



Implementation of Food Safety Management in the Food Industry in Algeria: Benefits and Barriers Factors

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ABSTRACT

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The key objective of this research review is to elucidate the mechanisms for applying a food safety scheme based on the Hazard Analysis and Critical Control Points (HACCP) system and to identify the difficulties and benefits of this technique (HACCP) in Algeria. Characterization of food processing companies around the capital of Algeria was carried out on the basis of questionnaires and direct interviews with the manager in charge of these companies. Forty-six agri-food firms working in the Algiers region and operating in the field for more than 15 years (80.5%) with Joint Stock company (JSC) status (23.9%), Limited Liability Company (LLC) (63%) and multinational companies (26.1%). The establishment of a transparent and effective framework for food safety controls will enable compliance with customer requirements, improved product quality and a stronger commitment to food safety managers. This is favorably correlated with the age as well as the level of education of the managers of the different surveyed companies. The survey conducted in the Algerian region showed that the key barriers to the introduction of the food safety management system (FSMS) in general are inadequate knowledge and competence of the HACCP and a long time to be developed FSMS, a lack of expertise and technical support and a lack of specialized expertise, intelligence and technological assistance to help the small and medium-sized enterprises (SME). The findings of the survey also revealed that the key reason for the introduction of the FSMS is to strengthen product protection, recognize the strengths and shortcomings of the business, enhance relationships with suppliers and enhance government and consumer confidence.

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Introduction

The agri-food industries sector has grown vigorously over the past 20 years. According to ONS (2019) agriculture and the agri-food sector account for nearly 23% of the working population. The study of Bessaoud et al., (2019) shows that the sector is private to more than 80%, it contributes today from 50 to 55% of industrial GDP excluding hydrocarbons. It is the largest employer in the industrial sector (40% of employment with nearly 150,000 employed) (Bessaoud et al., 2019). The development of the agricultural and agri-food sector is a major issue for Algeria at the economic, political and social levels; it is the second industry of the country, after that of energy (Bessaoud et al., 2019). The cause for this growth is a rise in personal disposable income, a desire for more affordable food and an increase in urbanization. The Algerian food industry includes many fields, including meat, poultry and dairy products, fruit and vegetables, confectionery and

snacks, cereals, fats, drinks and sea food. Although many food processors recognize that simple food safety and sanitation measures are critical to protecting consumers and their integrity, numerous claims of bad practices continue to erode customer trust in the sector (Tang and Babich, 2014; Aworh, 2021). This requires the application of a good protocol concerning the food safety system. "Food safety" is a wider term, which means ensuring that food does not affect the customer when it is processed and/or consumed in compliance with its intended use (Henson and Caswell, 1999; Seward II, 2003; Raspor, 2008; Grover et al., 2016). While most food processors understand that simple food protection and sanitation programs are required to protect customers and their reputations, recurrent allegations of malpractices continue to weaken consumer trust in the business (Jia and Jukes, 2013; Joanna and Wojciech, 2017; Al-Busaidi et al., 2017;

Panghal et al., 2018). Consumer fears over food-related therapies are increasing. As a result of recent food shortages such as those seen in Europe and America, food security and food safety have become a hot subject in the public sphere (Miraglia et al., 2009; Walls et al., 2019; Flynn et al., 2019). The agri-food sector in Algeria is dominated by small and medium enterprises (SME), most of which do not have a food safety management system. However, as the Algerian National Agriculture Agency has revealed, most agribusinesses fall into the group of small and medium-sized companies, most of which have not obtained formal basic training in food safety. Barriers and incentives to implement food safety management systems (FSMS) such as HACCP and ISO 22000 in the food manufacturing sector in Algeria have not yet been studied. Research has shown that the obstacles and barriers to the incorporation of a third party approved food safety scheme depends on the scale of the business (Karipidis et al., 2009; Christos et al., 2011; Dora et al., 2013; Giacomarra et al., 2016) or on the industry type (Kuepper and Batt, 2012; Chaoniruthisai et al., 2018). To this end, various national programs recognised at international level have been used to guarantee and prevent food safety. These systems are defined in particular by the implementation at national level of the hygiene codes, the HACCP scheme, the British Retail Consortium (BRC), and the Healthy Quality Food Consortium (SQF). Since its introduction in the 1990s, the HACCP system has been known as the food safety system of choice, and this voluntary solution has been adopted by Europe and North America at industry level. In addition, HACCP is a science-based framework that allows for the development and management of a continuous, cost-effective food safety policy. It also helps food producers to create a higher standard of food safety that could not be accomplished by merely adopting simple public hygiene practices (Gaze and Robert, 2015). However, it is more efficient to integrate HACCP with other quality control frameworks and normal operating procedures, such as Good Production Practices (GMP) or Good Hygiene Practices (GHP) (KÖK, 2009; Karaman et al., 2012). In Algeria, food companies have adopted different programs such as HACCP and ISO 22000 based on HACCP (Ministry of Industry, 2019).

These initiatives have been broadly applied in the different food industries across the world (Papademas and Bintsis, 2010; Murphy, 2010; Karaman et al., 2012). As a result, the application of HACCP systems allow to evaluate, manage, and control the potential hazards and produce products free from different types of hazards (Beuchat et al., 2013). The food protection literature indicates that progress in designing, deploying, monitoring and verifying an effective HACCP system require a combination of management, operational and technological tools (Taylor, 2001; Fotopoulos et al., 2011). Also the largest food corporations, armed with essential tools, technological experts and management skills, may face challenges in implementing the HACCP method. Small or medium-sized enterprises (SMEs) can also assume that the complexities of HACCP are insurmountable. There are a variety of considerations that obstruct the application and execution of the HACCP scheme, such as the scope of the expertise or support available to companies, and include internal factors, while

external factors include the inaccessibility of government or sector funding. The challenges vary from country to country and from business to industry (Jouve, 1994; Mortlock et al., 1999). Other issues may occur during the introduction of the HACCP method, such as lack of expertise, preparation, high turnover of employees, a wide amount of products, changing potential demand, rapidly changing workloads and a significant number of part-time personnel (Pierson, 2012; Sun and Ockerman, 2005). Moreover, the underlying reason for the non-application of food safety technology is the lack of awareness of these HACCP systems according to research performed in some food services, such as hospitals, food service companies, hotels, take-outs and restaurants. As far as we know, this study is the first to describe issues in the Algerian food industry concerning food safety. The primary aim of this research analysis is to identify the procedures for implementing a food safety system based on the HACCP Protocol, as well as to recognize the barriers and benefits of this system (HACCP) in Algeria. Questionnaires and direct interviews with the manager in charge of quality were used to characterize food processing firms in Blida and Algiers areas, in northern Algeria.

Methodology

Companies that use the HACCP system are included in this research. The Ministry of Industry, the National Chamber of Industry and Commerce and the Commerce Directorates provided the essential information on the agri-food companies, allowing 73 businesses in the Blida and Algiers areas to be identified. Each of these businesses was contacted by phone to confirm their desire to participate in the research on the benefits and barriers of implementing the HACCP system, and then the questionnaire was sent at the request of executive officers. Only 46 firms accepted the face-to-face interview and completed the questionnaires. This corresponds to a response rate of about 63%.

To conduct this research, a survey was designed with the help of both university colleagues (ENSA) and experts from consulting firms that assist companies in the development of food safety management systems. Before writing the research questionnaire, a pre-survey was conducted at the level of agri-food companies to evaluate the feasibility of the questionnaire and to closely observe the agri-business production method in order to address important concerns about the HACCP system's implementation. This questionnaire approach was used to collect views and information on the application of the HACCP program, the experiences of food sector administrators and staff, as well as their perspectives on public facilities and local legal bodies in the field of food safety systems. During our visits to the targeted food processing firms, a questionnaire was distributed to executive officers of each organization, followed by interviews, several sessions, to ensure the accuracy of the answers. The face-to-face interviewing approach enabled conscientious persons and interviewees to publicly discuss their familiarity with the implemented HACCP for these companies.

In this study, SPSS (Statistical Package for Social Sciences, version 25) was used to conduct all statistical

analyses. First, the software was used to categorize and statistically analyse the variables using the descriptive statistics to characterize the agri-food companies. On the other hand, SPSS is used to conduct the statistical significance levels which were established at $P < 0.05$ and $P < 0.01$. Then Correlation analysis was used to assess correlation between educational level and age of managers and barriers-benefits of FSMS and expectations of plant managers from the legal authorities.

Results and Discussion

The implementation of the HACCP framework is a need for both the food industry and the customer for the development of a country (W.H.O, 2006; Chen and Voigt, 2020; Gordon et al., 2020). This HACCP system, due to its sensitivity within an organization, makes it possible to recognise the various hazards that can impact the food manufacturing, processing and production chain (Chen et al., 2015; Martinovic et al., 2016; Dzwolak, 2019; Mtewa et al., 2020). The adoption of this system is not a simple matter, particularly in under developed countries, since there are many restrictions that need to be addressed (Motarjemi and Mortimore, 2005; Schillhorn van Veen, 2005; Hobbs, 2010; Lee et al., 2012). These limitations are primarily due to a significant lack of infrastructure for safe processing and, in some situations, protocols have been established without prior planning to make these complex protocols work (Panisello and Quantick, 2001; Christos et al., 2011; Wallace, 2014; de Oliveira et al., 2016; Swainson, 2019). In the following sections, we will examine in detail the benefits and barriers for the surveyed food companies in Algeria.

Descriptive Information on the Algerian Surveyed agri-food Companies

Table 1 summarizes the results of the main characteristics of agri-food industry and managers of different agri-food companies in Algiers and Blida regions. According to these findings, the vast majority (80.5%) of agri-food companies have been in operation for more than 15 years analogous to the finding of Karaman et al., (2012) and have the legal status of JSC (23.9%) or LLC (50%). Most agri-food firms are involved in the fields of soft drink and juice distribution (16%), cheese production (20%), dairy production (14%), cereal manufacturing (8%), ice cream and sausage production (4%). More than half (63%) of managers employed in the agri-food industry are aged between 31 and 50 as mentioned in Chaoniruthisai et al., (2018). Most of these administrators are university graduates (91.3%) the remaining (8.7%) are high school graduates, similar to the finding of Fotopoulos et al. (2009) and Karaman et al. (2012).

Improving Food Safety in Agri-food Companies

In order to gain more insight into the advantages and contributions of introducing a food safety scheme at the firm level, detailed questions were raised about the management of these companies. As shown in Table 2, the majority of agri-food managers discussed the key benefits of implementing a food safety management system. The main advantages are improved product safety (100%), better working conditions (100%), better client concerns

management (97.8%), stronger involvement of workers (95.6%), identifying the strengths and deficiencies of the company, improve relations with suppliers, raising awareness on health safety issues and increased trust in the availability of foodstuffs with an average of (92%).

Based on these findings, the application and operation of the HACCP method had significant benefits. Mensah and Julien, 2011 and Bas et al., 2007 have also reported similar findings.

The benefits of HACCP system in terms of food safety and efficiency as well as the improvement of protection steps would be expressed favourably by figures in food processing companies (Demirbas et al., 2008) and similar results have been reported by various studies (Shiferaw et al., 2000; Buccheri et al., 2007; Tokuç et al., 2009). The HACCP framework is used for the detection, review and monitoring of food product hazards before being sent to the consumer for purchasing or consumption. The HACCP scheme has been an obligation in Algeria for food processing firms. Additional benefits for the introduction of HACCP systems have been reported to satisfy regulatory standards and increase product quality and protection (Early, 2005; Fortin, 2013). Owing to the decline in product recalls, the opportunity to market goods at higher prices, minimize product waste and reduce manufacturing costs is also interesting (Scott, 2005; Yunus and Ray, 2007).

When senior managers were asked what they would like to do to strengthen food safety procedures in their facilities, a large percentage agreed with the need for a HACCP-based food safety management system.

Table 1. Characteristics of agri-food industry and managers (n= 46).

Characteristics	n(%)
Agri-Food business year of establish	
less 5 years	2(4.3)
5-15 Years	20(43.5)
15-25 Years	17(37)
>25 Years	7(15.2)
Education level	
Secondary	4(8.7)
university	42(91.3)
Manager age	
Less 30	2(4.3)
31-50	29(63)
>50	15(32.6)
Legal status of the company	
JSC	11(23.9)
LLC	23(50)
Multinational	12(26.1)
Company field	
Public	1(2.2)
Private	45(97.8)
Agri-food company type	
Cheese production	10(20)
Production and distribution of soft drinks and juices	8(16)
Transformation of cereals	4(8)
Production of milk	7(14)
Production of ice cream	2 (4)
Charcutery	2(4)

However, the executives of the agri-food industry claimed that examination and control of safety of staff is more important than cleaning and disinfecting techniques and insect and pest management with a frequency of (100%), frequency of cleaning and disinfection and the location and design of the food-campaign are higher than (97%), availability of waste bins (86.9%), shipping, collecting, treating and holding (82.6%) (see Table 3). According to these administrators, these responses tend to improve the consistency and the operation of a successful food protection scheme.

It is also worth noting that the food industry executives interviewed for this study agree that implementing the HACCP protocol has more benefits than disadvantages, including the cost and time that this HACCP system would require in the production circuit, and its effect will be felt by the entire company's employees. According to our

research, it would be interesting to operate well on the basis of the location and design of the food company, cleaning and disinfecting techniques and their frequencies, availability of waste bins, shipping, collecting, treating and holding and examination and control of safety staff. These findings agree well with previous studies (Ropkins and Beck, 2000; Kokkinakis et al., 2011). Our results show that the staff interviewed agreed that the HACCP protocol enhances product safety. However, other studies have demonstrated that the HACCP-based food safety system is effective and can eliminate all foodborne illnesses in the food chain only if HACCP plans are properly established and understood (Demirbas et al., 2008; Wallace, 2014; Oyarzabal and Rowe, 2017; Dzwolak, 2019). Any company needs its own food safety scheme, with realistic and easy on-site checklists (De Sitter and van de Haar, 1998; Egan et al., 2007; Ropkins and Beck, 2000).

Table 2. Managers opinions on HACCP Benefits implementation.

Responses	n(%)				
	Strongly disagree	Disagree	Without An opinion	Agree	Strongly agree
Improved product safety				15(32.6)	31(67.4)
Responding to certain calls for tender	2(4.3)	8(17.4)	3(6.5)	30(65.2)	3(6.5)
HACCP has more restrictions than advantages	30(65.2)	13(28.3)	3(6.5)		
Identifying the strengths and deficiencies of the company		3(6.5)		38(82.6)	5(10.9)
Stronger involvement of workers		2(4.3)		29(63)	15(32.6)
Enables to work in better conditions				15(32.6)	31(67.4)
Improve relations with suppliers		2(4.3)	2(4.3)	29(63)	13(28.3)
Better management of client concerns		1(2.2)		26(56.5)	19(41.3)
Better cost management		5(10.9)	1(2.2)	13(28.3)	27(58.7)
Reduce the risk of food-borne illnesses			8(17.4)	7(15.2)	31(67.4)
Raising awareness on health safety issues		1(2.2)	3(6.5)	22(47.8)	20(43.5)
Increased trust in the availability of foodstuffs			3(6.5)	23(50)	20(43.5)
Increased quality of life (health and socio-economic)	3(6.5)	6(13)	13(28.3)	16(34.8)	8(17.4)
Increased government and consumer confidence	1(2.2)	2(4.3)	10(21.7)	11(23.9)	22(47.8)

Table 3. The food company's hygiene condition after implementing the HACCP system.

Responses	n(%)		
	Average	Favourable	More favourable
The location and design of the food-company	1(2.2)	24(52.2)	21(45.7)
Cleaning and disinfecting techniques		15(32.6)	31(67.4)
Frequency of cleaning and disinfection	1(2.2)	15(32.6)	30(65.2)
Availability of waste bins	6(13)	11(23.9)	29(63)
Insect and pest management		13(28.3)	33(71.7)
Shipping, collecting, treating and holding	8(17.4)	16(34.8)	22(47.8)
Examination and control of safety of staff		12(26.1)	34(73.9)

Barriers and Difficulties Encountered in Implementing Food Safety Systems

In order to examine the effects of the various restrictions on the introduction of an effective food safety scheme, a questionnaire was sent, prior to the face-to-face interview, to all the managers of the food processing firms involved in this study. The feedback is shown in Table 4. It can be seen that insufficient knowledge and competence of the HACCP, long time to set up and cost of application constitute the main barriers according to the participants of the survey. These are the reasons most responsible for the challenge of developing a successful food safety scheme. In the second position, lack of motivation and commitment of workers, lack of expertise and technical support, inadequate basic hygiene and lack of effective training and education programs identified by

frequency varies from 95% to more than 97%. Lack of specialist expertise, intelligence and technological assistance to support SME account for 84.8% while difficulties relating to technologies and design of production account for only 23.9%.

It has previously been noted that small and medium-sized food companies are typically not in a position to enforce the HACCP recommendations due to their small size, lack of technological knowledge and preparation, high turnover of staff and limited capital (Azanza and Zamora-Luna, 2005; Wengle, 2016; Allata et al., 2017; Liu et al., 2021). Based on previous research, it was observed that the most important barrier to the introduction of a successful HACCP-based food safety system was resources shortage and a clear lack of awareness about the

food safety system (Jirathana, 1998; Taylor, 2001; Jevvsnik et al., 2006). However, it is widely accepted that it is very difficult to introduce the HACCP method in food companies and this is closely related to the psychological obstacles such as lack of knowledge of risk and morale of workers need to be addressed in order to enforce HACCP successfully (Gilling et al., 2001). This is reflected in an extension of lack of motivation and commitment of workers of more than 97.9% (see Table 4) (Taylor and Taylor, 2004; Joanne, 2008).

Based on the findings of this survey, insufficient knowledge and competence of the HACCP, long time to set up and cost of application are the major parameters that hinder the implementation of a successful HACCP protocol as shown in Table 4, results are also closely similar to prior works (Ramirez Vela and Martin Fernández, 2003; Jevvsnik et al., 2008; Motarjemi and Mortimore, 2014). On the other hand, the challenges of introducing the HACCP system in Algerian food firms have been described as the inadequacy of the facilities and the physical conditions of the institution (Al-Busaidi et al., 2017; Bas et al., 2006). Also, According to our report, it appears clearly that the lack of expertise and technical support described by the intensity of the documentation during the establishment of HACCP implementation (94.4%) represent a major barrier Table 4.

The challenges associated with tedious documentation in Algeria can be overcome by employing tools that minimize the amount of paperwork and thereby promote documentation in the execution of these programs. It was also proposed that food safety reporting and record keeping should not be a liability and may have several advantages other than conformity with the HACCP principles (Antle, 1996; Havinga, 2006; Antle, 1999; Manning and Baines, 2004). It is noted that the cost as well as the significant lack of understanding and preparation as such are among the most prominent barriers to the introduction of a food safety scheme in the agri-food sector based on the HACCP protocol (Karaman et al., 2012; Macheka et al., 2013; Rincon-Ballesteros et al., 2019). Among the obstacles to the introduction of HACCP in food enterprises in Algeria inadequate basic hygiene, insufficient training and the lack of local information sources on HACCP and employee training and financial resources are the most relevant. The results of this analysis matched those of the previous one

(Bas et al., 2007). In other works, Youn and Sneed, 2002 recognized personnel and resource obstacles in the National School Food Service Directors Report (Sneed and Henroid, 2003; York et al., 2009). They documented that the major obstacles were lack of knowledge for workers and lack of financial support. The difficulties arise also regarding managers that have little or no previous experience in food safety or sanitation instruction. Indeed, the survey reveals a lack of adequate training for both administrators and employees (more than 95.7%) (Table 4).

In other studies carried out in various countries, it appears that among the difficulties faced in the implementation of the standardized HACCP method, the most significant was due to the necessity of handling of big datasets containing heavy documents (Mayes, 1998; Taylor, 2001; Kowalska and Manning, 2020; Berdik et al., 2021).

Managerial Expectations for Government Support in Food Safety Systems

In the following, we will examine the commitment and funding of the state to the food processing companies under review, as well as the intentions of the managers of these companies for the state. The Chamber of Industry and Commerce and the Ministry of industry are the state-representing organizations. When asked if the Ministry could assist agri-food companies in introducing and preserving food safety programmes, managers concluded that the businesses who have benefited from government subsidies represent (37%) of them benefited from state support represented by the Ministry of industry. The majority of them have difficulty adapting to certain requirements provided by the public authority in order to receive these subsidies (63%). Any of the agribusinesses in question have benefited from foreign cooperation programs (34.8%) implemented by DIVICO 1 (European cooperation program for Algeria’s agricultural and agri-food industries). It’s worth noting that the businesses that have benefited from public assistance and have been reimbursed account for 32.6% of the total as shown in Table 5. In addition, the managers of the agri-food firms considered that the supports provided by the public authorities and international organisations mentioned above to set up a successful food safety scheme were related to the different costs that the companies had faced.

Table 4. Barriers identified by managers to implementing HACCP system (n= 46).

Responses	n(%)				
	Strongly disagree	Rather disagree	Neutral	Rather agree	Strongly agree
Insufficient knowledge and competence of the HACCP				11(23.9%)	35(76.1%)
Long time to set up.				5(10.9%)	89.1
Cost of application				10(21.7%)	36(78.3%)
Staff turnover.		1(2.2%)	1(2.2%)	15(32.6%)	29(63%)
Lack of motivation and commitment of workers		1(2.2%)		24(52.2%)	21(45.7%)
Lack of expertise and technical support (intensity of documentation).				14(30.4%)	32(64%)
Inadequate basic hygiene	3(6.5%)	1(2.2%)		32(69.6%)	10(21.7%)
Lack of effective training and education programs.		1(2.2%)	1(2.2%)	17(37%)	27(58.7%)
Lack of specialist expertise, intelligence and technological assistance to support SME		7(15.2%)		17(37%)	22(47.8%)
Difficulties relating to technologies and design of production.	13(28.3%)	22(47.8%)		10(21.7%)	1(2.2%)

Table 5. Expectations of agri-food business from the legal authorities (n= 46).

Reponses	n(%)	
	Yes	No
For businesses who have benefited from Government benefits	17(37.0)	29(63.0)
If yes, was it done entirely?	15(32.6)	31 (67.3)
Have the company benefited from a foreign development programme?	16(34.8)	30(65.2)

Table 6. The costs of implementing the HACCP system (n= 46).

Responses	n(%)				
	Not important	Little important	Important	Very important	Not concerned
Cost analysis of the product	5(10.9)	14(30.4)	21(45.7)	4(8.7)	2(4.3)
Cost investment in new equipment	1(2.2)	5(10.9)	24(52.2)	14(30.4)	2(4.3)
Cost of staff training		18(39.1)	20(43.5)	6(13)	2(4.3)
the cost system documentation	7(15.2)	19(41.3)	16(34.8)	2(4.3)	2(4.3)
Cost time spent on system documentation	5(10.8)	5(10.9)	30(65.2)	4(8.7)	2(4.3)
Cost structural changes in the company	2(4.3)	10(21.7)	28(60.9)	4(8.7)	2(4.3)
Cost upgrade of the system	3(6.5)	19(41.3)	11(23.9)	12(26.1)	1(2.2)

Table 7: Correlation between educational level and age of managers and barriers-benefits of FSMS and expectations of agri-food-- managers from the legal authorities. (n= 46).

Responses	Manager level	Manager age
System build time	-0.385 ²	
Meet customer requirements	0.314 ¹	
Stronger management commitment to food safety	0.324 ¹	
Application cost		0.311 ¹
Suppliers that aren't a great fit for the company		-0.385 ²
Improve product quality		0.426 ²
Correlation is significant at the 0.05 level (2-tailed) ¹ .		
Correlation is significant at the 0.01 level (2-tailed) ² .		

Discussions with managers of agribusinesses in Algeria have confirmed that the Ministry of Industry has various programs of technical assistance to agribusinesses, as well as training sessions for managers and technicians of these companies. Support and expertise of consultants approved by the State and specialized in a particular field are also available. On the other hand, one should be aware that several firms have found it difficult to secure funding on the basis of the documentation required by the government. Among the problems encountered in introducing food safety programs, the managers in this study concluded that it is difficult for enterprises to obtain government support (63%) and that 65.2% of enterprises have not benefited from international development programs as shown in Table 5.

In the first position, the investment cost of in new equipment (82.6%), the cost time spent on system documentation (73.9%), next the cost structural changes in the company (69.6%) and the other costs represented by analysis of the product (54.4%), cost upgrade of the system (50%) and finally the cost system documentation (39.1%) as shown in Table 6.

On the basis of these findings and the studies recently carried out, the opinion of managers affirms the control over the whole chain of food industry in order to enforce a successful food protection regime in these companies and also to ensure the processing of the various goods manufactured by these companies (Rodrigues et al., 2019; Tsai et al., 2021). Previous findings indicate that, in order to incorporate an effective HACCP framework, many forms, methods, guidelines and plans are required, in

addition to the study and validation of the HACCP system, to be applied in compliance with the requirements, requiring extensive demands for documents that were time intensive and complicated (Mari et al., 2013; Green and Kane, 2014; Zwietering, 2015). The production and introduction of solid written standard operating procedures in the food industry is one of the challenging phases needed to implement successful HACCP and other food safety programs in agri-food business (Taylor, 2001; Route, 2001; Taylor and Kane, 2005; Jin et al., 2008).

A correlation test has been performed in order to examine the relationship between the main parameters that can affect the phase of a successful HACCP protocol, as shown in Table 7. According to the obtained results (Table 7), there is a strong correlation between manager level education and satisfying customer and regulatory requirements, as well as a higher level of management commitment to food protection on the one side, and manager age and improving product quality and application cost on the other hand. It should also be remembered that, on the one hand, there is a negative correlation between system build time and manager-level instruction, and on the other hand, there is a negative correlation between suppliers who aren't a good match for the business.

The implementation of the HACCP food safety protocol is focused on operating as a group rather than recruiting people on their own (Azanza and Zamora-Luna, 2005; De Oliveira et al., 2016; Despoudi, 2021). In this way, collaboration and employee engagement in the growth of the HACCP framework may be a significant part

of staff motivation (Gilling et al., 2001; Liu et al., 2021). Similar surveys have confirmed that, as the standard of preparation of company staff grows, their demand for assistance from government agencies in terms of consultation on HACCP activities is diminishing (Jin et al., 2008; Wen-Hwa, 2013; Al-Busaidi et al., 2017). This inverse proportionality indicates that the application of FSMS to agri-food firms could increase by hiring plant managers from highly trained operators (Table 7). What might be clear is that, as the level of education of managers in agri-food industries is high at a certain level, the rate of daily product protection inspections that feed their companies in the various supply chains will increase (Demirbas et al., 2008; Qian et al., 2011) (see Table 7).

Conclusion

The goal of this work was to assess the implementation of a food safety management system in the Algerian agrifood industry and to examine barriers and advantages. Based on the findings obtained during this review, it is clear that the following are among the key obstacles encountered during the implementation of the HACCP scheme: insufficient knowledge and competence of the HACCP, long time to set up, cost of application, lack of expertise and technical support, inadequate basic hygiene and lack of effective training and education programs. It should be noted that the managers questioned agreed that while the HACCP scheme has constraints, the advantages are greater, it nevertheless helps to, identify the strengths and shortcomings of the business, and particularly to spot better conditions of operation and strengthening the bonds with suppliers. It is also worth noting that when managers were asked what pertinent steps should be taken in order to enhance food protection in their businesses, they agree that cleaning and disinfecting procedures, the intensity of cleaning and disinfection and the assessment and supervision of safety personnel were the key criteria that could help to enforce a successful HACCP framework. According to the findings obtained previously, it has also been found that the challenge of implementing the HACCP scheme at the level of an agro-food business depend on public support on the basis of a national development program. Moreover, our findings also indicate that training and a better knowledge for food company managers and workers is vital for the successful operation of the HACCP system. The Government must provide financial assistance for the establishment of FSMS in these plants and support the long-term maintenance of FSMS in the industry. In addition, public services represented by the Ministry of Agriculture, as well as local and regional services, need to improve and diversify consulting services in order to improve the implementation of a good HACCP system, particularly for microenterprises. In addition, good cooperation between universities, public services and food companies could afford these companies the best chances of success.

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