Implementation of Hazard Analysis and Critical Control Points (HACCP) in Egyptair Catering System

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ABSTRACT

The main aim of the airline catering operations is to produce high quality and safe foods. To assure the safety of the food, establishing a system based on a continuous management including total quality management, hygiene and good manufacturing practices, is essential. Accordingly, the development of HACCP system should be examined. The overall purpose of the present study was to document the cost, time, and resources devoted by Egypt Air Company to implement the HACCP system. The study also examined the benefits and barriers that were experienced during the total period of HACCP system development.

The development of HACCP system was assigned to an external consultant (Société Générale de Surveillance Company). The preparation of the company to install the system took place over a period of 54 working days or 432 hours. The cost was affected by the existing hygienic status, the complexity of the operation, the number and the experience of employees involved. In the initial stages, the implementation of the HACCP system required additional resources, technical support facilities and financial inputs to improve the Good Hygiene Practices "GHP" prerequisites.

Keywords: airline catering, HACCP, good hygiene practices "GHP", prerequisite programs

INTRODUCTION

Flight catering is probably one of the most complex operational systems in the world (Jones, 2004). A large-scale flight catering production unit may employ over 800 staff to produce as many as 25,000 meals per day during peak periods. A large international airline company may have hundreds of takeoffs and landings every day from just their main hub. These facts and others such as flight delays make flight catering unlike any other sector of the catering industry (Bata *et al.*, 2005).

The airline sectors could have significant epidemiological problems since occurrences of human health hazards or food poisoning in such establishments occur, primarily, on a massive scale (Martinez-Tome *et al.*, 2000, Sharin & Karen, 2002). Clearly, the implications of a food poisoning outbreak to a business can be significant. Costs could include tracing the source of the outbreak, loss of business through loss of contracts with airlines, and paying compensations to airlines and passengers (Mclearn & Miller, 2007).

Until recently, the major measures used for protection were control of temperature and time and the proper protection of food in a clean manner. Although these measures are still essential, it is apparent that these methods are unable to eliminate food safety problems (Henroid & Sneed, 2003, Jones, 2004). It is now widely acknowledged that traditional approaches, such as end product testing, inspection, and knowledge-based training provision do not provide the necessary controls to cope with modern day hazards (Eves & Dervisi, 2005).

The most effective way to achieve food safety is to focus on prevention of possible hazards and to improve the process (King, 1992). The HACCP system is currently regarded as the best preventive system for managing food safety (Hatakka, 2000). The HACCP system has been indicated as one of the most effective ways to guarantee high quality and safe food (Soriano *et al.*, 2002). However, its success and effectiveness in preventing foodborne diseases and risks to consumer health depend on the correct application of its principles, combined with other programs, which include safety infrastructure and the programs of Good Hygiene Practices (GHP) and Sanitation Standard Operational Procedures (SSOP) (WHO, 2002, Azanza, 2004).

The application of the seven principles of HACCP requires an investment in staff training, structural changes, new equipment, etc. (Panisello and Quantick, 2001). While the application of HACCP is making headway in manufacture sector of the food industry, catering establishments, including airlines, have experienced difficulties in implementing HACCP (Bata *et al.*, 2005).The majority of airline catering establishments do not have staff capable of developing and implementing all the elements of the HACCP system by themselves, therefore they are often supported by external consultants (Mclearn & Miller, 2007).

The cost of a HACCP system for most industries depends not only on the requirements of the system, but also on the improvement of the current status of food safety-related practices (Colatore & Caswell, 1998). Every stage of HACCP system development includes different costs like personnel, training, consulting services, laboratory equipments, product testing and external audit costs (Motarjemi & Kaferstein, 1999).

The overall purpose of the present study was to document the time and resources devoted by Egypt Air Company to implement the HACCP system. Moreover, the study also examined the benefits and barriers that were experienced during the total period of HACCP system adoption. The study also estimated the costs of development, implementation and operation of a HACCP system in EgyptAir catering establishments.

MATERIALS AND METHODS

The data had been collected from primary and secondary sources. For collection of data from primary sources, the study utilized two types of interviews: Firstly, the study used the structured personal interviews technique with almost key food catering executives in EgyptAir organization to verify the scale and scope of the food process flow and production facilities. Furthermore, the interview shaded the light on the different menus and strategies used for food production. Besides, whenever necessary the data had also been collected from the EgyptAir documents and reports. Interview was conducted with executives of the EgyptAir organization in March 2007.

Secondly, the study utilized the narrative interview technique in order to identify the conditions and level of services provided by the external consultant, namely, Société Générale de Surveillance Company (SGS), dealing with EgyptAir organization. Using the results of this interview, a cost-benefit analysis of the HACCP program for the investigated company could be assessed. A cost-benefit analysis is used to explore whether the HACCP application is economically feasible or not. This interview technique relied on a series of open-ended questions that asked for the company's experience with implementing and evaluating HACCP program and the costs and benefits of the HACCP system.

RESULTS AND DISCUSSION

EgyptAir case study

EgyptAir was founded as a private company in May 1932, becoming the seventh airline in the world. During the past 75 years, the company has expanded its network to cover more than 80 destinations worldwide and become one of the leading airlines in Africa and the Middle East. EgyptAir now operates more than 600 weekly flights from Cairo and several other Egyptian cities to more than 66 domestic and international destinations across the Middle East, Asia, Europe, Africa and North America.

Scale and scope of meals production facilities

EgyptAir production units produce 9 million meals per annum, which is equivalent to 25,000 meals per day. In making this estimate, a meal is considered to be the contents of an individual tray served to a customer and, as such, it can be anything from coffee and biscuits to a full meal. In a typical day, EgyptAir production units produce all the materials required for up to 100 flights. For that, over 800 employees may be needed.

Process flow

Food preparation planned to allow a workflow, whereby the food is processed through the flight kitchen from the point of delivery to the point of assembly on the tray ready for distribution to the aircraft with the minimum of obstruction.

Egypt Air production kitchens

EgyptAir production kitchen normally use a modified cook-chill system for the preparation and storage of cooked items. For some flights, frozen meals may be required, for example, where an aircraft is carrying food for the return leg. The production areas may be in operation 16-23 hours per day, with a short close-down for cleaning opera-

tions. Flexible cooking technology based on high-capacity cooking equipment (Bratt pans, combination ovens, convection ovens, pressurized steamers, etc.) allow a range of hot entrees to be produced from the same processing area. After foods are cooked, they are rapidly chilled to below 5°C and then stored below this temperature until required for packaging.

The basic elements of the flight kitchen can be arranged based on cold wet areas, cold dry areas, hot wet areas, hot dry areas, and dirty areas (Table 1).

The production area is divided into a number of segregated areas, each with its own temperature-controlled storage to hold materials that have been processed and waiting for the next processing operation.

EgyptAir menus and food product strategies

Establishing which food and dishes are to be served on board the aircraft is one of the basic planning functions. Airlines often stipulate exactly what food is to be served. This includes the precise combination of dishes, portions, sizes, etc. for each route. The basic principles which should be taken into consideration include:

- The function of the meal in relation to the flight patterns, i.e. which day part is covered (breakfast, mid-morning, lunch, mid-afternoon, evening meal, overnight).
- The size of the tray or bag, overall presentation and dish specification in relation to the routes being flown and aircraft being used.
- The various types of passengers, establishing that adequate provision is made for "special meals".
- The capabilities of the flight kitchen, its labor and equipment in relation to routes flown.
- The time in the year.
- The number of courses each airline requires, especially certain favourably applicable to the first class.

During morning flights, a smaller, continental-style or 'hot' breakfast may be served instead. For the continental-style breakfast, this may include a miniature box of breakfast cereal, cut fruits, a muffin or pastry, or a bagel. Some airlines offer the choice of 'hot' breakfast meals to the passengers (usually on long haul flights, or short/medium haul flights within Asia), which includes an entrée of pancakes or eggs, and there are muffins or pastry, fruits and breakfast cereal on the side. Coffee and tea are offered as well, and sometimes hot chocolate.

During mid-afternoon, evening, and overnight flights morning flights lunch and dinner can be served. Lunch and dinner may include rice and meat, evening snack (turkey and cheese on toasted French bread with salad and sweet cream cake), mid morning snack (hot croissant and bread roll with a selection of cheese, butter, jams, fruit salad and fresh juice), overnight snacks (cheese, beef, salad, cake and coffee).

The main benefits of applying the HACCP system

The principal benefits from HACCP reported by the company executives are more effective and efficient operations, a higher level of confidence in the safety of the food being produced, and greater customer satisfaction. The company attributed these benefits to HACCP because:

- Training makes the employees more aware of food safety and needed control measures, and empowers them to prevent problems and respond properly when deviations occur.

Table 1: Basic elements of the flight kitchen

Cold wet areas	Vegetables and fruit preparation, butchery (if used), poultry preparation, seafood preparation
Equipment	Washing machines, peeling machine, vacuum tumbler, meat grinder, high speed cutter, juice machine...etc.
Cold dry areas	Cold meat slicing, terrine and pate cutting, garnish production, salad production
Equipment	Slicing machine, cutting machine, modified atmosphere packaging machine, vacuum machine ... etc.
Hot wet areas	Blanching, boiling, poaching, steaming
Equipment	Steam jackets, pressure steamers, combination ovens ...etc.
Hot dry areas	Roasting, backing, grilling, sautéing, cooking, braising, gratinating, frying, emulsifying
Equipment	Convection ovens, frying pans, induction or infra-red ovens, salamander, rice cooker, grills and broilers, griddle plate ...etc.
Dirty areas	Refuse, small equipment cleaning, dish washing ..etc.

- Standard Operating Procedures (SOPs) and other documented procedures enable employees to implement their tasks more consistency and effectively, and this results in smoother operations.
- Continuous monitoring reveals problems quickly and enables prompt correction and continuation of production with less waste.
- Record-keeping reviews make employees more accountable and conscientious about food safety.
- Validation and verification activities provide the management with greater control over the operations.

A narrative interview approach with HACCP consultant

This interview aimed to identify the conditions and level of services provided by processors dealing with EgyptAir. Lack of time coupled with the lack of expertise and skilled personnel led the EgyptAir organization to assign the development of food safety system to a consulting company. The adaptation of an existing and reliable HACCP system, created by a leader in applying the HACCP approach, was considered as the best option under the given circumstances. This consulting firm developed the plan and trained the employees, also providing follow-up services for maintenance of the system. Interview was conducted with executives of the SGS Egypt Ltd. in April 2006.

Cost estimate for HACCP program development

The cost of a HACCP system for airlines companies depends not only on the requirements of the system, but also on the improvement of the current status of food safety-related practices of the hotels. Every stage of HACCP system development includes different costs like personnel, training, consulting services, laboratory consumables, product testing and external audit costs.

The purpose of this section was mainly to document the time, the effort and resources devoted by EgyptAir Company to successfully implement the HACCP system and to report problems that were experienced during the total period of HACCP system adoption. The following section details the cost-benefit analysis of implementing HACCP program for EgyptAir Company and the results are building on information from SGS Egypt Ltd. The company was asked to provide any available information on the costs and the benefits attributed to HACCP system. The information provided by the SGS executives relative to the payments for HACCP qualification and consultancy is summarized in the following section.

The HACCP plan development cost

Based on an analysis of the amount of time required to develop a HACCP plan, information from SGS Company indicated that on average, it takes approximately 69 working days or 552 hours (8 hours/day) to write and develop a HACCP plan for a given firm.

The implementation cost includes the cost of improvement of prerequisite programmes, training cost and cost of operational changes and equipment purchases for compliance with the HACCP requirements. The total cost for improving prerequisite programs and implementing HACCP for the first year was estimated to be L.E. 50,000 (Table 2). The largest portion of this cost was the investments made in operational changes and equipment purchases.

Table 2: The first year costs of a HACCP program

20, 000	Down payments upon signing the contract
	After stage one:
5,000	Diagnostic Assessment and submission of diagnostic report
	After stage two:
5,000	HACCP in-practice training for staff
	After stage three:
5,000	HACCP system design (documentation) and submission of HACCP manual.
	After stage four:
5,000	Implementation and follow up on the HACCP system.
5,000	After performing internal audit on the system
5,000	For induction training courses for staff
Total	50,000 Egyptian Pounds

The investment in materials to initiate the HACCP (thermometers, educational materials, etc.) is ranged from L.E. 1,000 to L.E. 2,000 per unit administered. The process of maintenance (laboratory analyses, registration analysis, review of the HACCP and training) involved disparate investments from L.E. 500 to L.E. 5,000 per month.

Training cost is an important part for the total expenses of the HACCP plan implementation. A training course that an individual attended is on average 3 days or 24 hours (8 h/day x 3 days). Personnel cost was estimated as the product of time spent on training and the average hourly cost of those who developed the HACCP plan. Training course registration fees estimated to be L.E 2,000. In addition, the cost of other expenses like traveling costs, lodging or other incidental costs were considered to be L.E.1000, since they were difficult to estimate. The cost of HACCP training was estimated by the company at the total amount of L.E. 2,000 to L.E. 5,000 per unit administered for implementation for the first three years and null annually for the consequent years. Training of employees resulted in greater awareness and compliance with appropriate personal hygiene and food handling practices. These behaviour changes took time to achieve (Bata *et al.*, 2005). It was obvious that the company recognized the importance of training and its potential positive impact on employees' behaviours.

These results could be used to develop a rough estimate of the costs of developing a HACCP plan for airline catering of $8,000. In addition, based on analysis of the few other cost estimates that were available, information from SGS Company suggested that at least annual HACCP costs are within a range of $1000 per operation if sanitation costs are not required.

Total costs compared to FDA estimates

The FDA (U.S. Food and Drug Administration) (2003) provided cost estimates of HACCP plan development. The cost analysis was represented in two scenarios: one for small operations with no Good Hygiene Practice (GHP) cost and the other for the companies with GHP cost included. Estimates were made for the first year (developing and implementing a plan) and for the second year (operating the HACCP system). For companies with no GHP costs, FDA estimated that the first year costs would be $ 5,600 and the second year costs would be $ 4,000. For companies that needed GHP improvements, first year costs were estimated to be $ 12,400 and second year cost $ 9,900. In addition, based on analysis of the few other cost estimates that were available, information from FDA suggested that at least annual HACCP costs are within a range of $3,000 to $6,000 if sanitation costs are not required.

Time estimate for HACCP program development

Based on an analysis of the time required to develop a HACCP plan, information from SGS Company indicated that on average, it takes approximately 54 working days or 432 hours (8 hours/day) to write and develop a HACCP plan. The period required to develop a HACCP plan was directly related to the complexity of the operations, the scope of activities that included in the estimate for HACCP plan development, and the skills and level of understanding of HACCP system. The SGS Company executives were also asked to report the amount of time that devoted to each of the HACCP regulation including conducting the hazard analysis, staff training, developing a HACCP plan, developing a HACCP records, and developing sanitation procedures and records. The results are summarized in Table (3).

The data presented in Table (3) showed that the most of the time was devoted to the development of the HACCP records, followed by the HACCP plan implementation. Company executives' responses

Table 3: Time devoted to each component of the HACCP system

Type of visit	No. of weeks	No. of visits	No. of days / visit	No. of days / stage
Conducting hazard analysis	4	5	3	15
Developing a HACCP plan	12	6	2	12
Staff training	8	5	3	15
Developing HACCP records	20	9	3	27
Total period for the project	44	25		69

appeared to have devoted an equal amount of time to the development of hazard analysis and staff training on HACCP and food hygiene.

Validation and verification activities

The SGS Company developed evaluation procedures to determine the adequacy of its HACCP system. These procedures became components of its HACCP plans and served to distinguish these HACCP plans from many types of quality assurance programs. There are two principle types of evaluations and each is important to the overall effectiveness of HACCP: Studies to determine the validity of the HACCP plan, and audits to verify that the plan is being properly implemented.

Validation

Validation of the HACCP plan is determining whether the food hazards that are reasonably to occur have been identified, and whether the control measures in the HACCP plan are capable of controlling these hazards. Validation evaluations are conducting by the company during the initial implementation phase when the HACCP plans are being checked to ensure they are functioning as intended. During this phase, the company assesses the adequacy of the critical control points (CCPs), critical limits, monitoring, record-keeping procedures, and corrective actions designate in the HACCP plan. The company reported that several adjustments were made in the HACCP plans as a result of these checks. The amount of time needed to complete this initial validation phase and to fine-tune the HACCP plans usually take 12 weeks.

Verification

The second type of evaluation is auditing the HACCP plan to verify that the HACCP system is functioning according to its design. During the narrative interview, the SGS Company executives demonstrated that properly applied verification audit procedures provided the built-in safeguards that can be effectively substituted for routine products inspection. That is, the company is able to rely on frequent reviews of its HACCP plan, CCP monitoring records, and corrective action records showing that procedures are being implemented to ensure that the final products are safe. The SGS Company performs three types of verification audits:

1. Daily HACCP record review

The first type is the daily review of HACCP system records to ensure that Standard Operating Procedures (SOPs) are being followed, deviations are detected, and corrective actions are being taken as required.

2. Audit of record review

A second type of verification audit is the periodic but frequent evaluation of the HACCP records to ensure that the daily reviews are being done and appropriate follow-up corrective actions are being taken if a critical limit deviation occurs.

3. Audit of system implementation

The third type of verification audit is the in-depth evaluation of the HACCP system to ensure that the prerequisite programs and HACCP plan are being implemented as designed. In some cases, the audits are conducted over a one-year period with different operational departments being audited in different quarters.

Verification records

Verification audits rely to a large extent on records, and the quality of an audit will normally depend upon the quality of the records. The SGS Company found that their HACCP system did not necessarily require more records but did require more focused records that documented specific activities. The information provided concerning this issue is summarized in Table (4).

Table 4: Types of HACCP system records

Type of HACCP System Record	Periods of Record Retention
CCP monitoring records	1 year and 2 year
CCP deviation and corrective action records	1 year and 2 year
Sanitation cleaning record	1 year
Incoming ingredients control records	1 year
Microbial tests	1 year
Staff and employee training records	1 year

CONCLUSION

The study indicated that EgyptAir Company elected to rely on consultants or outside expertise to develop HACCP plans rather than to develop and write their own HACCP plans. This is an indication of the importance of the training efforts needed to provide the tools and information needed for caterers to develop and write their own HACCP plans. This result also indicates that there is insufficient involvement of scientific expertise from the academia and the industry to strengthen the scientific basis for food control decision-making processes.

There are a number of factors that have impeded or delayed the use of HACCP in the investigated company. The lack of in-house HACCP skills and lack of HACCP understanding were identified as the main barriers to its implementation.

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تطبيق نظم تحليل المخاطر و تحديد نقاط التحكم الحرجة (الهاسب) فى قطاع التموين الغذائي بشركات الطيران

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تشكل خدمات الطعام أحد أهم الهواجس التي تشغل شركات الطيران العالمية في إطار سعيها المستمر لإرضاء المسافرين على متن طائراتها بتقديم أفضل الخدمات الجوية والأرضية وفي مقدمتها خدمات الطعام التي تضع لها مواصفات وشروطاً دقيقة لإنتاجها وتضع من أجل ذلك برامج مهنية صارمة وفقاً للمواصفات و المعايير الدولية لصناعة التموين الغذائي. لذا فقد استهدفت هذه الدراسة بصورة أساسية تقييم تجربة تطبيق نظام الهاسب في قطاع التموين الغذائي بشركة مصر للطيران، كما تم إجراء دراسة تحليلية لتكاليف تصميم وتطبيق وصيانة البرنامج لمعرفة مدى جدوى تطبيقه اقتصاديا بشركات الطيران مقارنة بالعائد المتوقع من هذا التطبيق.

وأشارت نتائج الدراسة إلى أن شركة مصر للطيران قد آثرت الاعتماد على الشركات الأجنبية المتخصصة في مجال تصميم وتطبيق نظم الرقابة على الأغذية حيث تم إسناد إنشاء هذا النظام وتطويره لشركة "Société Générale de Surveillance" باعتبارها إحدى المؤسسات الاستشارية العالمية في هذا المجال واستغرق تأسيس هذا النظام بالشركة ٥٤ يوم عمل فعلى بما يوازى ٤٣٢ ساعة تقريبا. وقد أظهرت الدراسة أيضا أن هناك عوامل عديدة أثرت علي التكلفة الإجمالية لإنشاء هذا النظام وتشغيله،من بينها النواحي الصحية الحالية ،وحجم الشركة، بالإضافة إلي كبر حجم التشغيل وعدد العاملين بالشركة وخبراتهم السابقة. وتطلب إعداد البرنامج – في مراحله الأولية – موارد إضافية، وتسهيلات فنية، علاوة علي توفير التمويل اللازم للتنفيذ. وتمثلت الاستثمارات المطلوبة لتنفيذ وتشغيل البرنامج في شراء أجهزة حديثة لقياس درجات الحرارة، وأخري لحفظ المواد الخام وما يتم إعداده من وجبات في درجات الحرارة المناسبة.