive program that covers input materials, productions, processing, final products

Table 1
Number of box meal factories and food services sectors implemented with HACCP system in the years between 1998 and 2001

Year	Box meal factories	Food service sectors
1998	20	0
1999	47	25
2000 and 2001	72	21
Total	139	46

Table 2
SOP for food manufactures (box meal factories and ready-to-eat foods manufactures) and food services sectors

Food manufactures	Food services sectors
SOP for sanitation management:	*SOP for sanitation management*:
1. Building and facilities	1. Building and facilities
2. Cleaning of equipment and utensils	2. Cleaning of equipment and utensils
3. Sanitation management of workers	3. Sanitation management of workers
4. Management of chemicals and detergents	4. Management of chemicals and detergents
5. Waste product treatment and	5. Waste product treatment and
6. Person responsible for sanitation management	6. Person responsible for sanitation management
SOP for processing and quality control:	*SOP for processing and quality control*:
1. Purchasing and receiving	1. Purchasing and receiving
2. Contract review	2. Contract review
3. Food additive management	3. Pretreatment
4. Process design	4. Processing or cooking
5. Prevention of cross contamination	5. Serve
6. Prevention of chemical and physical hazards	6. Process design
7. Measurement of samples	7. Prevention of cross contamination
8. Sample holding	8. Prevention of chemical and physical hazards
	9. Verification of product
SOP for storage	SOP for storage
SOP for delivery	SOP for delivery
SOP for testing and measuring	SOP for testing and measuring
SOP for customer complain	SOP for customer complain
SOP for product recall	SOP for product recall
SOP for documentation	SOP for documentation
SOP for education and training	SOP for education and training

and personnel at critical control points. In many cases, HACCP plan will not be successfully implemented without any "prerequisite programmes", such as good manufacturing practice (GMP), SOP or GHP. For food sectors that wish to establish HACCP system, they must apply the principles of HACCP to identify any significant hazards and develop an HACCP plan to prevent, eliminate or reduce the hazard to an accept-

able level. The required elements for HACCP plans include:

- Scope of the HACCP plan.
- The HACCP team.
- A description of the product and its intended use.
- A description of the process covering all process steps.

Table 3
Qualification of lead auditor and auditor for FSCS in Taiwan

Lead auditor	University faculties	Associate professor or professor in food related department of public or private universities.
		Trained on HACCP principle and application for at least 32 h and has experience in participating HACCP program for at least two years.
		Has experience in HACCP audit for at least four times.
	Experts from industries and research institute	Graduate with at least B.S. degree in the related area of Food Science.
		Has at least three years working experience in food industries and has experience in participating HACCP program for at least two years.
		Trained on HACCP principle and application for at least 32 h.
		Has experience in HACCP audit for at least four times.
Auditor	University faculties	Instructors, assistant professor, associate professor, or professor in food related department of public or private universities.
		Trained on HACCP principle and application for at least 16 h.
		Has experience in HACCP audit for at least four times.
	Experts from industries and research institutes	Graduate who possesses at least B.S. in the related area of Food Science.
		Has at least three years working experience in food industries and has experience in participating HACCP program for at least one year.
		Trained on HACCP principle and application for at least 16 h.
		Has experience in HACCP audit for at least four times.
	Government inspectors	Employees of health department of central or local government, and who is in charge of food sanitation management.
		Trained on HACCP principle and application for at least 16 h.
		Has experience in HACCP audit for at least four times.

Table 4
FSCS follow-up audit checklist

Assessment component	CN[a]	Ma[b]	Mi[c]	SN[d]	Comments
(1) *SOP for sanitation management in GHP*					
(A) Practice					
(a) Noncompliance with SOP for sanitation management in GHP			( )		
(b) Amendment of GHP content without proper procedures		( )			
(c) Others			( )	( )	
(B) Records (GHP content, monitoring, frequency, corrective action, verification and record taking)					
(a) Records are not updated			( )		
(b) Records are not taken on schedule		( )			
(c) Records are not correct		( )	( )		
(d) Records are not complete		( )	( )	( )	
(e) Records are forgery	( )				
(f) Others			( )	( )	
(2) *SOP for processing and quality control in GHP*					
(A) Practice					
(a) Noncompliance with SOP for processing and quality control in GHP			( )		
(b) Amendment of GHP without proper procedures		( )			
(c) Others			( )	( )	
(B) Records (GHP content, monitoring, frequency, corrective action, verification and record taking)					
(a) Records are not updated			( )		
(b) Records are not taken on schedule		( )			
(c) Records are not correct		( )	( )		
(d) Records are not complete		( )	( )	( )	
(e) Records are forgery	( )				
(f) Others			( )	( )	
(3) *SOP for storage, delivery, testing and measuring, customer complain, product recall control, documentation, and training*					
(A) Practice					
(a) Noncompliance with SOP for storage, delivery, testing and measuring, customer complain, product recall control, documentation, and training in GHP			( )		
(b) Amendment of GHP without proper procedures		( )			
(c) Others			( )	( )	
(B) Records (GHP content, monitoring, frequency, corrective action, verification and record taking)					
(a) Records are not updated			( )		
(b) Records are not taken on schedule		( )			
(c) Records are not correct		( )	( )		
(d) Records are not complete		( )	( )	( )	
(e) Records are forgery	( )				
(f) Others			( )	( )	
(4) *HACCP program*					
(A) Practice					
(a) Noncompliance with critical limit		( )			
(b) Noncompliance with monitoring procedures		( )			
(c) Noncompliance with corrective action		( )			
(d) Amendment of HACCP program without proper procedure		( )			
(e) Amendment of critical limit without proper procedure		( )			
(f) Others			( )	( )	
(B) Records (HACCP team, composition of products and delivery, intended use, process flow diagram, on-side verification of process flow diagram, HACCPs, critical limits, monitoring procedures, corrective actions, verification of the HACCP system, record-keeping system)					
(a) Records are not updated			( )		
(b) Records are not taken on schedule		( )			
(c) Records are not correct		( )	( )		
(d) Records are not complete		( )	( )	( )	
(e) Records are forgery	( )				
(f) Others			( )	( )	
(5) *Microbiological quality*					
Coliform and *E. coli*		( )			
(6) *Building and facilities*					
(A) Process flow is not conform to those described in the manual	( )				
(B) Building and equipments are not well maintained		( )	( )	( )	

Table 4 (*continued*)

Assessment component	CN[a]	Ma[b]	Mi[c]	SN[d]	Comments
(7) *Others*					
(A) The HACCP team members do not take additional 8 h HACCP relative training course each year		( )			
(B) Do not have qualified food sanitation management personnel	( )				
(C) If there is any change of the food sanitation management personnel, government authority should be notified within one month	( )				
Total	CN[a]	Ma[b]	Mi[c]	SN[d]	Comments

[a] CN: Critical noncompliance.
[b] Ma: Major noncompliance, three minor deficiencies can lead to one major noncompliance situation.
[c] Mi: Minor noncompliance.
[d] SN: Slight noncompliance.

- Hazard analysis and identification (covering those biological, chemical and physical hazards likely to occur).
- List of critical control points identified.
- Critical limits for each control factor at critical control points.
- Monitoring procedures.
- Corrective action to be taken when deviations from critical limits are observed.
- Verification procedures including validation, ongoing review and revalidation when changes to the process occur, and the frequency of verification procedures.
- Record-keeping system.

4. Food safety control system assessment

The main purpose of FSCS, including HACCP assessment, is to verify whether the food industries are able to manufacture and/or distribute quality product safely. For food industries, they need to carry out in-house HACCP assessment using internal resources and/or an external source of expertise. Based on "guidance norms for implementation of FSCS in food services industries", the audit team, which includes government inspectors, university faculties, experts from research institutes and food industries, has the responsibility to ensure that the HACCP plan used by the food industries or food service sectors is properly designed and implemented (DOH, 2001).

4.1. Audit program

4.1.1. Qualification of auditor
The qualification of auditor is shown in Appendix A.

4.1.2. Audit procedures
The verification of HACCP implementation includes the following activities:

- Preparation.
- Opening meeting.
- Document review: The document review may consist of a preliminary review of the HACCP program with emphasis on the implementation of elements of the system. Records on CCP monitoring, preventative measures, HACCP modification, HACCP verification, and training are often being reviewed.
- On-site verification: The verification is being conducted to assess the effectiveness of the program.
- Closing meeting.
- Assessment report.
- Assessment follow-up.

Both the verification of the HACCP plan and its implementation can be assessed using checklist. These are proven to be necessary and useful tools, which provide a harmonized approach within the inspection agency. Table 4 (Appendix B) shows the example of the checklist that was used during the follow-up audit procedures.

5. Conclusion

Department of Health spent several years promoting HACCP to the food industries and food service sectors in Taiwan. DOH continues to be responsible for developing the regulations, standards, policies and procedures, which are the guidelines for industry compliance. There has been an increase in knowledge and understanding of HACCP and GHP by the food industry in Taiwan. Taiwan's FSCS is fully compatible with international codes adopted by CODEX alimentarius (HACCP 1997a, 1997b) and will play an important role in maintaining the safety of foods not only in domestic market but also in international trade. The guidance and implementation of FSCS provided by the government has set a good model of collaboration among government authority, university faculties and experts from food industry. It has been a good start for box meal factories and food service sectors in Taiwan to build a

strong foundation to develop FSCS into a more effective and efficient one to ensure food safety.

Appendix A

Qualification of lead auditor and auditor for FSCS in Taiwan is given in Table 3.

Appendix B

Table 4 presents the example of a checklist for assessing FSCS implementation.

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