RESEARCH ARTICLE

A feasibility plan for implementing FSSC 22000 standard by gap analysing of existing HACCP system and FSSC 22000 standard

W.A.S.M. Wirasagoda[a], D.N. Surige[a], D.K.D.D. Jayasena[a], E.D.N.S. Abeyrathne[a*]

[a]*Department of Animal Science, Uva Wellassa University, Badulla 90000, Sri Lanka*

Submitted: August 15, 2016; Revised: July 25, 2017; Accepted: December 05, 2017
*Correspondence: sandun@uwu.ac.lk

ABSTRACT

Food safety is a scientific discipline, which describes handling, preparation, and storage of food to prevent foodborne illness. In all countries, food is governed by a complex of laws and regulations that set the government's requirements to be met by food chain operators to ensure the food is safe and of adequate quality. Food can transmit diseases from person to person; therefore, food safety is a necessary concept in food industries since it even focuses global consumers. Meat industry is one of the major rapidly developing industries throughout the world. There, major food safety incidences include biological, chemical, or physical hazards. ISO 22000: 2005 international standard specifies the requirements for a food safety management system that involves in interactive communication, system management, prerequisite programmes, and Hazard Analysis Critical Control Point (HACCP) principles. Latest standard for food safety is Food Safety System Certification (FSSC 22000) and it slightly differs from ISO 22000 food safety standard. This study was carried out to identify the gap between existing HACCP system and FSSC 22000 standard and thereby to evaluate the feasibility to fill the gap within the commercial meat processing line. To analyse the gap, solution selection matrix theory was applied. According to that, the most effective solutions were selected from a list of solutions. 37 solutions were suggested to overcome 'not-established requirements' complying with FSSC 22000 standard and the most effective 25 solutions were selected out of those 37 by ranking solutions according to frequency of happening, implementing feasibility and economic feasibility parameters. Total effectiveness was calculated by adding up scores to these three parameters. Finally, using the effectiveness value, priority of solutions was analysed and the most effective 25 solutions were selected to fill the gap and to be qualified for FSSC 22000certification in the factory.

Keywords*: Food safety, HACCP, FSSC 22000, gap analysing, solution selection matrix*

INTRODUCTION

Consumers are becoming more concerned about food safety. According to Marriott and Gravani (2006), major food safety incidents have common characteristics and include biological, chemical, or physical hazards. Over the years, many regional and customised food safety standards have evolved in order to enhance food safety and address the issues raised by manufacturers, suppliers, retailers and consumers (Food Quality & Safety, 2015). In 2001, the International Organization for Standardisation (ISO) started the development of an auditable standard for the food industry, building on the Hazard Analysis and Critical Control Points (HACCP) certification's role in food safety management. But, it was not approved by the Global Food Safety Initiative (GFSI) due to weak prerequisite programmes associated within. In order to overcome this issue, the Publicly Available Specification 220 (PAS 220:2008) was issued in 2008 (Sansawat and Muliyil, 2010).

GFSI agreed that the combination of ISO 22000:2005 and PAS 220:2008 contained adequate content for approval. Consequently, the Foundation for Food Safety Certification developed FSSC 22000 standard, combining ISO 22000 and PAS 220 included some additional regulatory and customer requirements (Sansawat and Muliyil, 2010). According to food safety system certification, those additional regulatory requirements are specifications for services, supervision of personnel in application of food safety principles, specific regulatory requirements, announced but unscheduled audits of certified organisations and management of inputs.

ISO has published a document similar to the PAS 220, a technical specification called ISO/TS 22002-1,which has the same requirements as the PAS 220. It may be used by food manufacturers seeking registration to ISO 22000 (22000-tools, 2010). FSSC 22000 has been developed for the certification of food safety systems of the organisations in the food chain, which process or manufacture perishable animal products, perishable vegetable products, products with long shelf life at ambient temperature, bio-chemical/chemical products and food packaging materials (Foundation for Food Safety Certification, 2013).

The ISO 22000 scheme and the FSSC 22000 scheme differ slightly. ISO 22000 Certification applies to all organisations in the food chain but, FSSC 22000 Certification applies only to food manufacturers (22000-tools, 2010). FSSC 22000 combines the benefits of a business management tool linking food safety and business processes with the ability to meet growing global customer requirements for GFSI recognised supplier food safety system certification. In commercial meat processing plant, which already establish HACCP system and some of ISO 22000 requirements has a possibility to reach the FSSC 22000. Hence, it is essential to consider the complete requirements of both ISO 22000 and ISO/TS 22002-1 to comply with the requirements of FSSC 22000 and to achieve objectives. The main objective of this study was to identify the gap between HACCP system and FSSC 22000 standard and develop a feasibility plan to fill that gap and implement FSSC standard in a commercial meat processing plant in Sri Lanka.

MATERIALS AND METHODS

Problem identification and propose appropriate solutions

The current study was carried out at a leading meat processing factory in Sri Lanka for a period of 12 wks from April to July, 2015. ISO 22000:2005 standard, ISO/TS 22002-1:2009 standard and FSSC 22000:2010 standard were used as main materials. First, the background of FSSC 22000 standard was studied.

FSSC 22000 is a combination of ISO 22000:2005 and ISO/TS 22002-1 standards. Therefore, total requirements of both standards were separately listed. After that, main areas of the company were identified: Production, Laboratory, Chilling rooms, Freezers, Store rooms, Cafeteria, Kitchen, Spice room and finally Loading/Unloading area. Then, a preliminary self-assessment was conducted to check the main areas in the factory against the proposed requirements. Contamination points and problems were marked in each area separately (Table 1). To select the highest scored solution, Solution Selection Matrix, which helps make a decision matrix and evaluates and prioritises a list of options, was used. Firstly, a list of weighted criteria was established and then, each option against those criteria was evaluated (Tague, 2004).

Table 1: Identified contamination points and problems in the factory

Area	Problem
Production areas	
Stuffing products	Sausage showering area is an open area. Cross contamination can happen when exchanging raw or cooked products through that area.
Uncooked products	For trimming and packing, raw meat is sent to a long distance. Cross contamination can take place.
Cold meat and slices	For mincing and tumbling, raw meat should be sent to a long distance. Cross contamination can happen.
Formed products with crumb	After the product is formed, it should travel to a long distance across an open area. This may cause contamination.
Topping products	When raw meat is taken for chilling, cross contamination can happen.
Buffalo wings	After finishing, the product should travel to a long distance across an open area. The product may contaminate.
General	The foot baths are not in recommended size. The corners of the floor should not be sharp; instead, it should be rounded. The drainage line in packing area should be covered or situated in a corner. The doors, which are situated near the packing section should not be opened from palm and fingers. It can be opened by an elbow or by using an automated door. Receiving raw meat should be microbiologically tested before adding to the processing lines.

Then, the factory was checked for identify whether they already established standard's requirements or not.

Table 2: Sample requirement checked for whether it is established or functioning.

Requirement	ISO 22000 Standard	
	Establishment	Functioning
Construction and layout of buildings		
- General requirements	√	√
- Environment	√	√
- Locations of establishments	√	√

Yet "not-established" requirements were identified. Then, the most appropriate solutions were suggested to establish those requirements within the factory. 37 solutions were suggested to improve already established and active requirements by this method. To activate the previously established but not active requirements same method was applied. Then, the requirement list was compared with the proposed solutions (37) to find out how many requirements can be overcome by each solution. It was recorded as a frequency as follows.

Frequency of the solution = No of requirements that can be fulfilled by the solution

Eg. Solution number 01 covers the sausage showering area and fulfills following requirements in ISO 22000 Standard and ISO/TS 22002-1 Standard:

ISO 22000 standard		
3. Resource management		
	3.3. Infrastructure	√
ISO/TS 22002-1 standard		
1. Construction and layout of buildings		
	1.1. General requirements	√
2. Layout of premises and workspace		
	2.1. General requirements	√
	2.2. Internal design, layout and traffic patterns	√
7. Measures for prevention of cross contamination		
	7.2. Microbial cross-contamination	√

This solution can be used to fulfill 5 requirements in the standard. Consequently, frequency of covering the showering area = 5.

Thereafter, the feasibility of the proposed solutions was calculated and the most feasible solutions were selected. Some social media state that, when suggesting solutions for a problem or situation, two or more factors should be considered such as; cost to implement, ease of implementation, ease of maintenance, safety, health, or environmental factors, potential effects on other systems, value to customer and potential problems during implementation (Anon, 2015). Therefore, two types of feasibility analyses were carried out to identify the most feasible solutions. Under this context, two feasibility categories were used: implementing feasibility and economic feasibility.

According to the solution selection matrix theory, a well experienced team is mostly suited to take decisions regarding cost and implementing ability of an action. Therefore, the top management of the company was involved in ranking solutions more accurately. When considering implementing feasibility, the easiness of introduce, maintenance and control of each solution were considered.

According to solution selection matrix theory, the highest number should be given to the highest weighted option and the lowest number should be given to the lowest weighted option (Asq. org, 2015). The proposed solution list comprised with 37 solutions. The highest feasible solution was ranked with the highest value (37) and the lowest feasible solution was ranked with the lowest value (01). When considering economic feasibility, total cost for implementing and maintenance of the relevant solution was considered. By doing feasibility studies the solutions were ranked from 37 to 1 according to their feasibility.

2.2 Establishing implementing feasibility

All solutions were scored according to the implementing feasibility. The highest score was given to highly feasible solution. For example, out of 37 solutions, maintenance of time gap between raw meat receiving to brat pan and semi-processed products removing from the brat pan is the easiest solution to implement. Therefore, the highest number (number 37) was given to that solution.

2.3 Establishing economic feasibility

All solutions were scored according to the economic feasibility.

The highest score = the highest feasibility

When considering the implementation of proposed packaging line and chilling system in the production area was quoted to be the highest cost. Therefore, the lowest number (number 01) was given to that solution. Then, all scores were calculated with respect to each solution and the total score was obtained using solution selection matrix.

Calculating total score

Total score = frequency + implementing feasibility + economic feasibility

Thereafter, the most effective solutions were ranked according to the value of total score.

Eg.

Solution list	Frequency	Implementing feasibility	Economic feasibility	Total score	Effectiveness
Cover the sausage showering area	5	34	10	49	11

RESULTS AND DISCUSSION

Upgrading the systems in food processing factories is vital and essential. Many factories tried to upgrade the system but less scientific approaches have been conducted on this. To check the feasibility of implementing FSSC standard, the gap between existing HACCP system and the proposed FSSC 22000 standard was analysed. Since the FSSC 22000 standard composed with the ISO 22000 and ISO/TS 22002-1 standards, the requirements of both standards were listed separately. However, Mindtools (2015) stated that, according to solution selection matrix theory, these weighted scores should be added up for each option and the options that score the highest, win over others. As a trial, effectiveness of each solution was obtained by considering the total score and ten highest total scored solutions were selected as the most effective solutions. Then, percentage of requirements, which could be covered by implementing the most effective 10 solutions (out of 37) were calculated. The requirements that are identified as 'already established' in the factory but not yet activated were planned to implement soon. Solution list was numbered from 1 to 37 for easy identification. They were listed and numbered as follows.

Proposed solutions

1. Covering the sausage showering area
2. Covering the final products when sending them in to the packing area
3. Maintenance of time gap between raw meat receiving to brat pan and semi-processed products removing from the brat pan

4. Implementing of proposed packaging line and chilling system in production area
5. Construction of the factory floor
6. Improve exhaust system
7. Properly cover the drainage lines
8. Establish, implement and maintain procedures to manage potential emergency situations and accidents that can impact food safety
9. Plan and implement the processes needed to validate control measures and improve the food safety management system
10. Prior to implement control measures, validate the selected control measures are capable of achieving the intended control of the food safety hazards
11. Validate the control measures that are effective and capable for ensuring the control of identified food safety hazards
12. Modify or re-assess the existing control measures
13. Systematically evaluation of the results of planned verification
14. Analyse the results of verification activities including internal and external audits
15. Record the results of verification activities accurately and analyse them on time for updating the food safety management system
16. Identify the trends, which indicate higher incidence of potentially unsafe products
17. Provide factors for corrections and corrective actions that have to take
18. Control an in-line and on-line test facilities to minimise risk of product contamination
19. Design equipment with smooth, accessible, cleanable surfaces and self-draining in wet process areas
20. Use of materials compatible with intended products and cleaning or flushing agents
21. Establishment of cleanable, drainable and minimum dead ended piping and duct working
22. Design equipment to minimise the contact between the operators' hand and the products
23. Documentation of wet and dry cleaning programmes to ensure that all plant, utensils and equipment are cleaned at defined frequencies
24. Specify the programmes, what is to be cleaned (including drains): the responsibility, the method of cleaning (COP, CIP etc.), use of dedicated cleaning tools, removal or disassembly requirements and methods for verifying the effectiveness of the cleaning
25. Maintain the buildings with good repair
26. Seal the holes, drains and other potential pest access points
27. Design external doors, windows and ventilation openings to minimise the potential for entry of pests
28. Design stores to minimise the availability of food and water to pests
29. Remove potential pest harborage areas

30. Protect store items from weather or pest damage when outside space is used for storage
31. Establishment of staff canteens and designated areas for food storage and consumption to prevent cross contamination
32. Carry out additional medical examinations for employees at intervals defined by the organisation
33. Advice employees to inform illness situations such as diarrhea, vomiting, fever, jaundice and discharges of ear, eye or nose
34. Use of bright colored and metal detectable dressings for injuries
35. Establish proportional protective measures for food defense, biovigilance, and bioterrorism
36. Identify, map and access controlling into potential sensitive areas
37. Physically restrict access or use of locks, electronic card key or alternative systems

No. 25 represented the total number of "Non-established and not-improved" requirements in the requirement list and no. 12 represented the number of fulfilled requirements after implementing most effective 10 solutions.

$$\frac{12}{25} \text{x } 100 = 48\%$$

The best selected 25 solutions were decided and implemented. This covers 96% of the total requirement. Therefore, 96% was considered as the efficient value. The most effective 25 solutions were listed according to their scores, from the highest value to the lowest value as number 3, 33, 2, 23, 24, 16, 15, 37, 25, 36, 29, 1, 34, 10, 30, 11, 8, 20, 26, 18, 7, 13, 35, 9 and 32. According to the solution selection matrix theory, a well experienced team is more suited to take decisions regarding cost and implementing ability of an action. Therefore, in that step the top management of the company was also involved with me to rank solutions more accurately. When considering implementing feasibility, the easiness of introduce, maintain and control of each solution was considered. Then, the solutions were ranked from 37 to 1 according to that parameters. According to solution selection matrix theory, highest number should be given to highest weighted option and lowest number should be given to lowest weighted option Asq.org (2015). The proposed solution list was comprised with 37 solutions, the highest value was 37 and the lowest value was 1. The highest feasible solution was ranked with the highest value 37 and the lowest feasible solution was ranked with lowest value 1. When considering economic feasibility, total cost for implementing and maintenance of the relevant solution was considered.

CONCLUSIONS

By filtering solutions, 25 solutions were selected out of 37 solutions. 96% of the solutions were fulfilled by this list of solutions and therefore, the processing factory has the possibility to implement FSSC 22000.

REFERENCES

22000-tools.com (2010). Introduction to ISO 22000 and FS22000 Certification (FSSC 22000). [Online] Available from: http://www.22000-tools.com/iso-22000-blog/introduction-to-iso-22000-and-fs22000-certification-fssc-22000/[Accessed: 29 May 2015].

Anon (2015). Solution selection matrix. Selecting the best solution. [Online] Available from: http://www.iwise2.com/solution-selection-matrix [Accessed 28 May 2015].

Asq.org. (2015). Decision matrix - ASQ. [Online] Available from: http://asq.org/learn-about-quality/decision-making-tools/overview/decision-matrix.html [Accessed 25 Apr. 2015].

Food Quality & Safety (2015). Moving towards FSSC 22000 certification - Food quality & safety.[Online] Available from: http://www.foodqualityandsafety.com /article /moving-towards-fssc-22000-certification/ [Accessed 10 July 2015].

Foundation for Food Safety Certification (2013). FSSC 22000 Part I. Gorinchem, Netherlands.

Fssc22000.com (2013). FSSC 22000. [Online] Available from: http:// fssc22000.com /downloads/PartIversion32013.pdf [Accessed 1 July 2015].

Marriott, N. and Gravani, R. (2006). Principles of food sanitation. 5th ed. Springer Science & Business Media, New York.

Mindtools.com (2015). Decision matrix analysis: Making a decision by weighing up different factors.[Online] Available from: http://www.mindtools.com/ pages/ article/newTED_03.htm [Accessed 3 Jul. 2015].

Sansawat, S. and Muliyil, V. (2010). Understanding the FSSC 22000 food safety system certification standard. [Online] Available from: http://www.sgs.com/media/ Global/Documents/White%20Papers/sgs-fssc-22000-whitepaper-en-10.ashx [Accessed 1 Jul. 2015].

Tague, N.R. (2004). The quality toolbox, 2nd ed. William A. Tony Publishers, Wisconsin.