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Food safety constraints analysis in Moroccan food industry - focus on documentation

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ABSTRACT

The objective of this study is to diagnostic the availability of documentation (regulations, product standards and guidelines relating to sector activities) for Moroccan food industry and the easiness of access to these documents and their updates. The use of software for quality / food safety management is also taken into consideration. In the last sections of the questionnaire, the floor is given to agribusinesses to express difficulties meet in controlling food safety and the peculiarities of business sector of the company in question. This information will allow us to offer tools to help Moroccan agribusiness for controlling documentation (regulations, standards and guides).

Key words: Certified food companies, Exporting companies, Food regulations, Moroccan food industry, GMP - GHP - GLP, Product standards, Questionnaire, Software quality / food safety management.

INTRODUCTION

In recent decades, important lifestyles changes determined deep modifications on food consumption [1]. Hence the important need for manufactured and semi-manufactured foods. Food industry produces finished products to the consumer and intermediate goods for further processing. Compared to many other industries, it is characterized by its diversity, which is reflected by the size and type of businesses, the extended range of raw materials, products and processes used and the various combinations they allow. Also it is characterized by manufacturing of globally standard products or special and traditional products, nationally or regionally. A large proportion of businesses are SMEs, most of which employ more than 20 people. They are subject to a variety of local economic, social and environmental conditions and different national laws [2].

Food safety has become a concern subject for health services, inspection services and consumer [3]. Delivering safe food to consumers is the responsibility of operators at all levels of food production chain [4].

In Morocco, food industry occupies a prominent place in economic activity. Units involved in food industry are distributed throughout Morocco. However, this sector suffers from many problems such as:

- The use of old manufacturing processes.
- Low productivity.

- High manufacturing costs.
- Lack of skilled labor.
- Lack of control of GHP.

It is especially this last point that raises the most recently, because a good number of poisonings are due to contaminated food products. Plus health consequences, this problem may causes a decline in economic activity in food industry due to the loss of consumers' confidence in product quality, and increased customers' complaints [5].

MATERIALS AND METHODS

The study was conducted during the period from December 2012 to December 2013. When the questionnaire was under preparation, the following factors were taken into consideration:
- Questions should be clear, simple and minimized,
- Time required to complete the questionnaire should not exceed 10 min,
- Information classified as confidential (such as: turnover, capital, main customers and suppliers, salaries, etc.) are not required,
- With the exception of "company's name", all questions are classified as "obligatory" to prevent uncompleted answers,
- Making access to the questionnaire easy by launching online via the following link:
https://docs.google.com/spreadsheet/viewform?formkey=dFpsQXJlU0doUlBDTEZKTTR5cTdkUVE6MQ.
Questions asked in this study are:
- Company's name
It is kept anonymously and is not included in the analysis. Its addition is optional.
- Main Activity *
- Business category *
According to the 13 categories established by the ISO 22003 standard. Categories are listed in the questionnaire. User can choose one that fits its business.
1- Are you an exporting company? *
2- Are you certified? *
If Yes, please specify reference(s) of certification
If On the way, please specify reference(s) of certification
3- Do you have all regulations related to your activity sector? *
4- Made you updates of regulations on a regular basis? *
Whether yes or in part, what is the tool you use?
5- Do you have all product standards related to your activity sector? *
6- Made you updates of these standards on a regular basis? *
7- Do you have all guides GMP, GHP and GLP related to your activity sector? *
GMP: Good Manufacturing Practices; GHP: Good Hygiene Practices; GLP: Good Laboratory Practices.
8- Made you updates of these guidelines on a regular basis? *
If Yes or in part, what is the tool you use?
9- Do you find that information about food safety (standards, regulations, PRPs, guides, etc.) is gathered and easily accessible? *
10- Do you find any difficulties in finding this information and its updates? *
11- What is the internal coaching rate? *
(Total of managers / total staff) x 100
12- Do you use software(s) for quality and / or food safety management? *
If Yes, please would you mention -if possible- the name of software;
If No, please would you mention reasons that do not motivate you to use software for quality and / or food safety management;
13- In your opinion, what are the difficulties faced by food industry in controlling food safety? *
14- What are the features of your activity sector? *
In terms of food security

*Obligatory questions
The e-mail address: y.elammari@univ-ibntofail.ac.ma created by IT department of the University IBN TOFAIL gives more confidence to the people for whom the questionnaire was sent. Their e-mail addresses (Quality Managers, Production Managers and leaders of some SMEs) are derived from the corresponding author contacts on professional networks such as www.viadeo.com and www.linkedin.com sites.

A note was sent with emails presenting the framework of the study. In total, the questionnaire was sent to 393 people. After several reminders by e-mail and phone calls, we received 94 responses. So a response rate of 23.92%. The responses are recorded immediately after the user clicks on "Send" in the link:

https://docs.google.com/spreadsheet/ccc?key=0ApCD1WcN_nAFdFpsQXJlU0doUlBDTEZKTTR5cTdkUVE#gid=0.

RESULTS AND DISCUSSION

The results of this study can be presented as follows:
Overall response rate:

Table 1: Response rate

	Questioned	Responses	Response rate
All categories	393	94	24%

Despite repeated reminders, response rate does not exceed 24% of surveyed companies. The maximum responses day was October 22th, 2013 with 11 responses, so about 12% of all responses received. This was the result of a stimulus email in which addressees were informed of the near close of the questionnaire.

In the following table, responses are divided by category. These categories are determined by ISO 22003 version 2007 [6].

Table 2: Repartition of answers of the questionnaire by categories of food industry

		Category's Responses	% of category
A	Farming (Animals)	4	4%
B	Farming (Plants)	16	17%
C	Processing 1	14	15%
D	Processing 2	12	13%
E	Processing 3	26	28%
F	Feed production	0	0%
G	Restoration	5	5%
H	Distribution	5	5%
I	Services	3	3%
J	Transport and storage	0	0%
K	Equipment manufacturing	2	2%
L	(Bio)chemical manufacturing	2	2%
M	Package material manufacturing	5	5%

It is found that the maximum responses, 28% of all, was from companies of "E" category (Processing 3). This can be explained by the strong dominance of this category in the Moroccan food industry [7]. However, we note that no response was received from "F" and "J" categories (respectively "Feed production" and "Transport and storage").

Question No 1: Are you an exporting company?
Over the period 2009-2011, Moroccan food exports were heavily concentrated to the European Union market, which has absorbed about 73% of it. Among importers we note France which leads with nearly 50%. The evolution of EU part from food industry exports informs about its dominance despite the obstacles placed for access to this market [8].

Table 3 shows that 67 % of questioned companies are doing export. To have a position in the international market, Moroccan food enterprise is obliged to apply GMP & GHP as well as compliance of either Moroccan regulations and those of the country where its products are destined.

Export activity provides for the enterprise a good profit margin and new markets.

Table 3: Question No 1 results

	Number	Percentage
Exportatring companies	63	67%
None exportatring companies	31	33%

To support the growth of the Moroccan food industry, the government is implementing a program to develop Food-Industrial Platforms (6 agro-food poles) and seafood processing (2 Fish Hubs), providing infrastructure and services at the best international standards [9].

Question No 2: Are you certified?

In many cases, certification improves organization's management and internal functioning. It is only one of management's components. Like any improvement process, certification has a positive effect on organization profitability and productivity [10]. Hence the high percentage of certified companies and on the way ones (78% in total): Table 4. These companies are dispatched on the 11 categories of food chain that answered the questionnaire. ISO 9001 version 2008 certification comes in first with 28% of total certifications followed by ISO 22000 version 2005 (Table 5).

Table 4: Question No 2 results

	Number	Percentage
Certified companies	58	62%
On the way of certification companies	15	16%
None certified companies	21	22%

Following of question No 2: If Yes, please specify reference(s) of certification

Table 5: Distribution of certified companies by standard of certification

Standard	Percentage	Number
ISO 9001: 2008	28%	28
ISO 22000: 2005	19%	19
BRC: 6	13%	13
IFS: 6	9%	9
GLOBAL GAP	5%	5
ISO 14001: 2004	5%	5
HACCP	4%	4
IPQI	3%	3
HALAL	2%	2
MS 00.5.801	2%	2
OHSAS 18001: 2007	2%	2
EN 45011	1%	1
AIB	1%	1
GMP	1%	1
Field To Fork (F2F)	1%	1
FOS	1%	1
ISO 17025: 2005	1%	1
MCGC label	1%	1
WISE	1%	1

Following of question No 2: If on the way, please specify reference(s) of certification

In Table 7, question number 2 second's part results are presented. It is noted that projects of certification according to ISO 22000 is initiated by 36% of companies, followed by 9001, BRC then IFS standards.

Table 7: Distribution of companies on the way of certification by standard

Standard	Percentage	Number
ISO 22000: 2005	36%	12
ISO 9001: 2008	18%	6
BRC v 6	12%	4
IFS v 6	12%	4
HACCP	6%	2
ISO 14001: 2004	6%	2
FSSC 22000	3%	1
ISO 50001: 2011	3%	1
Tesko choice	3%	1

Question No 3: Do you have all regulations related to your activity sector?
The real answer to this question is difficult for most companies. Because it is not logic / legal to work in a business without having all applicable regulations. Results received, presented in Table 8, are admitted although they are in contradiction with answers to questions 9 and 10 of this questionnaire.

Table 8: Question No 3 results

	Number	Percentage
Yes	70	74%
No	8	9%
In part	16	17%

Question No 4: Made you updates of regulations on a regular basis?
Since regulations disposal is not enough. Using updated revisions is necessary to ensure that the company complies with the latest version of applicable regulations. Results of this question reveals that companies that answered "Yes" to question No 3 have the same answer for this question. On the contrary, 3 companies among those who answered "In part" in the previous question confirmed that they do not update regulations on a regular basis.

Table 9: Question No 4 results

	Number	Percentage
Yes	70	74%
No	11	12%
In part	13	14%

Following of question No 4: If yes or in part, what is the tool you use?
Internet (without specifying websites frequented), consulting firms, FSNO and OB are the tools used, by 68% of companies who answered "yes" or "in part" to question No 4, for following of regulations updates. Among softwares developed for this purpose, we note: ARTEMIS, QualiproXL and VIGIAL. Their use does not exceed 6% of surveyed companies.

Table 10 presents tools used for following regulations updates.

Table 10: Tools used for following regulations updates

Tool	User's Number	Percentage
Artemis software	1	2%
Association	1	2%
OB	6	10%
TUV organization	1	2%
FITC	2	3%
Consulting firm	7	12%
Veterinary Service Direction	1	2%
AEECC	4	7%
Federation	1	2%
MIS	1	2%
Internet	19	32%
QualiproXL software	1	2%

Relation with universities	1	2%
ASTA & ESA Member	1	2%
CLINO	2	3%
FSNO	7	12%
Headquarter	2	3%
VIGIAL software	1	2%

Question No 5: Do you have all product standards related to your activity sector?
Results of this question, presented in Table 11, show that 71% of companies claim to have all product standards related to their activity sector. Against 11% who do not have and 18% partially have these standards.

Table 11: Question No 5 results

	Number	Percentage
Yes	67	71%
No	10	11%
In part	17	18%

Question No 6: Made you updates of these standards on a regular basis?
Because standards are updated from time to time, the fact of having the latest available updates is necessary to ensure enterprises competitiveness. The answers to this question, table 12, are exactly the same like those of the previous question.

Table 12 : Question No 6 results

	Number	Percentage
Yes	67	71%
No	10	11%
In part	17	18%

Question No 7: Do you have all guides GMP, GHP and GLP related to your activity sector?
Good manufacturing practices (GMP), good hygiene practices (GHP), good laboratory practices (GLP) and production systems are used to ensure food safety [11]. 61% of companies confirmed that they have all guides GMP, GHP & GLP in relation to their industry. For 23%, these guides are partially available while 16% do not have. The acquisition of these guides allows the company to refresh their knowledge and to be updated compared to competitors.

Table 13: Question No 7 results

	Number	Percentage
Yes	57	61%
No	15	16%
In part	22	23%

Question No 8: Made you updates for these guidelines on a regular basis?
93% of companies answered in question No 7 that they have all guides confirmed they updated them on a regular basis. This represents 56% of all companies surveyed. The rest is dispatched between those who partly do it and those that they do not update. Results of this question are shown in Table 4.

Table 4: Question No 8 results

	Number	Percentage
Yes	53	56%
No	21	22%
In part	20	21%

Following of question No 8: If Yes or In part, what is the tool you use?
The tool most commonly used to update good practice guides is internet with 43% of answers. Visited websites are not specified. Consulting firms in second place with 11%, followed by FSNO which is for 9% of companies a tool to update guides.

Table 15: Tools used to update guides

Tool	Number of users	Percentage
Alliance 7	1	2%
Mills Association	1	2%
Certification organization	1	2%
FITC	1	2%
Consulting firms	5	11%
Veterinary Service Direction	1	2%
PDM	1	2%
AEECC	3	6%
Federation	1	2%
MNF	2	4%
Internet	20	43%
ASTA & ESA Member	1	2%
Ministry of Agriculture and Maritime Sin	1	2%
CLINO	1	2%
FSNO	4	9%
Headquarter	3	6%

Question No 9: Do you find that information about food safety (standards, regulations, PRPs, guides, etc.) is gathered and easily accessible?

The purpose of this question is to detail the problem related to information on food safety such as standards, regulations, good practice guides and those describing PRPs. Responses received, in Table 16, clearly show that Moroccan enterprises suffer for acquiring such information. As indicated in the answers of next question, this information is dispatched and not grouped together and easily accessible. Researching this information is usually Quality Managers task in Moroccan food businesses. These Managers have many difficulties to collect this data in order to comply with them. These difficulties born of the current absence of a database containing all products standards, Moroccan regulation, GMP, GHP and GLP for each food sector.

Table 16: Question No 9 results

	Number	Percentage
Yes	37	39%
No	57	61%

Question No 10: Do you find any difficulties in finding this information and its updates?

Answers of this question confirm results of the previous question. Since information about food safety is not grouped and easily accessible so difficulties in finding it (information) and following updates appear. This is quantified in Table 17.

Table 17: Question No 10 results

	Number	Percentage
Yes	71	76%
No	23	24%

Question No 11: What is the internal coaching rate?

Traditionally, it is often distinguished executives, other managers, technicians, supervisors having a coaching position, and operational staff (workers and employees) [12]. The role of coaches and local management is fundamental to ease tensions and reduce passions [13]. All managers have as mission reaching results and achieving targets fixed for their services or units [14].

In the case of our study, a high internal coaching rate means that operators are more heighten, monitored and supervised in term of food safety.

Table 18 below shows that coaching rate between 1 and 20% represent 80% of all companies surveyed.

Table 18 : Question No 11 results

		Number	Percentage
1	$1 \leq ICR < 5$	17	19%
2	$5 \leq ICR < 10$	25	28%
3	$10 \leq ICR \leq 20$	29	33%
4	$20 < ICR < 50$	7	8%
5	$50 \leq ICR < 100$	11	12%

Question N° 12 Do you use software(s) for quality and / or food safety management?

In recent years, contribution of information systems to business competitiveness is increasingly visible. From tools handling repetitive tasks, they have become real management tools for optimization in daily activities. Today, integrated management software can often give a significant competitive advantage [15]. In the case of surveyed companies, 79% do not use software for quality and / or food safety management (Table 19). The 21% remaining work with various softwares such as QualiproXL, SAGE, QUALITY Pro, etc. as summarized in Table 20. We note that only 12 of the 20 companies that answered "Yes" for this question mentioned used softwares names.

Table 19: Question N° 12 results

	Number	Percentage
Yes	20	21%
No	74	79%

Following of question 12: If Yes, please would you mention -if possible- the name of software

Table 20: Softwares used for quality / food safety management

Ages	8%	1
AUDITEXPRESS	8%	1
Confidential	8%	1
Internally developed software	8%	1
LOGICO	8%	1
Logista	8%	1
QualiproXL	8%	1
QUALITE Pro	8%	1
SAGE	8%	1
SAGE 100	8%	1
SAP	8%	1
Tracfruit	8%	1

Following of question 12: If No, please would you mention reasons that do not motivate you to use software for quality and / or food safety management

Many reasons for not using software for quality and / or food safety management are mentioned by companies surveyed. Table 21 shows the distribution of causes according to cause-effect diagram named also 7M diagram. This tool helps in classifying different causes of a problem. When analyzing case by case, we find that "budget priority" constraint leads with 16% of responses, followed by the lack of suitable software to business need then management decision to do not buy / use software. We find with the same percentage (10%) companies wishing to develop their own software. While the classification of causes per class, according to 7M method, shows, in table 22, that Method, Money then Management classes represent 75% of cases.

Table 21: Reasons of not using software for quality and/or food safety management

7M class	Cause	Number of answers	Percentage
Money	Priority and budget	9	16%
Material	Lack of suitable software to business need	8	14%
Management	Management decision	6	10%
Method	Project to be developed internally	6	10%
Money	Expensive cost	4	7%
Method	Acquisition on the way	3	5%
Method	Not necessary for 1 or 2 certifications	3	5%
Method	Complexity of use	2	3%
Men	Few information about Quality & FS softwares	2	3%
Men	Lack of Quality Manager position	2	3%
Method	Project in the way of realization internally	2	3%
Method	Manuel management is more easy	1	2%
Management	Quality Management System not yet installed	1	2%
Milieu	Not necessary for the actual company's size / activity	1	2%
Method	Not necessary for the time being	1	2%
Men	Lack of qualified staff	1	2%
Management	Lack of motivation of the management	1	2%
Management	Quality management system not yet mature	1	2%
Management	Not a regulation obligation	1	2%
Method	Project to be studied	1	2%
Management	Decision taken in the headquarter	1	2%
Method	Use of products traceability software	1	2%

Table 22: Distribution of causes according to 7M method

Method	34%	20
Money	22%	13
Management	19%	11
Material	14%	8
Men	9%	5
Milieu	2%	1
Matter	0%	0

Question No 13: In your opinion, what are the difficulties faced by food industry in controlling food safety?

The aim of this question is to give the opportunity to surveyed persons to express about food safety constraints frequently meet by Moroccan agribusiness. Table 23 summarizes answers. We remark that the first 8 constraints represent 79% of all results. The difficulty must encounter is the lack of implication of staff in quality / food safety approach. This is very important point, because without staff implication no management system can be concretely implemented. Moroccan companies suffer from workers qualification, thing that makes their compliance with internal rules (quality / food safety or other) low. The second difficulty concerns the application and research of new regulations and guides for each area. This confirms answers to questions number 9 and 10 of this questionnaire.

Currently in Morocco, collection of such data (regulations, guide and product standards) is a hard work for quality managers in charge of this mission. Hence the need to provide a database gathering all this information. With the same percentage (12%) we find difficulty No 3 related to inadequate management commitment for investment. This constraint is related to the behavior of some managers badly aware of food safety importance in maintaining the sustainability of their business.

Table 23: Question No 13 results

No	Difficulties meet	Number of answers	Percentage	Cumulative percentage
1	Lack of staff implication in quality / FS approach	38	29%	**29%**
2	Application and research of new regulations and guides for each area	16	12%	**41%**
3	Inadequate management commitment for investment	16	12%	**53%**
4	Lack of approved suppliers / raw material in good quality	8	6%	**60%**
5	Lack of skilled workers	8	6%	**66%**
6	Lack of coaching / skills	7	5%	**71%**
7	Lose of traceability	6	5%	**76%**
8	Regular staff awareness is needed	5	4%	**79%**
9	Lack of training	4	3%	82%
10	High cost of machinery	3	2%	85%
11	Application of standards requirements in reality	3	2%	87%
12	Food contamination danger (perishable matter)	3	2%	89%
13	PRP control	3	2%	92%
14	Dominance of informal sector which is not governed by laws	2	2%	93%
15	The majority of food companies have old architecture	2	2%	95%
16	No effective monitoring from FSNO for 28-07 law	2	2%	96%
17	Stock management / logistics	2	2%	98%
18	Sabotage	1	1%	98%
19	External environment does not does not help in providing food safety	1	1%	99%
20	Machines maintenance	1	1%	100%

Question No 14: What are the features of your activity sector (In terms of food security) ?

Food chain, scope of this standard is divided into 13 categories. Each one of them has a code which is a letter from A to M. Annex A of ISO 22003 version 2007 represents food chain categories classification [6]. Answers relating to specificities of each sector are classified in Table 24 depending on the category in which companies belong. Numerals in the table are related to repetition number of the same feature. For example, feature "Clients very demanding in terms of food safety, traceability and hygiene" is repeated 3 times in companies belonging to G category and 3 times in those belonging to H category. We note that each category can have many features, sometimes contradictory. This is the case for example of the category B where there is as particularity "minimal risk of contamination: FS under control" and "highly perishable products". This can be explained by the difference of products manufactured by companies belonging to the same category.

Table 24: Question No 14 results

A	B	C	D	E	G	H	I	K	L	M	Particularities
x											It is an upstream which can affect safety of transformed products
x											Hygiene is the pillar of this sector
x		x									Respect of the cold chain during marketing
	x										Use of expensive cleaning products
	3x			2x							Minimal risk of contamination: FS under control
	x										Compliance with instructions for use of plant protection products (doses, time, period of use etc.)
	x										To be ensure of origin and holiness of seeds / plants
x											Respect of ratios recommended in cattle feed
	x			x							Perishable products
				x							All machines are automated, no direct contact between operator and food
x											Dangers of contamination by pathogens from human
	2x										Pesticides residues risk
	x			x							Not highly perishable products (honey, jam, coffee)
	x										Confidentiality
					3x	3x					Very demanding customers in terms of food safety, traceability and hygiene
						x					No production therefore low FS danger
						x					Wide range of products to manage: different storage conditions and CDL to follow
						x					Different suppliers
									x		Production of biopesticides and biofertilizers
		x	2x	2x				x	x		No particularities
								x			Rapid innovation in machines
							x				Speed of service
							x				Labelling of products on the day of preparation
		x								x	RM good quality is rare and expensive
										2x	Production from virgin RM (no recycling)

					x						Continuous monitoring of cold and hot chain
					x						No on-site laboratory control
		6x		x							Highly perishable products
		x									FS uncontrolled at suppliers
		x									CDL fresh product is reduced
		3x	x	x							Product requiring strict attention: high risk
		x									Seasonal activity
			x	x							Regulation governing the sector remains inadequate
			x								Availability of RM
			2x	x							Traceability difficult to implement
			x	x							Pasteurization minimizes contamination risk
			x								Monthly checks of products quality in the market
				2x							No disinfection required
				x							Lack of continuous microbiological analyses
				x							Acid production environment (juice): low risk of microbiological contamination
				4x							Product can be stored at room temperature
				x							Very sensitive consumers (babies)
				x							Lack of sterilization step in the process

CONCLUSION

From the questionnaire analysis, we can conclude that with the exception of categories "F: Feed production" and "J: Transport and Storage" all other food chain categories are represented in this study despite the response rate has not exceeded of 24% of all companies questioned. Two thirds of these are exporting their product and 78% of them are certified or in the way of certification according to 17 different standards. Although the answers to questions relating to provision of regulations, guidelines and product standards in relation to their sectors and their updates were affirmative, with an average of 85% (between yes and in part), the answers to questions 9 and 10 show the opposite. Moroccan food companies have confirmed the presence of difficulties in collecting these documents (regulations, product standards and guides) as they are not organized and easily accessible. This information is confirmed by the diversity of sources used for documents research and update. However, the most popular tool used by companies for this purpose is Internet in general without specification of consulted websites. Moreover, application and research of new regulations and guides for each area is classified as the second difficulty faced by companies surveyed after the one related to lack of staff involvement in quality / food safety approach. Establishment of a database of all information (regulations, guides and product standards) will provide a strategic intelligence for Moroccan food industry and minimize time spent by quality managers for its research. This database, probably as software, should take into account reasons which prevent agro-industrial companies to do not investing in this technology. These reasons are classified in this study according to 7M method.

Our environment is increasingly competitive and globalized. Regulation, and also technologies evolve in a rapid way and all businesses (large or small) are facing customers demands and more restrictive requirements [16]. To maintain businesses competitiveness and sustainability, especially those operating in food industry, they should be updated on all plans as well technologic ones as of documentation.

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