Behind the Closed Doors: Performance Assessment of Food Safety Management Systems in Five-Star Hotels in Egypt

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Abstract

The metamorphosing environment wherein hotels operate and the growing requirements for food safety have prompted hotels to critically assess and improve their food safety management systems (FSMS) and its performance. This study aims to analyze and assess the performance of FSMS applied in five-star hotels in Egypt through a diagnostic instrument that specifically designed for this purpose. The diagnostic instrument included a detailed checklist to assess contextual riskiness characteristics, core control and assurance activities, and overall performance of the FSMS. The assessment of twenty-five hotels revealed that all deal with high-risk raw materials, have non-supportive organizational conditions, are at a frail position with suppliers, and adapted differently their FSMS to their moderate-risk context. Hierarchical cluster analysis showed three clusters of hotels differing in their FSMS activities levels. The largest cluster showed a marginal performance level which is expected to be insufficient for achieving good food safety outputs given the riskiness of their context. However, a few hotels in this cluster operated at an advanced level and achieved good food safety outcomes. In the second cluster, a limited number of hotels achieved an overall rating ranging from satisfactory to outstanding for the core control activities. The vast majority of this cluster had a satisfactory assessment for the core assurance activities, which seems to be appropriate for the moderate-risk context wherein they have to manage. Like for the third cluster, the majority of the hotels showed overall satisfactory scores for the core control and assurance activities. These findings can support hotels in creating the basis for future improvements.

Keywords: Food safety management systems (FSMS), performance, hotel sector, Egypt.

Introduction

Food safety and quality are critical paradigms for the assurance of public health, economic improvement and above all for food security. However, due to the expanded incidence of foodborne illnesses in many countries, food safety turned out to be a worldwide concern influencing and affecting the lives of millions of people every year (Al-Busaidi and Jukes, 2015). The World Health Organization (WHO) has detailed that more than 200 maladies can be spread by contaminated food or water with the level of foodborne illnesses being amplified by expanded global food trade and population versatility. Accurate and precise statistics on the amount of foodborne illness are particularly difficult to determine in developing countries because of insufficient surveillance and destitute detains (reporting) systems. However, the WHO has assessed that 600 million people, around one out of each ten individuals in the world, fall sick in the wake of eating contaminated food, while 420,000 people die annually. Foodborne diseases are usually infectious or poisonous and caused by microscopic organisms, infections, parasites, or synthetic compounds buildups entering the human body through contaminated food or water. Foodborne pathogens can cause intense loose bowels or incapacitate contaminations, including meningitis. Synthetic sullying can cause intense harming or long haul diseases, such as cancer. Foodborne diseases can cause long-term disability and death. Examples of unsafe foods include uncooked animal food, fecal fruits and vegetables, and raw shellfish containing marine biological toxins (WHO, 2017). Foodborne illness is still preceding

risk due to the complexity of the food system from the generation of raw materials to the point of consumption (Al-Busaidi and Jukes, 2015). The most commonly reported reasons to foodborne outbreaks are related to the food preparation practices such as improper heating of foods followed by inadequate handling, cross-contamination, poor hygiene, improper food storage and food contaminated by food handlers (Martins and Rocha, 2014).

There could be a potentially devastating impact of foodborne outbreaks on the hotel business. A solitary episode of foodborne infection can prompt unfathomable economic losses. Economic analysis of costs associated with food safety has shown that it is considerably less expensive for the producer to invest in preventing outbreaks of foodborne diseases than the cost after the event. Therefore, ensuring food safety by hotel operations is critical. There are many reasons that why hotels call for the improved safety of their products: to avoid the expected financial losses, to evade the costs of lawful prosecutions, to keep up the notoriety of the hotel, to maintain customer reliability and loyalty (Hussain and Dawson, 2013). Moreover, hotels must comply with the governmental regulations and measures that require having a proper FSMS in place.

During the last two decades, the management of food safety has greatly evolved and new scopes of internationally recognized systems are available to ensure food safety such as Hazard Analysis Critical Control Point (HACCP), Safe Quality Food (SQF), International Food Standard (IFS), Food Safety Management System scheme (FSSC 22000), Global GAP, and most recently, the ISO 22000 (Macheka *et al.,* 2013). For HACCP, there is a wide range of plans for specific food sectors (Luning *et al.,* 2013). With so many systems, the questions arising now are how effective are these FSMS and how well do these systems affect food safety outputs. Hotel operators want to see their return on investment and need to know what aspects they should improve in these systems. In addition, interested parties such as governmental and sectorial organizations are interested in these questions to measure the effectiveness of the systems to identify weaknesses for further improvement (Jacxsens *et al.,* 2010).

Different studies have illustrated that implementation of FSMS in hotels enhanced the safety of the served food (e.g. Doménech *et al.,* 2011; Osimani *et al.,* 2011). Though, hotels are still considered to be an important source of foodborne outbreaks, with a reported event of (29%) in industrialized nations (Luning *et al.,* 2013). This claim is validated by the monitoring of the epidemiological data available for foodborne illnesses worldwide. For example, as indicated by Luning *et al.* (2013), hotel businesses continue to be considered as the most common setting for foodborne illness outbreaks in England and Wales. In another study conducted by Dominguez *et al.* (2007) in Spain, it was reported that (37%) of the foodborne outbreaks reported between 2004 and 2006 were attributed to foodservice establishments. The same matter has been reported in the U.S, where a growing number of foodborne disease and sporadic studies gastrointestinal illnesses proposed that restaurants' food is one of the most important infection sources (Jones and Angulo, 2006). In Egypt, *Salmonella* was secluded from rice prepared by a five-star hotel and *Shigella* was found in boiled rice in a four-star hotel in Egypt. In many food samples taken from the five and four-star hotels, *Staphylococcus aureus* and *Bacillus aureus* were also frequently found (Osei-Kofi, 2011). Recently, reports stated that E. coli bacteria were behind the death of two British tourists in a hotel in Hurghada (Calder, 2018).

Many studies attributed this failure to the inadequacies in currently implemented FSMS in the hotel industry, related to the inadmissible high tallies of pathogens and hygiene indicators in food products served in hotels (e.g. Fontanarosa *et al.,* 2004;

Guida *et al.,* 2006; Giraudon *et al.,* 2009; Ilic *et al.,* 2012; Luning *et al.,* 2013). These studies underlined that FSMS outputs are still variable in the hotel industry. In addition to that, studies on food safety practices in the hotel industry have drawn the attention to the fact that the typical deficiencies in these systems include poor compliance to hygiene procedures, non-compliance to the use of metering equipment, lack of active monitoring, inadequate heating and cooling practices, cross-contamination, poor hygiene, inappropriate food storage and food contaminated by food handlers (Eves and Dervisi, 2005; Osimani *et al.,* 2011; Luning *et al.,* 2013; Martins and Rocha, 2014).

Many authors argued that the outputs of the FSMS depend not only on the performance of the system's activities (core control and assurance) but also on the context riskiness in which it operates (Luning *et al.,* 2011; Sampers *et al.,* 2012). Context factors are situational characteristics of the spatial environment in which the system is implemented and are often unchangeable and affect the food safety outputs and thus entail requirements on the system. Many studies have assumed that firms that are operating in a high-risk context require advanced systems capable of achieving good food safety output, while simpler systems in a low-risk context will be sufficient. Respectively, the characteristics of the food products used, the organization of production processes, and the complexity of the food chain are the main context factors affecting FSMS activities (Luning *et al.,* 2011; Luning *et al.,* 2013).

FSMS in hotels usually operate in a different context than in the food industries. For example, hotels should control a variety of items (menus and buffets) that must be prepared partly in advance, frequently in the same area, under time strain, and the number of customers is usually not known in advance. These typical characteristics may require certain demands when applying FSMS in the hotel industry and may affect food safety outputs (Luning *et al.,* 2013). Moreover, data revealed that large hotels are more often scrutinized by regulations comparing to medium-size and small businesses. Records have shown that those large firms have faced external pressure from customers and governmental regulations to meet food safety standards (Wu, 2012).

Statement of the problem

The increasing challenges on the performance of FSMS in hotels and the availability of new or improved food safety control measures underpin the need for continuous improvement of existing systems. Therefore, there is a need to evaluate the performance of the currently implemented FSMS to identify weaknesses and suggest improvement points. Previous studies have developed different tools to evaluate the performance of FSMS (Ren *et al.,* 2016). For example, some studies assessed FSMS using a tool of food safety management system-diagnostic instrument (FSMS-DI) for improving diagnosis (e.g. Hartwell and Edwards, 2001; Garayoa *et al.,* 2011; Luning *et al.,* 2013; Kirezieva *et al.,* 2013; Ren *et al.,* 2016). Other studies relied upon assessment tools to evaluate the microbial outputs of current FSMS (e.g. Guida *et al.,* 2006; Luning *et al.,* 2011; Osimani *et al.,* 2011; Kafetzopoulos *et al.,* 2013; Tzamalis *et al.,* 2016). These approaches are perceived as general tools that focus on the implementation and evaluation of FSMS principles in the food industry. For instance, FSMS-DI is composed of extensive lists of evidence used to analyze key control and assurance practices routed to the firm's specific FSMS (Lahou *et al.,* 2015; Tzamalis *et al.,* 2016). Initially, these diagnostic tools were developed within the European context. In later stages, it was expanded to measure the performance of FSMS in non-European contexts (e.g. Osei-Kofi, 2011; Luning *et al.,* 2013; Jacxsens *et al.,* 2015;

Lahou *et al.,* 2015; Ren *et al.,* 2016; Tzamalis *et al.,* 2016, Xiong *et al.,* 2017). However, studies on FSMS in the hotel industry in Egypt are yet limited to the extent to which food safety systems and quality standards are implemented and the factors that influence such implementation (Abd El-Fattah and Fouad 2013; Ibrahim and Ibrahim, 2014; Elias *et al.,* 2016). However, the context of the Egyptian hotel industry (such as the environmental framework and organizational characteristics) is expected to be different and could have a further impact on the design and operation of the implemented systems over the long-term.

Whilst positive results may be expected when applying FSMS efficiently, it is also required to establish ways of measuring FSMS effectiveness. As far as Egypt is concerned, information about the status of core control and assurance activities in implemented FSMS is restricted in the view of the FSMS outputs. Although there are seventeen regulatory bodies responsible for food safety control in Egypt, food safety levels are low from the perspectives of both international and domestic trade (American Chamber of Commerce in Egypt, 2015). Consequently, an insight is needed into the status of FSMS in the Egyptian hotel sector. Accurate assessment of these systems provides the right platform for improvements.

The aim, scope, and significance

This study tried to go beyond the previous research on FSMS in the hotel sector. This study assessed the performance of the current FSMS applied in five-star hotels in Egypt through a diagnostic instrument. The diagnostic instrument included a detailed checklist to assess contextual riskiness characteristics, core control and assurance activities, and overall performance of the food safety system. The findings of the current study are expected to provide useful information to policymakers in the hotel industry in Egypt. Specifically, the outputs of this evaluation are expected to provide an indication of the relations between contextual factors, activities, and food safety outputs. Further, the instrument that is tested in this study will help Egyptian hotels to determine the current level of the control and assurance activities of FSMS and to identify the required improvements over the short and long-term.

Methodology

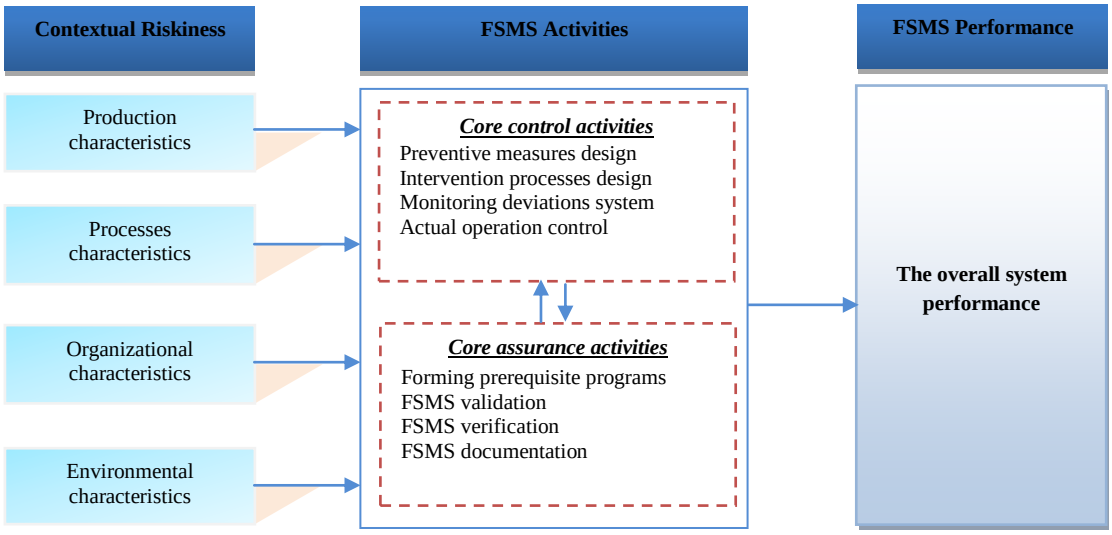
The population and sample

The population of this study is composed of all five-star hotels located in three significant tourist regions in Egypt; namely, Cairo, Giza, and Alexandria. These regions were selected as they comprise a variety of international and domestic hotels of different types and sizes. According to the estimates of the Egyptian Hotel Association (EHA) for 2018, these three regions contain (41) five-star hotels. The study focused on hotels that have effectively implemented FSMS. It's worth noting that many hotels claim to have FSMS in place, but few are doing so effectively. Effective implementation means that key practices in the system are well-exercised and deployed within the hotel. Accordingly, the study relied on food safety certificates as evidence of effective FSMS implementation. Hotels have been contacted in person or by e-mail to clarify the possibility of their participation in the review visits. The sample size comprised of (25) hotels representing (61%) of the total listed five-star hotels. The study sample was limited to this number due to the nature of the study and its application mainly in the back areas of the hotels which are considered to be prohibited areas for outsiders.

Data collection method and process

The study was conducted in two phases. In the first phase, a comprehensive review of the related literature was conducted to identify the content material and the selected indicators that addressing the core aspects of control and assurance activities of the FSMS. In the second phase, and based on the FSMI-DI developed by Luning *et al.* (2013) and Xiong *et al.* (2017), a self-assessment instrument with scoring system was applied to evaluate the performance of FSMS in the five-star hotels in Egypt based on the perspective of their prescribed food safety activities, contextual riskiness, and food safety performance (See Figure 1). In order to validate the instrument; it has been reviewed by seven hotel managers and three experts from the Egyptian National Food Safety Authority. Their opinions and suggestions helped to modify the initially selected indicators. Between May 15 and August 27, 2018, twenty-five surveys were completed by visiting the hotels that have agreed to participate in this survey. Furthermore, the quality assurance persons of the respective hotels were interviewed to collect information about the profiles of the hotels, food safety details, FSMS, training programs, and assessment of major risks to food safety.

Figure 1: Structure and relationship between the study variables



The framework of the self-assessment instrument

According to Figure (1), three types of variables have been identified. Firstly, the instrument included an assessment of the contextual riskiness factors in terms of characteristics that can influence the decisions taken during FSMS activities (Luning *et al.*, 2011). In order to analyze the contextual riskiness that may affect the efficiency and the yields of the FSMS, the instrument included (15) indicators as follows: production characteristics (3 indicators), process characteristics (2 indicators), organizational characteristics (7 indicators), and environmental characteristics (3 indicators). Secondly, the instrument involved lists of corresponding assessment indicators to evaluate the levels of implementation of different practices related to core control and core assurance activities, both of which contribute to the outputs of the system. Control activities are targeted to maintain the performance of both production and human processes within specific acceptable tolerances and taking preventive actions when needed while the assurance activities are concerned with the identification, evaluation, and modification of the system (Luning *et al.*, 2008). The core control activities are classified into four types according to their functions: prevention, intervention, monitoring, and actual operation. Preventive control

activities aim to prevent food contamination (10 indicators); intervention activities are directed towards contamination elimination (3 indicators), and monitoring activities provide information about deviations to enable corrections (7 indicators). In addition, the core control activities evaluated the actual operation (7 indicators). The assessment of core assurance activities included the formation of prerequisite programs (2 indicators), FSMS validation (3 indicators), FSMS verification (3 indicators), and FSMS documentation (3 indicators). Each indicator has diverse checking points that can analyze the compliance individually. These indicators were used as evaluation tools since they are considered the most common sources that create risks in the hotel business. Thirdly, the system output was evaluated through the overall performance indicators (Ren *et al.*, 2016).

Evaluation of the contextual riskiness levels

The main assumption of the self-assessment tool is that hotel facilities operating in high-risk contexts need a more stringent food safety management system to achieve good food safety outcomes, while hotels operating in less-risk contexts will need less complex systems to achieve good food safety outputs. Therefore, it was important to assess the contextual riskiness levels in the surveyed hotels. As shown in Table (1), contextual indicators had been scored on a three-point circumstantial grid ranging from low-risk (prospect 1), moderate (prospect 2), and high-risk level (prospect 3) (See Table 2 for more details).

Table 1: Scales to differentiate context riskiness prospects

Contextual riskiness	Prospect 1 (low-risk)	Prospect 2 (moderate)	Prospect 3 (high-risk)
Production characteristics	Major raw materials are not vulnerable to food contamination.	Minor raw materials are vulnerable to food contamination.	Final products are at risk.
Processes characteristics	Food is not susceptible to handling problems.	Food is potentially susceptible to handling problems.	Food is highly susceptible to handling problems.
Organizational characteristics	High workforce quality, supportive organizational conditions, and proper communication channels.	Restricted workforce quality, lack of supportive organizational structures, improper communication channels.	Low workforce quality and critical issues in the organizational and communication structures.
Environmental characteristics	Low reliability on other parties. More rigorous decision-making process.	Likely to be dependable on other parties. Potentially to be at risk.	Highly dependable, at risk.

Table 2: Performance diagnosis of the context riskiness

Context riskiness	Indicators	likely occurrence of risk		
		1	2	3
Production characteristics	Potential hazards associated with raw materials.			
	Potential hazards associated with final products.			
	The production processes contain intervention steps.			
Processes characteristics	Assortment of recipes.			
	Rates of menu design changes.			

Organizational characteristics	Availability of multidisciplinary food safety teams.			
	Volatility in the composition of the workforce.			
	Sufficiently qualified operators.			
	Availability of a detailed written food safety vision.			
	Availability of documented standard operation procedures.			
	Staff involvement in the design and modifications of the FSMS.			
	Sufficiency of effective information systems.			
Environmental characteristics	Safety contribution in configuring the hotel's image.			
	The extent of strength in hotel relations with suppliers.			
	Legislative requirements.			

Assessing the performance of FSMS activities

The study also assumed that the more advanced level of performance of the control and assurance activities will result in better system outputs and lower risks of unexpected food safety problems. Accordingly, in order to evaluate the performance levels of the implemented FSMS, four situations were specified for each indicator; these are poor performance (score 0), marginal performance (score 1), satisfactory performance (score 2), and advanced performance (score 3) (See Table 3). Advanced performance level means that all aspects of the element have been met or exceeded. This rating is distinguished for control and assurance activities through the use of scientific knowledge/evidence and specific information, application of advanced analysis of critical control points, procedural methods and methodological activities in the major meals preparation processes which are classified as the most important for the FSMS. No significant food safety problems can be expected at this time. The focus should be on maintaining the element at the current level.

Table 3: Performance diagnosis of the FSMS control and assurance activities

FSMS activities	Indicators	Performance level			
		0	1	2	3
Assurance activities					
Preventive measures	Visual inspection of items on delivery.				
	Correct and separate storage facilities.				
	Proper handling of food products.				
	Temperature monitoring and control.				
	Hygienic design of equipment and facilities.				
	Cross-contamination with other menu items.				
	Personal hygiene and health requirements.				
	Sanitation control programs.				
	Methods of thawing frozen food.				
	Availability of hot holding facilities.				
Intervention process	Adequacy/readiness of intervention equipment.				
	Scheduled plans for equipment maintenance.				
	The effectiveness of intervention methods.				
Monitoring deviation procedures	Monitoring procedures for each CCP.				
	Control standards are functioning as intended.				
	Adequacy of data about the levels of pathogens.				

	Measuring devices for monitoring preparation and processing.				
	Calibration program for measuring devices.				
	Organization of food sampling procedures.				
	Number of corrective actions aroused.				
Actual operation	Availability of general working instructions on the workplace.				
	Staff compliance with the written instructions.				
	Apparent efficiency of equipment and facilities.				
	The actual capacity of refrigerants (<4° C).				
	The actual capacity of hot holding units (>80° C).				
	Core temperatures are being measured.				
	Apparent efficiency of measuring equipment.				
Assurance activities					
System prerequisites	Requirements of stakeholders in designing the hotel's FSMS.				
	Systematic use of feedback information to modify the FSMS.				
Validation	The efficiency of preventive measures is judged by FSM team.				
	The efficiency of intervention processes is judged by FSM team.				
	The efficiency of the monitoring system is judged by FSM team.				
Verification	Application of verification methods, procedures, and tests.				
	Results of management review.				
	Guests complain recording and analysis.				
Document and record-keeping	Monitoring records are being maintained properly.				
	Records of previous modifications.				
	Records of the system updating.				

The second category (satisfactory) corresponds to almost full compliance with the requirement. Performance varies from one site to another within the same hotel. Some food safety problems can be expected but are controlled through the existing FSMS. The satisfactory level for the control activities is characterized by the application of collaboration with the external parties (experts, examiners, and suppliers), the application of governmental and sectoral legislation and guidelines, the adoption of best practices, and the use of the best available devices. For assurance activities, this rating is consistent with the active and continuous analysis of records and reports, and independence in system evaluation. Significant changes must be made in order to reach the required level. Sufficient resources and/or modifications must be introduced to correct deficiencies.

The third category (marginal) complies with a small part of the requirements. The element is either missing or not properly applying. Additionally, this category is granted when the control activities are characterized by such aspects as the use of self-experience, use of the general knowledge, undocumented tools or programs, lack of standardization of tools and facilities and/or inefficiency during operation. This assessment is typified in insurance activities through the lack of periodic examination,

lack of collection of information on sources and risk points, or lack of analysis of such data/information to identify appropriate corrective actions, and lack of periodic control reports.

Finally, category (poor) is given to any condition when there is a significant failure to meet the requirements although it can be applied (e.g. the standardization of appliances and equipment in the kitchen) or is unknown (e.g. the absence of information about the actual management of the control practices).

Data processing and analysis

The data collected through self-assessment surveys were subjected to content analysis. The self-assessment diagnosis yielded in a list of (53) scores for each hotel. To attain the overall performance indication, overall scores were assigned. For this purpose, an independent T-test was performed to compare the mean scores of the whole set of indicators representing respectively the contextual factors and the FSMS activities. The statistical significance was determined at $P < 0.05$. Mean scores were converted to custom grades as described in Table (4). Further, a hierarchical cluster analysis was applied to get an insight into the differences between the surveyed hotels. For each cluster, spider charts were developed based on the mean values for each indicator per cluster. Additionally, diagrams to show the most variation between the clusters regarding the control and assurance activities were developed.

Table 4: Conversion of mean scores into assigned scores with interpretation

Mean score	Assigned score	Interpretation of the assigned score			
		Contextual riskiness	Core control activities	Core assurance activities	FSMS overall performance
0-0.2	0	--------	Poor	Poor	Poor performance
0.3-1.2	1	Low-risk	Marginal	Marginal	Poor performance
1.3-1.7	1-2	Low-moderate	Marginal - satisfactory	Marginal - satisfactory	Poor to average
1.8-2.2	2	Moderate risk	Satisfactory	Satisfactory	Average
2.3-2.7	2-3	Moderate-high	Satisfactory-advanced	Satisfactory-advanced	Average-good
2.8-3.0	3	High-risk	Advanced	Advanced	good

Results and discussion

Characterization of the investigated hotels

The breakdown of hotels that participated in the survey is summarized in Table (5). These characteristics are important as they can be used for further statistical analysis.

Table 5: Characteristic of the investigated hotels (n = 25)

Attribute	Five-star hotel chains	
	Freq.	%
Years of operation:		
Less than 10 years	2	8.00%
From 10-20 years	12	48.0%
More than 20 years	11	44.0%
No. of employees in food-handling functions:		
Less than 100 employees	0	00.0%
From 100 to 500 employees	18	72.0%
More than 500 employees	7	28.0%
Valid food safety certification *:		
ISO 9001:2008	9	36.0%
ISO 22000	7	28.0%
HACCP	14	56.0%
Control of FSMS:		
Internal control	5	20.0%
External control (contracting with external consultants)	20	80.0%

* Hotels have more than one certification.

According to Table (5), of the (25) investigated hotels, 12 hotels (48%) operate the business from 10-20 years. Similarly, 11 hotels (44%) operate the business for more than 10 years and the remaining (8%) are in the sector for less than 10 years. The presence of a hotel in the field for more than a decade suggests a more stable regulatory environment and more mature processes. It also identified the average number of staff required to ensure the efficiency of the service provided. The size of the hotel in terms of the number of employees in food handling related functions determines significant characteristics such as the financial potential, the technical and organizational expertise, and staff capabilities. The distribution of the investigated hotels was as follows: medium-size hotels (with less than 100 employees), large hotels (from 100 to 500 employees), and macro hotels (with more than 500 employees). Out of the (25) investigated hotels, 18 hotels (72%) have 100 to 500 employees in food handling related functions. Large firms tended to have a better understanding of FSMS and sufficient financial support resulting in the broad implementation of FSMS. On the other hand, small hotels need more incentives and are facing greater difficulties in allocating the financial resources needed to implement FSMS. This means that the size of hotels has a significant impact on the effectiveness of the implementation of FSMS (Xiong *et al.,* 2017). All of the investigated hotels have some forms of valid food safety certifications. The vast majority of the investigated hotels (64%) were certified by ISO 9001:2008 and ISO 22000. More than half of the hotels (56%) were certified by HACCP. The preference for ISO certifications may be attributed to the fact that ISO standards provide hotels with the opportunity to take the advantages from both the HACCP system and the additional advantages of management responsibilities, which ensure management's commitment to make FSMS more effective (Kök, 2009). Generally, these findings show clearly that there is an advanced level of interest in the application of voluntary food safety systems in this segment of hotels in Egypt. All of the investigated hotels had their own quality teams for controlling the daily activities and operations of the applicable systems. However, the vast majority of the surveyed hotels (80%) relied on

the external consultancy agencies to control and validate the performance of the overall systems.

The contextual riskiness characteristics

As mentioned earlier, the basic assumption behind the self-assessment tool is that hotels operating in high-risk contexts (overall score 3) need more stringent and advanced FSMS to perform well in food safety. Hotels operating in a moderate-risk context (overall score 2) require a moderate FSMS to perform well in food safety. Whereas, for hotels operating in a lower-risk context (overall score 1), simple systems may be more adequate to perform good food safety outputs (Luning *et al.*, 2011; Luning *et al.*, 2013, Xiong *et al.*, 2017). The selected contextual factors for this study (production, processes, organizational and environmental characteristics) directly influence the outputs of FSMS. In order to get an insight into the exemplary risk profiles of the entire surveyed hotels, Table (6) presents the number of hotels with similar estimates for each context indicator and the overall context riskiness scores. In general, the surveyed hotels were operated in a moderate-risk context (overall score 2.1).

Table 6: Hotels with similar scores for contextual indicators

Context riskiness	Indicators	likely occurrence of risk [a]			Mean score	P-value
		1	2	3		
Production Characteristics	PC_1: Potential hazards associated with raw materials	0	0	25	3.0	1.000
	PC_2: Potential hazards associated with final products	5	8	12	2.2	0.012
	PC_3: The production processes contain intervention steps	4	12	9	2.2	0.212
Processes Characteristics	PR_1: Assortment of recipes	5	16	4	2.0	0.000
	PR_2: Rates of menu design changes	12	8	5	2.1	0.279
Organizational Characteristics	OC_1: Availability of official multidisciplinary food safety teams	9	7	9	2.1	0.005
	OC_2: Volatility in the composition of the workforce	13	9	3	1.6	0.006
	OC_3: Sufficiently qualified operators (professional education levels)	12	10	3	2.3	0.000
	OC_4: Availability of a detailed written vision statement on food safety	8	14	3	2.0	0.306
	OC_5: Availability of documented standard operation procedures	20	3	2	1.3	0.004
	OC_6: Staff involvement in the design and modifications of the FSMS	3	20	2	2.1	0.005
	OC_7: Sufficiency of effective information systems	0	0	25	3.0	0.000
Environmental Characteristics	EC_1: Safety contribution in configuring the hotel's image	0	0	25	3.0	0.000

	EC_2: The extent of strength in hotel relations with suppliers	0	25	0	2.0	0.197
	EC_3: Legislative requirements for governmental/sectorial bodies	25	0	0	1.6	0.000
Context riskiness (Overall)					2.1	0.000

[a] Risk level (score 1: low, score 2: moderate, score 3: high-risk context)

For the product characteristics, all hotels deal with high-risk raw materials (score 3), which require special handling conditions to prevent cross-contamination, growth and/or, multiplication of pathogens. Most hotels reported a moderate level of risks with the following points: "potential hazards associated with final products" and "the production processes contain intervention steps". Based on these scores, it can be said that the surveyed hotels had a moderate to high-risk in the production process. These findings are not surprising given the complexity of the production processes and their diversification, the intrinsic properties of raw materials (e.g. raw meat, raw fish, raw poultry, fresh and canned fruits/vegetables, milk, eggs, fresh cheeses, processed and ready-to-eat food), and the high initial microbial load of these products contribute to the formation of a high-risk environment which exposes these products to subsequent contamination (Luning *et al.,* 2013). Thus, accurate control of incoming raw materials, periodic evaluation of specifications, and suppliers' implementation of approved FSMS are essential to ensure the quality/safety of raw materials (Kussaga *et al.,* 2013).

Although the production processes in hotels contain intervention steps (e.g. cooking) to inactivate pathogens, spores can resist and survive and contamination can still occur during the subsequent intervention step (e.g. during processing or serving meals, particularly for buffets that offer potentially hazardous foods (such as seafood, meat, and dairy products). This leads to a lower level of food safety performance and places higher requirements on the FSMS by demanding rigorous implementation of the control and assurance activities. For example, in some hotels, the shipments of chilled and refrigerated food left at the receiving areas for a long period of time so that providing an ideal environment for pathogens multiplication. Some other hotels didn't have refrigerators or freezers for quick and temporary storage. In addition, all the delivered refrigerated and frozen items were not properly checked with an accurate thermometer upon delivery. Moreover, more than one-quarter of the surveyed hotels had food delivered to their premises outside the business hours. Food delivered to these hotels might be at risk of contamination due to the lack of temperature control. The handling of the incoming potentially hazardous materials requires the need to provide adequate cooling conditions at the receiving sites, as well as more accuracy in selection of suppliers and also stricter follow-up during storing, preparation, and cooking processes. The final products were categorized as a moderate risk situation because some of them are vulnerable to food contamination as a result of intrinsic properties of the products and are prone to post-contamination.

For the process characteristics, the majority of the surveyed hotels reported a moderate level of risks associated with the following points "assortment of recipes" and "rates of menu design changes". This is due to the fact that in most hotels a large number of recipes (hot daily menus) are prepared and processed, which may allow in-between cleaning and disinfection interventions during the preparation of such recipes. Further, most hotels are relying mainly on à la carte or cyclical menus, which allows for fewer modifications on both the products offered and the required processes.

For organizational characteristics, which indicate the ability of the hotels to prevent or reduce food safety problems, the results indicated that most hotels have shown non-supportive organizational conditions for the FSM performance (mainly levels 1 and 2). Non-supportive situations refer to aspects like lack of technical workforce, specific requirements on the competence level of operators, and staff involvement in the design and modifications of the FSMS. For example, the food safety team approach was inconsistent as more than one-third of the surveyed hotels did not have official multidisciplinary food safety team to manage their FSMS. The formation of such a team is important to monitor all safety and environmental issues that might impact the hotels' operations. Another obvious finding was the lack of efficiency of the information systems (supporting decisions in FSMS). It has been noted that the information systems in which information and data are supposed to be formally recorded to support decisions related to food safety and quality issues were inaccurate to take control decisions and data was manually recorded which may lead to a high-risk situation. Therefore, hotels need more focus on creating a supportive organizational environment through hiring skilled and experienced staff, developing of a specific food safety information system, and training of operators and employees on food safety to enhance their commitment and involvement (Kussaga *et al.,* 2013).
With regard to environmental characteristics, which refer to the contribution of food safety in configuring the image of the hotel and the relationship between the hotel and stakeholders (i.e. suppliers and governmental/sectorial bodies), all the surveyed hotels scored three for the indicator "safety contribution in configuring the hotel's image" because hotels are in the final stage of the food supply chain and serve meals to final customers. Inadequate safety control in the meal preparation process directly affects the health of end-users, which implies vulnerability to safety problems (Luning *et al.,* 2013). The level of strength in hotel relations with suppliers is often at a moderate level of risk. Hotels can determine the specifications required for each product being handled, but hotels have no impact on the FSMS of their suppliers. However, hotels have the ability to negotiate the microbial specifications required with their suppliers and then select the best specifications available. This ability to select the microbiological specifications of raw materials before entering the hotel kitchen ensures the accessibility to high-quality supplies and thus reduces the possibility of contaminated products entering the hotel (Lahou *et al.,* 2015). From another perspective, the excessive reliance on suppliers' performance exposes hotels to food safety problems and involves demands on their FSMS (e.g. more control of incoming materials) (Jones *et al.,* 2008). The surveyed hotels indicated a relatively low-risk context regarding the legislative requirements. The governmental policies and regulatory environment oblige hotels to adopt standards and guidelines to ensure food safety and quality. This is believed to have been among the main drivers behind the adoption of HACCP and ISO systems. However, obsolete food legislation, inefficient food control systems, lack of compatibility with scientific development, and the absence of advanced training programs are key factors leading to low food safety performance in this sector (The National Food Safety Agency of Egypt, 2018).

The performance of core control activities

Control activities are related to the ongoing process of assessing the performance of both technological and human processes and taking corrective action when needed. Control activities assume that the best level of activity is more capable of maintaining the characteristics of the products, production processes and human processes among some acceptable tolerances (Luning *et al.,* 2008). As shown in Table (7), the core

control activities were satisfactorily performed in the surveyed hotels (assigned score 2).

Table 7: Hotels with similar scores for the core control activities

Control activities	Indicators	Performance level a				Mean score	Ass. score b
		0	1	2	3		
Preventive measures	PM_1: Visual inspection of items on delivery.	0	10	5	10	2.1	2
	PM_2: Correct and separate storage facilities.	0	13	9	3	1.6	1-2
	PM_3: Proper handling of food products.	0	14	10	1	1.8	2
	PM_4: Temperature monitoring and control.	0	12	7	6	1.9	1-2
	PM_5: Hygienic design of equipment and facilities.	0	4	9	12	2.7	2-3
	PM_6: Cross-contamination with other menu items.	0	7	17	1	1.9	2
	PM_7: Personal hygiene and health requirements.	0	17	7	1	1.7	1-2
	PM_8: Sanitation control programs.	0	8	15	2	2.3	2-3
	PM_9: Methods of thawing frozen food.	0	8	14	3	2.3	2-3
	PM_{10}: Availability of hot holding facilities.	0	5	16	4	2.5	2-3
Intervention process	IP_1: Adequacy/readiness of intervention equipment.	0	8	13	4	2.2	2
	IP_2: Scheduled plans for equipment maintenance.	0	10	14	1	1.8	2
	IP_3: Effectiveness of intervention methods.	0	18	1	6	1.6	1-2
Monitoring deviation procedures	MP_1: Monitoring procedures for each CCP.	0	6	17	2	1.3	1-2
	MP_2: Control standards are functioning as intended.	0	12	13	0	1.8	2
	MP_3: Adequacy of data about the levels of pathogens.	0	20	5	0	0.7	1
	MP_4: Measuring devices for monitoring preparation and processing.	0	21	4	0	1.8	2
	MP_5: Calibration program for measuring devices.	0	23	2	0	0.7	1
	MP_6: Organization of food sampling procedures.	0	18	7	0	1.4	1-2
	MP_7: Number of corrective actions aroused.	0	0	19	6	2.9	3
Actual operation	AO_1: Availability of general working instructions on the workplace.	0	9	15	1	2.3	2-3
	AO_2: Actual staff compliance with	0	10	13	2	1.9	2

	the written instructions.						
	AO_3: Apparent efficiency of equipment and facilities.	0	3	22	0	2.7	2-3
	AO_4: The actual capacity of refrigerants (< 4° C).	0	18	3	4	1.5	1-2
	AO_5: The actual capacity of hot food holding units (> 80° C).	0	8	15	2	1.4	1-2
	AO_6: Core temperatures are being measured with probes.	0	17	7	1	1.6	1-2
	AO_7: Efficiency of measuring equipment.	0	23	2	0	0.7	1

[a] Core control levels (score 0: poor, score 1: marginal, score 2: satisfactory, score 3: (outstanding) [b] (See Table 3: the interpretation of the assigned scores)

However, Table (7) showed that with respect to the preventive measures, which are aimed to create healthy circumstances to prevent the presence or proliferation of pathogens in the food production systems, the majority of the surveyed hotels got marginal-satisfactory rates in the following activities: "correct and separate storage facilities", "temperature monitoring and control", and "personal hygiene and health requirements". Proper storage facilities are important to preserve the quality of the food and to prevent cross-contamination and spoilage (Luning *et al.*, 2013). Failure to provide correct and separate storage facilities can at the very least lead to early food decomposition with the consequent reduction in the shelf-life (Knowles, 2012). More serious problems could occur if food poisoning organisms are allowed to multiply to dangerous levels during storage. Several poor handling practices were observed. For example, over half of the surveyed hotels were not covering refrigerated food properly to prevent overhead contamination. Moreover, the majority of the refrigerated items were not labeled or dated. The frozen storage areas were not clean in a number of hotels.

A marginal-satisfactory level was also assigned to temperature monitoring and control. Information was sought on the practices used by the investigated hotels to ensure that potentially hazardous food is kept under the correct temperature ranges during storage, preparation, and cooking. Correct temperature ranges for refrigerated and frozen foodstuffs are critical in ensuring that foodstuffs are maintained at high quality (both nutritionally and bacteriologically) as possible (Jackson *et al.*, 2007). All the surveyed hotels have standard cooling facilities with automatic temperature control units. However, there was a noticeable variation in the overall adherence to temperature control between the hotels implementing HACCP system and hotels that applied other systems such as ISO. Hotels with documented HACCP system scored better performance in most circumstances. Checking the food temperature was undertaken by different methods depending on the type of food and the location where the check was carried out. It was noted that some hotels used either sight or equipment gauges when assessing food temperature.

With respect to personal hygiene and health requirements, information was sought on handling practices and facilities, clothing worn by food handlers, and the extent of using personal hygiene practices. Although standard personal hygiene and health requirements were commonly available, they must be improved to be effective. Poor practices related to employee hygiene included inadequate hand-washing, lack of hair restraints, and eating and drinking while on duty. Inadequate hand-washing was a problem that frequently observed. Again, there was a marked variation in the overall

compliance with personal hygiene standards between the hotels implementing HACCP system and hotels that applied other systems such as ISO. Hotels with documented HACCP system achieved better performance in most circumstances. Hand-washing facilities were not sufficient in nine kitchens. In these instances, hand-washing consisted of rinsing hands without soaping, inadequate scrubbing, and washing of hands in the food preparation sinks. The majority of food handlers in the surveyed hotels were not using gloves while on duty. The provision of personal hygiene requirements is inadequate and should be accompanied by increased staff awareness of the importance of these practices in reducing the chances of food contamination which will contribute positively to food safety (Luning *et al.,* 2008).

Regarding intervention methods, which aims at eliminating the microbial load of pathogens to the acceptable levels, Table (7) showed that the majority of the surveyed hotels got satisfactory rates in the following activities: adequacy/readiness of intervention equipment, and scheduled plans for equipment maintenance. In most hotels, the current interference equipment (steam furnaces, cooking utensils, and frying pans) are suitable for the production process (different menus are available) and the capacity is tested by observing the core temperatures (≥70 ° C). In addition, it was noted that structural maintenance programs that contain specific instructions on repetitive maintenance tasks required for each device were present in most of the surveyed hotels. However, most of the surveyed hotels have achieved modest rates regarding the efficiency of intervention methods in which intervention equipment is tested by measuring the core temperatures of finished food products. Some of the surveyed hotels didn't have a documented system for ensuring that the time and temperature of the cooked potentially hazardous food were appropriate to meet the safety standards. Several studies underpinned that inadequate time and temperature control was the main cause of unsafe products (DiPersio *et al.,* 2005; Baş *et al.,* 2006; Luning *et al.,* 2008).

With respect to monitoring deviation procedures, which provide information about the real state of production or process conditions that enables improvements to the system in cases of critical deviations, the surveyed hotels had several common rates. Firstly, there was a lack of adequate data about the pathogenic levels. Data derived from the use of analytical methods by laboratories are internationally validated and approved methods (Lahou *et al.,* 2015). Secondly, there was a shortage in supplying standard metering devices complying with the international standards, online/in-line measurement (e.g., steam chamber probes). Consequently, in most hotels, there were no documented calibration programs. Finally, and most importantly, it was noted that the majority of the surveyed hotels do not take their own samples of raw materials, and rely only on food samples that are randomly taken by the governmental authorities. These samples cannot in any way reflect the status of food safety due to their small numbers. In addition, it was noted that there is a lack of interest by the surveyed hotels to create an electronic database that includes the inspection reports and irregularities recorded during the inspection. The creation of such a database ensures the review of the actions taken by the concerned hotels to remove irregularities and determine the dates of upcoming visits and other important preventive measures. Several previous studies demonstrated that deficiencies in monitoring deviation procedures can cause food safety problems (e.g. Osimani *et al.,* 2011; Martin and Rocha, 2014; Tzamalis *et al.,* 2016; Xiong *et al.,* 2017).

The actual operation practices of the FSMS are critical for the realization of food safety. However, these practical practices are often not correctly followed, which may result in undesirable food safety consequences. Regarding actual operation, the

majority of the surveyed hotels lack insight in the actual cooling capacity. Unstable performance of refrigeration facilities (>4° C) has been recorded in many hotels. The temperature was monitored manually and the automatic alarm was not available at temperature deviation. Additionally, in twelve hotels the core temperatures of the food were not being measured with probes. In some kitchens, cooks were not observed taking the internal temperature of hot food at any time during the cooking process. These hotels relied on visual checks and experience, a procedure which has been shown to be fatally flawed in the past (Azanza and Zamora-Luna, 2005). It was also noted that there was a deficit in the provision of the required measuring equipment, such as thermometers and standardized inspection models, which weakens the ability to conduct effective surveillance and detect hazards. These results are consistent with the results of previous studies that observed the poor overall performance of measuring equipment in foodservice operations due to lack of real measurements (Luning *et al.,* 2013). Many researchers have studied the reasons for noncompliance with food safety guidelines, procedures, and instructions. Some researchers pointed out that this may be due to the lack of awareness and lack of familiarity with the guidelines and procedures (Azanza and Zamora-Luna, 2005), as well as the persistence of certain behavioral habits and attitudes that affect compliance to procedures (Panisello and Quantick, 2001).

The performance of core assurance activities

The importance of quality assurance activities in the hotels is attributed to the fact that they provide evidence and confidence to hotel stakeholders that food safety requirements will be met in accordance with standards (Luning *et al.,* 2013). From Table 8), it can be derived that most of the assurance activities in the surveyed hotels were performed on a satisfactory level (assigned score 2).

Table 8: Hotels with similar scores for the assurance activities

Assurance activities	Indicators	Performance level [a]				Mean score	Ass. score [b]
		0	1	2	3		
Setting system prerequisites	SP_1: Requirements of stakeholders in designing the hotel's FSMS.	0	13	2	1	1.8	2
	SP_2: Systematic use of feedback information to modify the FSMS.	0	14	9	2	1.9	2
Validation activities	VA_1: Efficiency of the preventive measures is judged by FSM team.	0	0	17	8	2.9	3
	VA_2: Efficiency of the intervention processes is judged by FSM team.	0	0	18	7	2.9	3
	VA_3: Efficiency of the monitoring system is judged by FSM team.	0	8	17	0	2.3	2-3
Verification activities	VE_1: Application of verification methods, procedures, and tests.	0	16	5	4	1.5	1-2
	VE_2: Results of management review.	0	13	7	5	1.9	2
	VE_3: Guests complains recording.	0	14	8	3	1.9	2
Document and record-keeping	DR_1: Monitoring records are being maintained properly.	0	12	12	1	1.5	1-2
	DR_2: Records of previous modifications.	0	17	8	0	1.2	1
	DR_3: Records of the system updating.	0	17	8	0	1.5	1-2

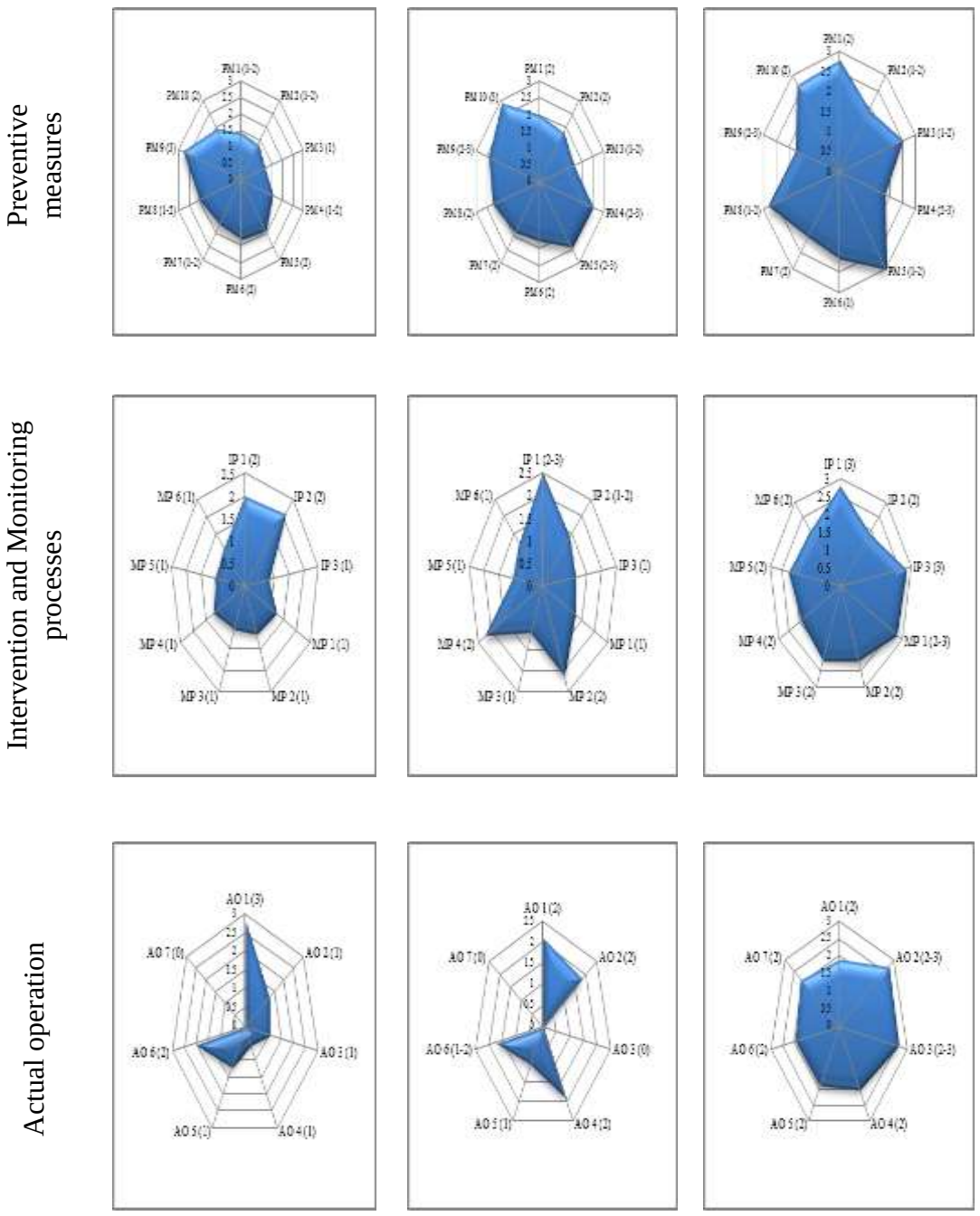
[a] Core assurance levels (score 0: poor, score 1: marginal, score 2: satisfactory, score 3: (outstanding) [b] (See Table 3)

An outstanding level was assigned to the validation activities because most of the surveyed hotels relied on external consultancy agencies to validate the performance of their FSMS. On the other hand, the verification and documentation activities were assigned marginal levels because no verification activities of the procedures were executed. Although hotels surveyed through their external consultants analyze records regularly but without confirmation by actual testing. There was a marked variation in the overall compliance with verification and documentation activities between the hotels implementing HACCP system and hotels that applied other systems such as ISO. Hotels with documented HACCP system achieved an advanced level in the design and implementation of the most activities than other hotels which were at the basic level. The majority of the ISO-certified hotels did not verify controls and preventive methods and procedures as well as verify performance tests related to personnel and equipment. These findings are consistent with the results of previous studies which indicated that firms implementing more systematic and rigorous system evaluations have more in-depth and reliable insight into the functioning of the verification activities (Crandall *et al.,* 2012; Jacxsens *et al.,* 2015). In addition, some hotels are not keeping updated records of previous modifications and/or feedback to the FSMS updating. The absence of such basic assurance activities means that hotels do not evaluate the effectiveness of the FSMS as required. Conducting verification activities by external experts ensures that independent and impartial views are provided on the performance of the system (Luning *et al.,* 2008).

FSMS overall performance indicators

The overall performance indicators provide more information about the outputs of the FSMS. A better level is assumed to be associated with higher system performance, which means that food exposure to contamination is significantly reduced. As noted in Table (6), the overall score for the context riskiness for all hotels was 2.1 (moderate-risk). A hierarchical cluster analysis was performed to provide an insight into the homogeneous clusters of hotels that have similar aspects with regard to FSMS activities. Moreover, the following analyses were performed in order to validate the cluster analyses. First, a significant test of the variables was used to obtain the clusters. Second, a discriminatory analysis revealed that (95%) of the originally collected cases were properly classified after a scientific discrimination function covering all the cases except the one being studied. Thus, the cluster analysis proved to be valid (Claver-cortés *et al.,* 2008). At this point, the analysis resulted in three main clusters I (n= 14), II (n=7), and III (n=4) at a dissimilarity distance of 25. The three clusters differed on the comprehensiveness of both the control and assurance activities, with the smallest group (cluster III) achieved the best results. The hotels in this cluster were more frequently performed at the advanced levels, whereas the hotels in the largest clusters (I and II) were performed at satisfactory or sometimes even at marginal levels. Figure (2) presented spiderweb diagrams that showing the performance profiles of the core control activities for each cluster.

Figure 2: Spiderweb diagrams showing the performance of the core control activities

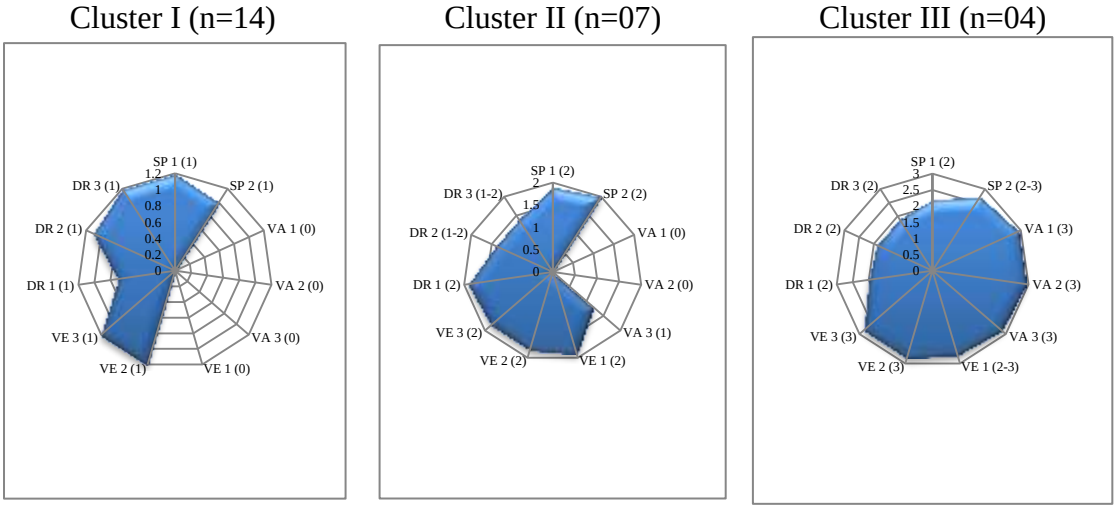


The data presented in Figure (2) revealed that all hotels clustered in I (n=14) were generally scored ≥ 1-2 for the core control activities. Most food safety management systems in this cluster obtained scores ranged from marginal (score 1) or satisfactory (score 2), which is expected to be insufficient to cope with their context riskiness (score 2.1), and achieve rather good food safety outputs. These levels of performance refer to the instability of processes, equipment or methods with unexpected and/or unexplained critical deviations. The typical mode of the outstanding level (score 3) is that the actual performance is systematically monitored and deviations are analyzed in an instantaneous manner. Hotels are required to conduct a more detailed analysis of the core control activities to get indications about the possible causes of such

insufficient performance. However, only for a small group of hotels in this cluster that the systems are sufficient to deal adequately with the contextual risks as reflected in their advanced food safety outcomes (score 3). In the second cluster (n = 07), a limited number of hotels achieved an overall rating ranging from satisfactory to outstanding (overall score 2-3) for the core control activities. The vast majority of this cluster had a satisfactory assessment for the core control activities (score 2), which seems to be appropriate for the moderate-risk context wherein they have to manage. Like for cluster III (n=04), the majority of the hotels showed overall satisfactory scores for the core control activities (score 2). There are a few hotels in this cluster that performed a satisfactory to outstanding level (overall score 2-3).

Core assurance activities, on the other hand, were implemented in lower level. Figure (3) provided the spiderweb diagrams showing the performance profiles of the core assurance activities for each cluster.

Figure 3: Spiderweb diagrams showing the performance profiles of the assurance activities



The data presented in Figure (3) revealed that all hotels clustered in I (n=14) were generally executed on a marginal level (score 1). In this cluster, the verification and documentation activities were executed on marginal levels. This means that hotels only check if procedures are present, but they do not perform internal tests or audits to check the actual behavior of the food handlers to assure that they work in compliance with procedures. It is apparent that hotels focus only on the implementation of the basic requirements and this can be attributed to the fact that assurance activities are time-consuming and require intensive efforts and substantial additional resources (Jacxsens *et al.*, 2015). Previous studies have suggested that the implementation of verification methods through internal monitoring, external assessments and inspections contribute to the promotion of food safety and are amongst the most effective measures to reduce the incidence of foodborne diseases. Studies have shown that improper verification and documentation practices can lead to serious food safety risks (Green *et al.*, 2006; Lianou and Sofos, 2007; Powell *et al.*, 2011; Neal *et al.*, 2012). Therefore, hotels are required to focus more on the application of internal verification audits and properly maintain the monitoring records. The improvement of these indicators will not only lead to coping better with the context riskiness but will also contribute to the realization of controllable and predictable safety outputs. In the second cluster (n = 07), the vast majority of this cluster achieved an overall rating ranging from marginal to satisfactory (overall score 1-2) for the core assurance

activities which seems to be inappropriate for the moderate-risk context wherein they have to manage. The majority of the hotels in cluster III (n=04) showed a satisfactory to outstanding level (overall score 2-3) for the core assurance activities.

Conclusion and future perspectives

In this study, a self-assessment instrument was presented to evaluate the performance of FSMS in the five-star hotels in Egypt based on the perspective of their prescribed food safety activities, contextual riskiness, and food safety performance. The indicators for product and process characteristics scored similarly for all hotels, reflecting the moderate-high risk context. For the product characteristics, the high-risk context was posed by the high-risk raw materials (ingredients) entering the hotels. Therefore, well-controlled handling conditions to prevent cross-contamination, growth and/or, multiplication of pathogens, are required to deal with these microbial risks and thus higher requirement are raised from the FSMS. A moderate- risk context was also posed by the potential hazards associated with final products and serving meals directly to the customers. Thus, accurate control of incoming raw materials, periodic evaluation of specifications, and suppliers' implementation of approved FSMS are essential to ensure the quality/safety of raw materials. For the process characteristics, the majority of the surveyed hotels reported a moderate level of risks associated with the following points "assortment of recipes" and "rates of menu design changes". This is due to the fact that in most hotels a large number of recipes (hot daily menus) are prepared and processed, which may allow in-between cleaning and disinfection interventions during the preparation of such recipes. Further, most hotels are relying mainly on à la carte or cyclical menus, which allows for fewer modifications on both the products offered and the required processes. These critical situations need to be eliminated by the implementation of proper control and assurance measures, e.g. intensified storage control, temperatures monitoring and control, personal hygiene and health requirements to control cross-contamination, setting up a food sampling plan, validation and verification plan of the FSMS, and well-maintained monitoring and modifications records.

There are a number of limitations associated with this study, which may suggest future research proposals. Given that the sample of responding hotels is limited to five-star hotels in Egypt; therefore, these results may not be suitable for other hotel sectors. Future research may attempt to expand the applicability of the self-assessment instrument in other hotel sectors. Further in-depth studies are required on the best practices that hotels can apply to improve the performance of their FSMS.

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