بسم الله الرحمن الرحيم

Sudan University of Science and Technology

College of Graduate Studies

IMPACT OF APPLICATION ISO 22000:2005

ON A FOOD ORGANIZATION

In Khartoum State- Sudan

اثر تطبيق ايزو 22000:2005 علي شركة غذائية في ولاية الخرطوم- السودان

A thesis submitted in partial fulfillment for the requirement of Master Degree in Quality Management and Excellence

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August 2017

الاستهلال

قال تعالي:

(رَبِّ أَوْزِعْنِي أَنْ أَشْكُرَ نِعْمَتَكَ الَّتِي أَنْعَمْتَ عَلَيَّ وَعَلَى وَالِدَيَّ وَأَنْ أَعْمَلَ صَالِحًا تَرْضَاهُ وَأَدْخِلْنِي بِرَحْمَتِكَ فِي عِبَادِكَ الصَّالِحِينَ)

صدق الله العظيم

سورة النمل:19

Dedication

I dedicate this work to my mother with all my love.

Acknowledgement

All thanks to Allah for all grants

Thanks to Sudan University of science and Technology, college of graduate studies

Thanks to my supervisor Prof. Mohamed Abdelsalam Abdalla for his guidance

Thanks to my brother Mohamed for his endless support and to my General Manager at work he makes it easy to reach here.

To every person helped and supported me to achieve this work.

Abstract

Food safety management regarded as most important quality systems which effect directly on food safety and public health, this research study **impact of application ISO 22000:2005 on a food organization in Khartoum State- Sudan**, and their positive trends that help the growth of business. This study conducted in Khartoum- Sudan in a company that has the ISO 22000 certification from February to September 2017. In this research descriptive and quantitative methods have been used to analyze data that collected by questionnaire. From results this study came out with that application of ISO 22000:2005 have positive impact on profit based on the increasing of sales, positive impact on marketing according to the increase the market share, positive impact on resource management based on the optimum distribution of resource, positive impact on customer satisfaction and retention by increasing customer confidence and reduce compliance, positive impact on internal process by reducing waste and enhance performance and positive impact on product quality by improving safety and the end product quality.

مستخلص البحث

يعتبر نظام سلامة الاغذية من اهم انظمة الجودة لتاثيره المباشر علي سلامة الاغذية والصحة العامة, هذا البحث يقوم بدراسة **اثر تطبيق ايزو22000:2005 علي شركة غذائية في ولاية الخرطوم- السودان** والاتجاهات الموجبة التي تساعد في نمو الاعمال,اجريت هذه الدراسة علي شركة مطبقة لنظام سلامة الاغذية في الخرطوم–السودان في الفترة من فبراير وحتي سبتمبر 2017م, في هذا البحث استخدمت المعايير الكمية لتحليل البيانات التي جمعت بواسطة الاستبيان, اظهرت الدراسة تاثيرات ايجابية لنظام ايزو 22000 في زيادة الارباح وذلك بدليل زيادة المبيعات, اثر ايجابي علي التسويق وذلك لزيادة حصة الشركة في السوق, اثر ايجابي علي ادارة الموارد وذلك للتوزيع الامثل والفعال للموارد, اثر ايجابي علي رضاء العملاء وذلك بتقليل الشكاوي و زيادة ثقة العملاء في منتجات الشركة, اثر ايجابي علي العمليات الداخلية بتحسين الاداء وتقليل الهدر, اثر ايجابي علي جودة المنتج بتحسين سلامة وجودة المنتج النهائي.

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INTORODUCTION

The food industry is an important industry therefore it is necessary to ensure the conformity, assurance and trust worthiness of the quality of food product, the quality of food product is referred to be every single aspect of the food including the safety, nutrition and hygiene (Nyakiokibe and Wanjau, 2014).

The last few years have provided ample evidence that control of food safety is critical, recent media reports have clearly documented supply chain short comings that have threatened consumers' health and safety these ongoing problems and the need of customer's safety require additional tools to reduce or eliminate risks (Ames,2009).

Through ISO 22000 certification, the organization transmits to all stakeholders that: the main objective is the safety of the food and compliance with legal requirements regarding food safety, all aspects of the organization (process performance, staff competence, products, services) are continuously improved, it demonstrates ability to control safety requirements agreed by customers and regulators, it has major interests and proposes to improve customer satisfaction through the effective control of food safety hazards (Dobrin,*et al*;2015).

Mamalis *et al*; (2009) refer that the advantages of ISO 22000 include:

- Optimum distribution of resources inside the food chain organization.
- Effective communication of suppliers, clients, authorities and other involved authorities.
- Focus on the prerequisite programs.
- Better documentation.
- Creation of trust with the prerequisite the credibility of management system based on the provision of the conditions for the accomplishment of solid.

The main objective of company operations is making profits, regardless of the type of certified systems, is widely used by organization to increase sales to individual customers (Kafel and Sikora, 2011).ISO 22000 certification

was considered as a promotional and marketing tool. Also certification will create favorable image for the company and enhance the firm's reputation, for competitive survival, companies are focusing on areas in their operations that might give them an edge over their competitors, ISO 22000:2005 can become a valuable tool for marketing managers in order to differentiate their companies and compete to highly competitive environment(Mamalis,*et al*;2009).

RESEARCH OBJECTIVES:

The research aims to achieve the following:

- To evaluate impact of ISO 22000:2005 on profit.
- To evaluate impact of ISO 22000:2005 on marketing.
- To evaluate impact of ISO 22000:2005 on the quality of products.
- To evaluate impact of ISO 22000:2005 on customer satisfaction.

Literature Review

1.1 Quality definition:

We may define quality in many ways. Most people have a conceptual understanding of quality as relating to one or more desirable characteristics that as product or service should possess. Although this conceptual understanding is certainly a useful starting point (Montgomery, 2009).

Quality should be aimed at the needs of the consumer present and future. Quality begins with intent (Deming, 2000).

Quality means those features of products which meet customer needs and there by provide customer satisfaction; in this sense the meaning of quality is oriented to income (Juran, 1999).Also Quality means fitness for use, quality improvement is the reduction of variability in processes and products (Montgomery, 2009).

Quality is in the eye of the beholder. With total quality approach customers ultimately define quality (Goetsch and Davis, 2013).

1.2 Benefits of improving quality:

Gitlow *et al*; (2005) listed the benefits in:

- Deming approach to the relationship between quality and productivity stresses improving quality to increase productivity.
- Promoting quality unleashes the chain reaction of quality.
- Stressing quality can produce all the desired results: less rework, greater productivity ,lower unit cost, price flexibility, improved competitive position, increase demand, larger profits, more jobs, customer get high quality at low, vender get predictable long-term sources of business, and investors get profits.

1.3 Evolution of quality:

1.3.1 Quality inspection:

The inspection function define as: inspection consists of judging whether and individual article is defective or non- defective comparing the result of a test carried out by some means or other with a quality criterion, or judging whether a particular lot is acceptable or rejectable by comparing a test result with acceptability criterion (Singh, 2008).

1.3.2 Quality control:

Quality control deals with techniques used in monitoring and maintenance of the technical elements of the systems that affect the quality (Papp, 2002).

A modern definition of quality control and improvement is the reduction of variability in processes and products, the reduced variability can be directly translated in to lower cost, better functions and fewer repairs, the critical factors that affect quality the most should be identified and thoroughly investigated (Wei,*et al*;2014).

1.3.3 Quality assurance:

Quality assurance in all-encompassing management program used to ensure excellence through the systematic collection and evaluation of data, the primary objectives of QA scheduling management techniques, departmental policies and procedures, technical effectiveness and efficiency (Papp, 2002).

1.3.4 Total quality management:

Total quality consist of the continual improvement of people, processes, products (including services), and environment, with total quality anything and everything that effect quality is a target for continual improvement (Goetsch and Davis, 2013).

Total quality management is composed of all the organization's policies, procedures, plans, resources, processes, and delineation and responsibility and authority, all deliberately aimed of achieving product or service quality levels consistent with customer satisfaction and organization's objectives.

They define how organization works and how quality is managed (Goetsch and Davis, 2013).

1.4 Food standards:

Food standards give scientific criteria to ensure that products are fit for their stated purposes with legal requirements. They provide common frames of reference for defining the product. Standards are useful to consumers, the industry and regulatory authorities, standards may also include specifications for labeling, packaging, methods of analysis and sampling (Jaiswal, 2009).

1.4.1 International system towards quality and safety assurance:

According to Jaiswal (2009) systems are:

International organization for standardization (ISO):

ISO is the world's largest developer and publisher of international standards established in 1947, it has a central secretariat in Geneva, Switzerland that coordinates the system.ISO deals with development, approval and promulgation of consensus based international standards

Codex Alimentarius Commission:

The codex alimentarius is the collection of internationally recognized standards, codes of practice, guidelines and other recommendations relating to foods. Foods production and food safety under the aegis of consumer protection. Established in 1963 by the food and agriculture organization of the united nation (FAO) and world health organization (WHO), the commission's main aims are stated as being to protect the health of consumers and ensure fair practices in the international trade

International plant protection convention (IPPC) :

IPPC was adopted in 1951 and is administered through FAO, the focus is on providing scientific inputs to deliberations on global trade. The revisions incorporate the contemporary discourses on plants health in context of Uruguay round agreements.

Europe GAP:

This has been introduced in the year 1997 by virtue of initiative of retailers participating in a working group. The objective is to comply with the standards and producers for the development of good agricultural practices.

1.4.2 ISO:

Continued growth in international trade revealed a need for a set of quality standards to facilitate the relationship between suppliers and purchasers. The creation of the ISO series of international standards began in 1979 with the formation of technical committee with participants from 20 countries, named the international organization for standardization, this Geneva-based association developed and continues to revise and update the standards (Summers, 2009).

1.4.3 Management requirements:

Support quality: develop quality management system, support it, formulate quality policy, establish quality objectives and make available quality resources. Continuously improve quality management system, perform reviews and create resources to improve quality system (Jaiswal, 2009).

Satisfy customers: identify customer requirements, increase customer satisfaction (Jaiswal, 2009).

Establish a quality policy: describe quality policy, ensure that serves purpose, emphasizes the need to meet requirements and facilities the development of quality objectives and ensure commitment for continual improvement. Manage organization's quality policy and communicate them to all relevant persons. Review policy to ensure its continual suitability (Jaiswal, 2009).

Do quality planning: formulate quality objectives satisfy that objectives are for functional areas, organizational levels and facilitate product realization and support the quality policy and are measurable. Plan quality management system and plan the modification (Jaiswal, 2009).

Control quality system: specify responsibilities and authorities without confusion and communicate to all involved. Nominate management representative. Over see quality management system and report on the status and support the improvement. Support internal communications to ensure that processes are established (Jaiswal, 2009).

Perform management reviews: review quality management system, evaluate the performance and examine if quality system has improved. Properly examine management review inputs, check audit results, product conformity data, opportunities for improvement, feedback from customers, process performance information. Examine changes which effect system and earlier quality management reviews. Create actions to improve quality system, improve products and address resource needs (Jaiswal, 2009).

1.5 ISO 22000: 2005:

ISO 22000 is a generic food safety management system standard, it defines a set of general food safety requirements that apply to all organizations in the food chain. ISO 22000 specifies the requirements for a food safety management system in the food chain where an organization needs to demonstrate its ability to control food safety hazards in order to provide consistently safe end products that meet both the requirements agreed with the customer and those of applicable food safety regulation (Jaiswal, 2009).

1.5.1 ISO 22000 and HACCP:

ISO 22000 uses HACCP (Hazard Analysis and Critical Control Points) developed by the codex alimentarius commission. HACCP is a methodology and management system, it is used to identify, prevent, and control food safety hazards (Jaiswal, 2009).

HACCP management system applies the following methodology:

1- Conduct a food safety hazard analysis.
2- Identify critical control points (CCPs).
3- Establish critical limits for each CCP.
4- Develop procedures to monitor CCP.
5- Design corrective actions to handle critical limit violation.

6- Create a food safety record keeping system.
7- Validate and verify system.

This is used to develop a HACCP plan. A HACCP plan is a document that describes how an organization plans to manage and control its food safety hazards. ISO 22000 exhibits organization to combine the HACCP plan with prerequisite programs and operational prerequisite programs in to a single integrated food safety management strategy (Jaiswal, 2009).

Table 1:1 Cross references between the HACCP principles and application steps and clauses of ISO 22000:2005:

HACCP Principles	**HACCP application steps**		**ISO 22000:2005**	
	Assemble HACCP team	Step 1	7.3.2	Food safety team
	Describe product	Step 2	7.3.3 7.3.5.2	Product characteristics Description of process steps and control measures
	Identify intended use	Step 3	7.3.4	Intended use
	Construct flow diagram On-site confirmation of flow diagram	Step 4 Step 5	7.3.5.1	Flow diagrams
Principle1 Conduct a hazard analysis**.**	List all potential hazards Conduct a hazard analysis Consider control measures	Step 6	7.4 7.4.2 7.4.3 7.4.4	Hazard analysis. Hazard identification and Determination of acceptable levels. Hazard assessment. Selection and assessment of control Measures.
Principle 2 Determine the critical control points (CCPs),	Determine CCPS	Step 7	7.6.2	Identification of critical control points (CCPS)
Principle 3 Establish critical limit(s).	Establish critical limits for each CCP	Step 8	7.6.3	Determination of critical limits for critical control points
Principle 4 Establish a system to monitor control of the CCP.	Establish a monitoring system for each CCP	Step 9	7.6.4	System for the monitoring of critical control points

Principle 5 Establish the corrective action to be taken when monitoring indicates" that a particular CCP is not under control**.**	Establish corrective actions	Step 10	7.6.5	Actions when monitoring results exceed critical limits
Principle 6 Establish procedures for verification to confirm that the HACCP system is working effectively**.**	Establish verification procedures	Step 11	7.8	Verification planning
Principle 7 Establish documentation concerning all procedures and records appropriate to these principles and their application	Establish documentation and record keeping	Step 12	4.2 7.7	Documentation requirements. Updating of preliminary information and documents specifying the PRP! and the HACCP plan.

Source: Bureau of Indian standards (2012)

ISO 22000:2005 uses roughly the same basic structure as the ISO 9001quality management standard. This should make it little easier for ISO 9001 certified organizations for ISO 22000 certification (Jaiswal, 2009).

Table 1:2 Cross references between clauses of ISO 22000:2005 and clauses of ISO 9001:2000:

ISO 22000:2005		**1SO 9001:2000**	
Introduction		0 01 02 03 04	Introduction General Process approach Relationship with ISO 9004 Compatibility with other management systems
Scope	1	1 1.1 1.2	Scope General Application
Normative reference	2	2	Normative reference
Terms and definitions	3	3	Terms and definitions
Food safety management system	4	4	Quality management system
General requirements	4.1	4.1	General requirements
Documentation requirements General	4.2 4.2.1	4.2 4.2.1	Documentation requirements General

Control of documents Control of records	4.2.3 4.2.1	4.2.3 4.2.1	Control of documents Control of records
Management responsibility	5	5	Management responsibility
Management commitment	5.1	5.1	Management commitment
Food safety policy	5.2	5.3	Quality policy
Food safety management system planning	5.3	5.4.2	Quality management system planning
Responsibility and authority	5.4	5.5.1	Responsibility and authority
Food safety team leader	5.5	5.5.2	Management representative
Communication External communication Internal communication	5.6 5.6.1 5.6.2	5.5 7.2.1 7.2.3 5.5.3 7.3.7	Responsibility, authority and communication. Determination of requirements related to the product. Customer communication. Internal communication. Control of design and development changes.
Emergency preparedness and response	5.7	5.2 8.5.3	Customer focus Preventive action
Management review General Review input Review output	5.8 5.8.1 5.8.2 5.8.3	5.6 5.6.1 5.6.2 5.6.3	Management review General Review input Review output
resource management	6	6	resource management
Provision of resources	6.1	6.1	Provision of resources
Human resources General Competence, awareness and training	6.2 6.2.1 6.2.2	6.2 6.2.1 6.2.2	Human resources General Competence, awareness and training
Infrastructure	6.3	6.3	Infrastructure
Work environment	6.4	6.4	Work environment
Planning and realization of safe products	7	7	product realization
General	7.1	7.1	planning of product realization
Prerequisite programmed (PRPs)	7.2 7.2.1 7.2.2 7.2.3	6.3 6.4 7.5.1 8.5.3 7.5.5	Infrastructure. Work environment. Control of production. and service provision. Preventive action. Preservation of product.

Source: Bureau of Indian standards (2012)

Table 1:2 Cross references between clauses of ISO 22000:2005 and clauses of ISO 9001:2000(continued)

ISO 22000:2005		1SO 9001:2000	
Preliminary steps to enable hazard analysis.	7.3	7.3	Design and development.
General	7.3.3	7.4.2	Purchasing requirements.
Food safety team	7.3.2		
Product characteristics	7.3.3	7.2.1	Determination of requirements related to the product.
Intended use	*7.3.4*		
Flow diagrams, process steps and control measures	*7.3.5*	7.2.1	Determination of requirements related to the product.
Hazard analysis	7.4	7.3.1	design and development planning
General	*7.4.1*		
Hazard identification and determination of acceptable levels	7.4.2		
Hazard assessment	7.4.3		
Selection and assessment of control measures	7.4.4		
Establishing the operational prerequisite programmed (PRPs)	7.5	7.3.2	design and development inputs
Establishing the HACCP plan	7.6	7.3.3	design and development outputs
HACCP plan	7.6.1		
Identification of critical control points (CCPS)	7.6.2	7.5.1	control of production and service provision
Determination of critical limits for critical control points	7.6.3	8.2.3	monitoring and measurement of processes
System for the monitoring of critical control points.	7.6.4	8.3	control of nonconforming product
Actions when monitoring results exceed critical limits.	7.6.5		
Updating of preliminary information and documents specifying the PRPs and the HACCP plan	7.7	4.2.3	control of documents
Verification planning	7.8	7.3.5	design and development verification
Traceability system	7.9	7.5.3	Identification and traceability
control of nonconformity	7.10	8.3	Control of nonconforming product
corrections	7.10.1	8.3	Control of nonconforming product
corrective actions	7.10.2	8.5.2	Corrective actions
handling of potentially unsafe products	7.10.3	8.3	Control of nonconforming product
withdrawals	7.10.4	8.3	Control of nonconforming product

Validation, verification and improvement of the food safety management system	8	8	Measurement, analysis and improvement
General	8.1	8.1	General
Validation of control measure combinations	8.2	8.4 7.3.6 7.5.2	Analysis of data Design and development validation. Validation of processes for production and service provision
Control of monitoring and measuring	8.3	7.6	Control of monitoring and measuring devices
Food safety management system verification Internal audit Evaluation of individual verification results Analysis of results of verification activities	8.4 8.4.1 8.4.2 8.4.3	8.2 8.2.2 7.3.4 8.2.3 8.4	Monitoring and measurement Internal audit Design and development review Monitoring and measurement of processes Analysis of data
Improvement Continual improvement Updating the food safety management system	8.5 8.5.1 8.5.2	8.5 8.5.1 7.3.4	Improvement Continual improvement Design and development review

Source: Bureau of Indian standards (2012)

1.5.2 ISO 22000:2005 requirements:

Table 1:3 ISO 22000 requirements:

ISO 22000:2005 clauses	
No	System requirements
4	**Food safety management system**
4.1	Establish a food safety management system (FSMS)
4.2	Documentation requirement
4.2.2	Control of documents
4.2.3	Control of records
5	**Management responsibility**
5.1	Demonstrate a commitment to food safety
5.2	Establish food safety policy
5.3	Food safety management system planning
5.4	Responsibility and authority
5.5	Food safety team leader
5.6	Communications
5.6.1	External communication
5.6.2	Internal communication
5.7	Emergency preparedness and response
5.8	Management review
5.8.2	Review input
5.8.3	Review output
6	**Resource management**
6.1	Provision of resources
6.2	Human resources
6.2.1	Competence, awareness and training
6.3	Infrastructures
6.4	Work environment
7	**Planning and realization of safe products**
7.2	Prerequisite programs (PRPs):
7.3	Preliminary steps to enable hazard analysis
7.4	Hazard analysis
7.5	Establishing the operational prerequisite programs OPRPs
7.6	Establishing the HACCP plan
7.7	Updating of preliminary information documents specifying the PRPs and the HACCP plan
7.8	Verification planning

7.9	Traceability system
7.10	Control of nonconformity
8	**Validation, verification and improvement of the food safety management system**
8.2	Validation of control measure combination
8.3	Control of monitoring and measuring
8.4	Food safety management system verification
8.5	Improvement

Source: Bureau of Indian standards (2012)

4-Food safety management system:

Jaiswal (2009) illustrated the requirements of the food safety in below:

4.1 Establish a food safety management system (FSMS):

Develop and effective food safety management system and document, implement, maintain, evaluate and update food safety management system.

4.2 Documentation requirements:

4.2.2 Control of documents:

- Develop food safety management documents, policy document, the procedures required by this standard.
- Control food safety management documents and develop procedures to control FSMS documents.

4.2.3 Control of records:

Establish a set of records, develop procedure to control, document record control procedure.

5-Management responsibility:

5.1 Demonstrate a commitment to food safety:

Ensuring that organization's managers demonstrate commitment food safety management system and top managers support the establishment of a FSMS.

5.2 Establish food safety policy:

Top managers established a food safety policy, communicated their support for food safety policy, and see that food safety policy is implemented throughout organization (Jaiswal, 2009).

5.3 Food safety management system planning:

Top management shall ensure that planning of the food safety management system is carried out to meet requirements as well as the objectives of the organization that support food safety, and the integrity of the food safety management system is maintained when changes to the food safety management system are planned and implemented.

5.4 Responsibility and authority:

Top management shall ensure that responsibilities and authorities are defined and communicated within the organization to ensure the effective operation and maintenance of the food safety management system, all personnel shall have responsibility to report problems with the food safety management system to identified person(s). Designated personnel shall have defined responsibility and authority to initiate and record actions (Jaiswal, 2009).

5.5 Food safety team leader:

Top management shall appoint a food safety team leader who, irrespective of other responsibilities, shall have the responsibility and authority to manage a food safety team and organize its work, to ensure relevant training and education of the food safety team members, to ensure that the food safety management system is established, implemented, maintained and updated, and to report .to the organization's top management on the effectiveness and suitability of the FSMS (Jaiswal, 2009).

5.6 Communications:

5.6.1 External communication:

The organization shall establish, implement and maintain effective arrangements for communicating with suppliers and contractors, customers or consumers, statutory and regulatory authorities, and other organizations that have an impact on, or will be affected by, the effectiveness or updating of the FSMS.

5.6.2 Internal communication:

The organization shall establish, implement and maintain effective arrangements for communicating with personnel on issues having an impact on food safety (Jaiswal, 2009).

5.7 Emergency preparedness and response:

Top management shall establish, implement and maintain procedures to manage potential emergency situations and accidents that can impact food safety and which are relevant to the role of the organization in the food chain

5.8 Management review:

Review organization's food safety management system, carryout regular reviews and keep a record.

5.8.2 Review input:

The input to management review shall include, information on follow-up actions from previous management reviews, analysis of results of verification activities, changing circumstances that can affect food safety, emergency situations, accidents and withdrawals, reviewing results of system-updating activities, review of communication activities, including customer feed-back , and external audits or inspections (Jaiswal, 2009).

5.8.3 Review output:

The output from the management review shall include decisions and actions related to assurance of food safety, improvement of the effectiveness of the food safety management system, resource needs, and revisions of the organization's food safety policy and related objectives (Jaiswal, 2009).

6-Resource management:

6.1 Provision of resources:

Provide resources needed to establish, implement, maintain and update organization's FSMS.

6.2 Human resources:

Employ competent food safety personnel; maintain a record of contracts and agreements with external food safety management system exports.

6.2.1 Competence, awareness and training:

Identify the competencies of personnel and ensure that personnel have the required level of competencies they need, make personnel aware as to how their job performance influences food safety. Evaluate the effectiveness of training and awareness activities and maintain a record (Jaiswal, 2009).

6.3 Infrastructures:

Establish the infrastructure needed and maintained to comply with ISO 22000.

6.4 Work environment:

Establish, manage and maintain the work environment required to comply with ISO 22000.

7-Planning and realization of safe products:

Plan the processes needed to realize safe products. Develop, implement and operate.

7.2 Prerequisite programs (PRPs):

PRPs are the conditions which must be established throughout the food chain, PRPs are also turned to as good hygienic practices, good agricultural practices, good production practices, good manufacturing practices, good distribution practices, good storage practices, good transport practices, and good marketing practices.

Establish, implement and maintain PRPs, ensure that PRPs are suitable meet organization's unique food safety needs, reflect and respect the nature of organization, meet legal requirements and food safety team formally approves PRPs before implemented (Jaiswal, 2009).

7.3 Preliminary steps to enable hazard analysis:

Collect the information needed to conduct hazards analysis, documents all information before undertaking hazards analysis, deploy a food safety team, a appoint a multidisciplinary food safety team to develop and implement organization FSMS.

7.4 Hazard analysis:

Assess food safety hazards and control, ensure that organization's food safety team performs a hazard analysis and select suitable measures to control hazards, identify hazards and define acceptable levels, identify food safety hazards consider hazard environment. Use hazard assessment to select control measures capable of controlling organization's food safety hazards, implement food safety control measures document the methodology and the parameters used to categorize food safety control measures and record the results (Jaiswal, 2009).

7.5 Establishing the operational prerequisite programs OPRPs:

Mention types of hazards to be controlled by each OPRPs, identify control measures, define the procedures used to monitor, specify corrections and corrective action for OPRPs.

7.6 Establishing the HACCP plan:

Establish a plan to control food safety hazards, identify critical control points CCPs, identify CCPs for each control measure which will be used by HACCP plan to manage and control food safety hazards. Specify critical limits for all CCP, use critical limits to ensure that they do not exceed acceptable food safety hazard levels for intended end products (Jaiswal, 2009).

7.7 Updating of preliminary information documents specifying the PRPs and the HACCP plan:

Update documents previously used for hazard analysis, prerequisite program and the HACCP plan.

7.8 Verification planning:

Plan organization's FSMS verification activities and verify that FSMS is implemented record the results of verification activities and report to food safety team.

7.9 Traceability system:

Ensure that system can trace products lots, supplied materials and product distribution.

7.10 Control of nonconformity:

Identify and correct nonconforming products, identify and control the use and release of all nonconforming products, establish a procedure to manage and control them and do product correction, evaluate data obtained from the monitoring of food safety hazard and control measures, manage potentially unsafe products, ensure control of potentially unsafe products to dispose, apply appropriate techniques to verify the effectiveness product withdrawal program and record (Jaiswal, 2009).

8-Validation, verification and improvement of the food safety management system:

Plan for confirmation that how food safety methods are working, implement plans to confirm that methods working.

8.2 Validation of control measure combination:

Validate control measures before implementation, ensure that validations are effective, and revalidate control of measures in case of change.

8.3 Control of monitoring and measuring:

Prove that monitoring and measuring methods, and equipments are quite adequate, validate all monitoring and measuring software (Jaiswal, 2009).

8.4 Food safety management system verification:

Carryout regular internal audits, establish an internal audit program, plan internal audit projects, ensure that managers solve problems discovered in their areas through internal auditors, evaluate verification results, be sure that food safety team evaluates the specific results of previous verification activities and taken action if evaluation shows that FSMS fails to comply with planned arrangements. Confirm that FSMS meets requirement, record the results of verification analysis and the activities that result from analysis, use analytical results as input to help update organization's FSMS.

8.5 Improvement:

Continually improve organization's FSMS, use communication management reviews, internal audits, corrective actions, verification studies and research, control measures , validation results to help continually improves the effectiveness of FSMS, continually update organization's FSMS, be sure that food safety team evaluates FSMS at planned intervals, ensure that food safety team studies their evaluation reports and decides whether food safety programs and plans need review, update, record, and report FSMS updating activities (Jaiswal, 2009).

1.6 Previous study:

Gerundino (2014) mentioned that Juhayna Company as a case study for the economic benefits of standards:

Company name: Juhayna food industries

Country: Egypt

Industry: Agri- food business

Revenues/ profits: EGP 2 billion /N.A (average annual revenue 2009 to 2012).

Main product: milk, fruit juice and yoghurt products

Economic benefits generated by standard: EGP 66.7 million annually which amounts to 3.3% of the annual average revenue.

Most important standards used:

- ISO 9001:2008 Quality management system.
- ISO 22000:2005 Food safety management system.
- Good manufacturing practices.
- ISO 17025:2005 Requirement for the competence of testing and calibration laboratories.
- OHSAS 18001:2007 Occupational health and safety management system.
- HACCP (FAO/Codex alimentarius.

Using standards allowed Juhayna to implement a highly effective management system and specific functional improvement to:

- Enhance communication with suppliers.
- Reduce costs for rework and replacement as a consequence of deficient quality.
- Ensure product safety.
- Achieve high- volume production and improve efficiency.
- Reduce waste and scrap and improve environmental performance.
- Increase market share.

Materials and Methods

2.1 Research Methodology:

Research methodology involved such general activities as identifying problems, review of the literature, formulating hypotheses, procedure for testing hypotheses, measurement, data collection analysis of data, interpreting results and drawing conclusions (singh, 2006).

In this research descriptive method was used, using a questionnaire testing approach aim to examine impact of application ISO 22000:2005 on a food organization, this chapter illustrate the method of data collection, questionnaire and data analysis.

2.2 Research design:

Research design is a choice of an investigator about the components of his project and development of certain components of the design. The selection of research components is done keeping in view of the objectives of the research. Research hypotheses also provide the basis for designing a research work (singh, 2006).

2.3 Study area:

This study conducted in Khartoum- Sudan in a company that has the ISO 22000 certification.

Company area: Khartoum

Industry: Dairy food production

Main products: Milk, yoghurt

2.4 Study population:

The study targets only the departments of marketing, sales, quality control and supply chain.

2.5 Sampling:

The sample was selected by using random sampling technique to select 22 samples.

2.6 Data collection:

The rating scale involved qualitative description of a limited number of aspects of a thing or of traits of a person. When using rating scales (or categorical scales), and judged an object in absolute terms against some specified criteria (kothari, 2004).

The questionnaire was used 5 point of likert scale (strongly disagree, disagree, neutral, agree, and strongly agree). Scaling described the procedures of assigning numbers to various degrees of opinions, attitude and other concepts (Kothari, 2004).

2.7 Data analysis:

Inferential analysis was concerned with the various tests of significance for testing hypotheses in order to determine with what validity data can be said to indicate some conclusion or conclusions. It was concerned with the estimation of population values. It was mainly on the basis of inferential analysis that the task of interpretation is performed (Kothari, 2004).

SPSS software was used to analyze data.

Results

3.1 Descriptive of the Variables Study:

3.1.1 General information:

In table 3:1 most of the individuals study was males by (16/72.7%) while the total number of females (6/27.3%).The qualification of the individuals study were BA and MA by (11/50). Years of experience of most individuals study were 1-5 years by (11/50), followed by whom years of experiences 6-10 years (7/31.8), while the total number of whom individuals more than 10 years is (4/18.8).

Table 3:1 Demographic characteristics of the individuals of the study (n=22)

Characteristics	Frequency	Percentage
Gender:		
Male	16	72.7%
Female	6	27.3%
Total	22	100%
Qualification:		
BA	11	50%
MA	11	50%
PhD	0	0.0%
Total	22	100%
Years of experience:		
1 – 5 years	11	50%
6 – 10 years	7	31.8%
More than 10 years	4	18.2%
Total	22	100%

3.2 Test questionnaire:

The questionnaire came out with:

3.2.1 Impact of ISO 22000 2005 on profit

In table 3:2 the value of chi-square for all phrases in the first axis (35.70), with (p-value =0.000 < 0.05), this indicated that there was significant differences at the level (5%) between answers of study individuals and in favor of agree.

From the above the first axis " **impact of ISO 22000 2005 on profit** " has been achieved and in favor of agree.

Table 3:2: Frequency distribution of the first axis phrases Answers (n=22):

No.	Phrases	Frequency and percentages%				
		Strongly agree	Agree	Neutral	Disagree	Strongly disagree
1	The implementation of ISO 22000 increase profit	7 31.8%	13 59.1%	1 4.5%	1 4.5%	0 0.0%
2	The implementation of ISO 22000 increase turnout on company products	11 50%	7 31.8%	4 18.2%	0 0.0%	0 0.0%
3	The implementation of ISO 22000 increase sales	10 45.5%	9 40.9%	2 9.1%	1 4.5%	0 0.0%

3.2.2 Impact of ISO 22000 2005 on marketing

In table 3:3 the value of chi-square for all phrases in the second axis (13.36), with (p-value =0.001< 0.05, this indicated that there was significant differences at the level (5%) between answers of study individuals and in favor of strongly agree.

From the above the second axis "**Impact of ISO 22000 2005 on marketing**" has been achieved and in favor of strongly agree.

Table 3:3: Frequency distribution of the second axis phrases Answers (n=22):

No.	Phrases	Frequency and percentages%				
		Strongly agree	Agree	Neutral	Disagree	Strongly disagree
4	The implementation of ISO 22000 increase company market share	9 40.9%	9 40.9%	4 18.2%	0 0.0%	0 0.0%
5	The implementation of ISO 22000 increase the advantage agonist competitors	12 54.5%	6 27.3%	4 18.2%	0 0.0%	0 0.0%
6	The implementation of ISO 22000 enhance company image in market	12 54.5%	9 40.9%	1 4.5%	0 0.0%	0 0.0%

3.2.3 Impact of ISO 22000 2005 on resource management

In table 3:4 the value of chi-square for all phrases in the third axis (15.91), with (p-value =0.000 < 0.05), this indicated that there was significant differences at the level (5%) between answers of study individuals and in favor of agree.

From the above the third axis "I**mpact of ISO 22000 2005 on resource management**" has been achieved and in favor of agree.

Table 3:4 Frequency distribution of the third axis phrases Answers (n=22):

No.	Phrases	Frequency and percentages%				
		Strongly agree	Agree	Neutral	Disagree	Strongly disagree
7	The implementation of ISO 22000 increase the awareness of food safety among the staff	9 40.9%	9 40.9%	4 18.2%	0 0.0%	0 0.0%
8	The company provides training for the staff based on the ISO 22000	6 27.3%	14 63.6%	2 9.1%	0 0.0%	0 0.0%
9	The company provides suitable work environment and infrastructure based on the ISO 22000	17 77.3%	4 18.2%	1 4.5%	0 0.0%	0 0.0%

3.2.4 Impact of ISO 22000 2005 on customer satisfaction

In table 3:5 the value of chi-square for all phrases in the fourth axis (46.46), with (p-value =0.000 < 0.05), this indicated that there was significant differences at the level (5%) between answers of study individuals and in favor of agree.

From the above the fourth axis "**Impact of ISO 22000 2005 on customer satisfaction**" has been achieved and in favor of agree.

Table 3:5: Frequency distribution of the fourth axis phrases Answers (n=22):

No.	Phrases	Frequency and percentages%				
		Strongly agree	Agree	Neutral	Disagree	Strongly disagree
10	The company looks for satisfy internal and external customers	11 50%	11 50%	0 0.0%	0 0.0%	0 0.0%
11	Customer satisfaction is the company main target	13 59.1%	9 40.9%	0 0.0%	0 0.0%	0 0.0%
12	The implementation of ISO 22000 increase customer confidence on company products	9 40.9%	8 36.4%	5 22.7%	0 0.0%	0 0.0%
13	The implementation of ISO 22000 reduce customer compliance	5 22.7%	9 40.9%	7 31.8%	0 0.0%	1 4.5%

3.2.5 Impact of ISO 22000 2005 on internal processes

In table 3:6 the value of chi-square for all phrases in the fifth axis (23.91), with (p-value =0.000 < 0.05), this indicated that there was significant differences at the level (5%) between answers of study individuals and in favor of agree.

From the above the fifth axis " **Impact of ISO 22000 2005 on internal processes** " has been achieved and in favor of agree.

Table 3:6 Frequency distribution of the fifth axis phrases Answers (n=22):

No.	Phrases	Frequency and percentages%				
		Strongly agree	Agree	Neutral	Disagree	Strongly disagree
14	The implementation of ISO 22000 improves internal processes	9 40.9%	4 18.2%	8 36.4%	1 4.5%	0 0.0%
15	The implementation of ISO 22000 increase production	10 45.5%	7 31.8%	4 18.2%	1 4.5%	0 0.0%
16	The implementation of ISO 22000 reduce waste and rework	7 31.8%	10 45.5%	3 13.6%	2 9.1%	0 0.0%
17	The implementation of ISO 22000 enhance performance	6 27.3%	12 54.5%	3 13.6%	1 4.5%	0 0.0%

3.2.6 Impact of ISO 22000 2005 on product quality:

In table 3:7 the value of chi-square for all phrases in the sixth axis (38.33), with (p-value =0.000 < 0.05), this indicated that there was significant differences at the level (5%) between answers of study individuals and in favor of agree.

From the above the sixth axis " **Impact of ISO 22000 2005 on product quality** "has been achieved and in favor of agree.

Table 3:7: Frequency distribution of the sixth axis phrases Answers (n=22):

No.	Phrases	Frequency and percentages%				
		Strongly agree	Agree	Neutral	Disagree	Strongly disagree
18	The implementation of ISO 22000 helps to improve and enhance the company products	11 50%	9 40.9 %	2 9.1%	0 0.0%	0 0.0%
19	There is a system to evaluate the critical control measures validation	9 40.9%	12 54.5 %	1 4.5%	0 0.0%	0 0.0%
20	There is a system to control nonconformance products	10 45.5%	11 50%	1 4.5%	0 0.0%	0 0.0%
21	The implementation of ISO 22000 improves final product	10 45.5%	10 45.5 %	2 9.1%	0 0.0%	0 0.0%
22	There is a traceability system help to pull or recall products when it need it	9 40.9%	13 59.1 %	0 0.0%	0 0.0%	0 0.0%

Discussion

From the questionnaire analysis results and based on the values of Chi-square study came out with implementing ISO 22000 increase profit and this agreed with the economic benefits of standards mentioned by Gerundino (2014) in Juhayna food industry that implementing this standard increase annual revenue. Implementation of ISO 22000 have positive impact on marketing and this identical to Kafel and Sikora (2011) whom considered the standard as a marketing tool and also agreed with Mamalis *et al;* (2009) also considered standard as a marketing tool and according to Gerundino (2014) implementing ISO 22000 increased market share. Individuals of this study agreed that application of ISO 22000 have positive impact on resource management and this agreed with Mamalis *et al;* (2009) one of the standard advantages the optimum distribution of resources inside the food chain organization. Implementing ISO 22000 have positive impact on customer satisfaction this results agreed with Dobrin *et al;* (2015) ISO certification improve customer satisfaction through the effective control of food safety hazards. Individuals of this study agreed that application of ISO 22000 have positive impact on internal process and this agreed with Gerundino (2014) ISO 22000 enhance performance and reduce cost of rework also agreed with Deming (2000) approach improve quality to increase productivity. Individuals of this study agreed that application of ISO 22000 have positive impact on product quality and this agreed with Nyakiokibe and Wanjaw (2014) mentioned that safety is one of the product quality aspects and also agreed with Jaiswal (2009) ISO 22000 help organization to provide consistently safe end product. ISO 22000 it is an important standard for any organizations work in food production to assure that they produced safe food. In Sudan there are many organizations implement food safety management system that's indicate the awareness of organizations and customers to the significant of food safety and it is impact on both business growth and customer health.

Conclusions:

According to literature reviewed and findings from results this study conclude that application of ISO 22000:2005 have positive impact on profit based on the increasing of sales, positive impact on marketing according to the increase the market share, positive impact on resource management based on the optimum distribution of resource, positive impact on customer satisfaction and retention by increasing customer confidence and reduce compliance, positive impact on internal process by reducing waste and enhance performance and positive impact on product quality by improving safety and the end product quality.

Recommendations:

- The full commitment from organization is requires to ensure the effectiveness and efficiently of the implementation ISO 22000.
- Adopt and adapt the requirements of the ISO 22000 to make it easy to implement in organizations in Sudan.
- Increase the awareness on food safety and make it a culture and life style in Sudan.
- Government regulations must be strict in food safety to push organizations to adopt ISO 22000:2005 to ensure food safety.

References:

Ames Mark, (2009), The importance of ISO 22000, quality digest 2009 Article, available at http//m.quality digest.com.

Bureau of Indian standards, (2012), IS/ISO 22000:2005 Food safety management system. Published under the right to information act.

Deming W Edward, (2000), Out of crisis, 1st MIT press ed.p:507.

Dobrin Comin, Girneata Adriana, Mascu Mihacla and Crotoru Oana,(2015), The evaluation of ISO certification for management system, proceeding at the 9thinternational management conference,2015,availableathttp:// conferinta.manaement.ase.pp 1062-1073.

Gerundino Daniele,(2014), Economic benefits of standard. Available at www.iso.org. p:65.

Gitlow Haward S, Oppenheim Alan J and Levine David M, (2005), Quality management. McGraw-Hill 3rd ed,. P: 797.

Goetsch David L and Davis Stanley, (2013), Quality management for organization excellence. Introduction to total quality, Pearson, 2013 7th ed,. P: 456.

Jaiswal Prem Kumar, (2009), Total Quality and Safety management system. P: 236.

Juran Joseph M, (1999), Juran's Quality handbook, McGraw-Hill 5th ed,. P: 48.36.

Kafel Piotr and Sikora Tadeusz, (2011), Benefits of implementation and certification of management systems in the food industry enterprises, the international quality conference, 2011, international Journal for quality research available at http// www.cqm.rs.pp:625-629.

Kothari C.R, (2004), Research Methodology Methods and Techniques, New age international (p) ltd 2nd ed,. P: 373.

Mamalis Spyridon, Kafetzopoulos Dimitrios P and Aggelopoulos Stamatis, (2009), The new food safety ISO22000 assessment, comparison and correlation with HACCP and ISO 9001:2000 paper presented in 113th EAAE seminar available at http:// ageconsearch.umn.edu.

Montgomery Douglas C, (2009), Statistical Quality Control a modern introduction, Wiley 6th ed,. P: 549.

Nyakiokibe Evelyn and Wanjau Kenneth, (2014), The effect of Quality Management system on performance of food processing firms in Kenya, IOSR journal of business and management may.2014 available at www.iosr journals.org. pp 61-72.

Papp Jeffrey, (2002), Quality management in the imaging sciences. Mosby 2nd ed,. P: 287.

Singh Yogesh Kumar, (2006), Fundamental of Research Methodology and statistics. New age international (p) ltd. P: 310.

Singh Brijendra, (2008), Quality control and reliability analysis. p: 281.

Summers Donwc S, (2009), Quality management, creating and sustaining organizational effectiveness. Pearson/ prentice hall 2nd ed,.p: 574.

Wei Zhigang, Lue Limin, Lin Shengbin and Konson Dmitri, (2014), Quality control and improvement based on design of experiments and statistical data analysis, SAE technical paper:2014.01.0774 available at www.papers.sae.org. p: 9.

Appendix:

Appendix A: Questionnaire

PART ONE:

Tick (√) in front the proper answer:

Gender: Mail ( ) female ( )

Job description: ……..

Qualification: BA ( ) MA ( ) PHD ( )

Years of experts: 1_5 years ( ) 5_10 years ( ) over 10 years ( )

PART TWO:

No	statements	Strongly disagree	Disagree	Neutral	Agree	strongly agree
Impact of ISO 22000 2005 on profit						
1	The implementation of ISO 22000 increase profit					
2	The implementation of ISO 22000 increase turnout on company products					
3	The implementation of ISO 22000 increase sales					
Impact of ISO 22000 2005 on marketing						
4	The implementation of ISO 22000 increase company market share					
5	The implementation of ISO 22000 increase the advantage agonist competitors					
6	The implementation of ISO 22000 enhance company image in market					
Impact of ISO 22000 2005 on resource management						
7	The implementation of ISO 22000 increase the awareness of food safety among the staff					

8	The company provides training for the staff based on ISO 22000					
9	The company provides suitable work environment and infrastructure based on ISO 22000					
Impact of ISO 22000 2005 on customer satisfaction						
10	The company looks for satisfy internal and external customers					
11	Customer satisfaction is the company main target					
12	The implementation of ISO 22000 increase customer confidence on company products					
13	The implementation of ISO 22000 reduce customer compliance					
Impact of ISO 22000 2005 on internal processes						
14	The implementation of ISO 22000 improves internal processes					
15	The implementation of ISO 22000 increase production					
16	The implementation of ISO 22000 reduce waste and rework					
17	The implementation of ISO 22000 enhance performance					
Impact of ISO 22000 2005 on product quality						
18	The implementation of ISO 22000 helps to improve and enhance the company products					
19	There is a system to evaluate the critical control measures validation					
20	There is a system to control nonconformance products					
21	The implementation of ISO 22000 improves final product					
22	There is a traceability system help to pull or recall products when it need it					

Appendix B: Figures

Figure (1): Gender

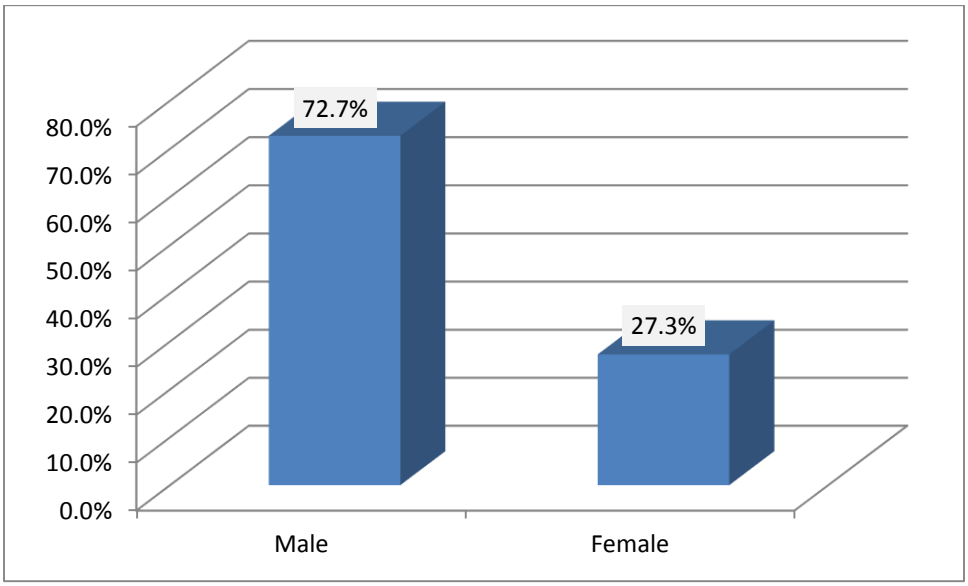


Figure (2): Qualification

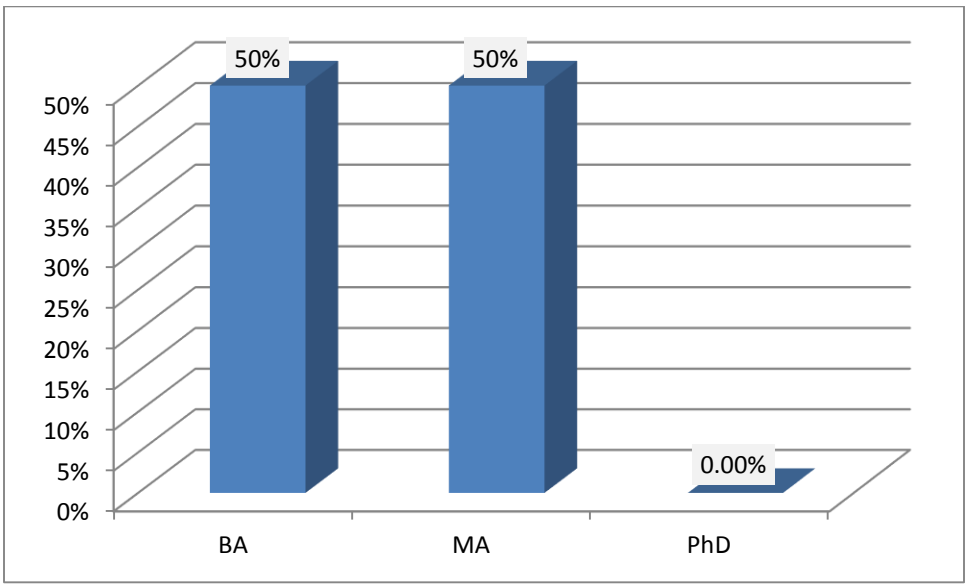
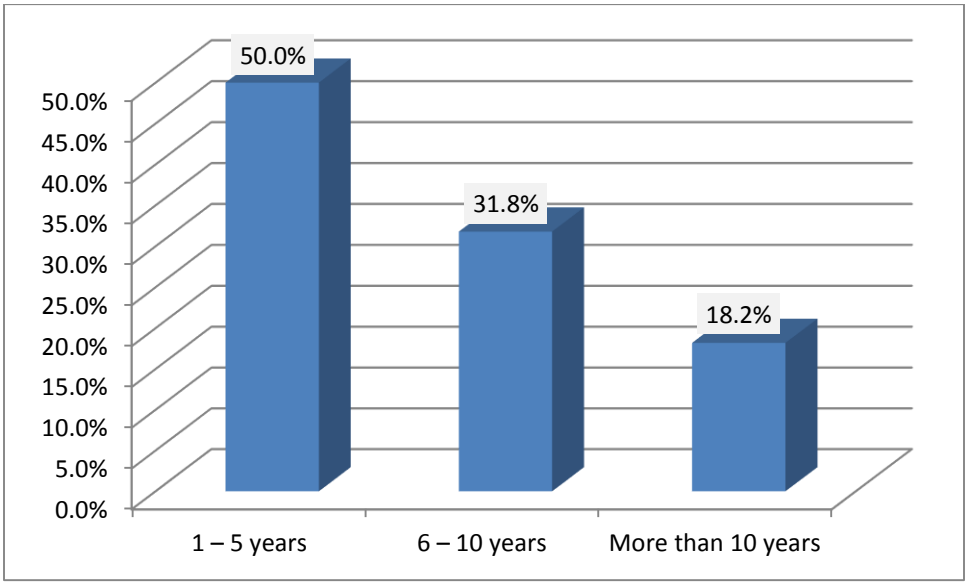


Figure (3): Years of experts



Appendix C: Results

Reliability and Validity:

Stability means that measures give the same results if used more than once under similar conditions.

Reliability is defined as the extent to which a questionnaire, test, observation or any measurement procedure produces the same results on repeated trials.

Validity is defined as the extent to which the instrument measures what it purports to measure. And calculate in many ways represents the easiest being the square root of the reliability coefficient

$$\text{Validity} = \sqrt{\text{Reliability}}$$

Researcher calculates the reliability coefficient of the scale used in the questionnaire by alpha equation and the results as follows:

Reliability and Validity**:**

reliability coefficient	**Validity coefficient**
0.91	0.95

Source: prepared by researcher, using SPSS, 2017

Notes from the results above that all reliability and validity coefficients for questionnaire is greater than (50%) and close to the one, This indicates that the questionnaire is characterized by high reliability and validity, and makes statistical analysis acceptable.

Impact of ISO 22000 2005 on profit

Chi-square test results first axis:

No	Phrases	Chi-square value	P-value	Median	Trend
1	The implementation of ISO 22000 increase profit	18.00	0.000	4	Agree
2	The implementation of ISO 22000 increase turnout on company products	3.36	0.186	-	-
3	The implementation of ISO 22000 increase sales	11.82	0.008	4	Agree
Axis		35.70	0.000	4	Agree

Impact of ISO 22000 2005 on marketing

Chi-square test results second axis:

No	Phrases	Chi-square value	P-value	Median	Trend
4	The implementation of ISO 22000 increase company market share	2.273	0.321	-	-
5	The implementation of ISO 22000 increase the advantage agonist competitors	4.727	0.094	-	-
6	The implementation of ISO 22000 enhance company image in market	8.18	0.012	5	Strongly agree
Axis		13.36	0.001	5	Strongly agree

Impact of ISO 22000 2005 on resource management

Chi-square test results third axis:

No	Phrases	Chi-square value	P-value	Median	Trend
7	The implementation of ISO 22000 increase the awareness of food safety among the staff	2.27	0.321	-	-
8	The company provides training for the staff based on the ISO 22000	10.18	0.006	4	Agree
9	The company provides suitable work environment and infrastructure based on the ISO 22000	19.73	0.000	5	Strongly agree
Axis		15.91	0.000	4	Agree

Impact of ISO 22000 2005 on customer satisfaction

Chi-square test results fourth axis:

No	Phrases	Chi-square value	P-value	Median	Trend
10	The company looks for satisfy internal and external customers	0.00	1	-	-
11	Customer satisfaction is the company main target	0.727	0.394	-	-
12	The implementation of ISO 22000 increase customer confidence on company products	1.18	0.554	-	-
13	The implementation of ISO 22000 reduce customer compliance	6.36	0.095	-	-
Axis		46.46	0.000	4	Agree

Impact of ISO 22000 2005 on internal processes

Chi-square test results fifth axis:

No	Phrases	Chi-square value	P-value	Median	Trend
14	The implementation of ISO 22000 improves internal processes	7.46	0.059	-	-
15	The implementation of ISO 22000 increase production	8.18	0.042	4	Agree
16	The implementation of ISO 22000 reduce waste and rework	7.46	0.059	-	-
17	The implementation of ISO 22000 enhance performance	12.55	0.006	4	Agree
Axis		23.91	0.000	4	Agree

Impact of ISO 22000 2005 on product quality

Chi-square test results sixth axis:

No	Phrases	Chi-square value	P-value	Median	Trend
18	The implementation of ISO 22000 helps to improve and enhance the company products	6.09	0.048	5	Strongly agree
19	There is a system to evaluate the critical control measures validation	8.82	0.012	4	Agree
20	There is a system to control nonconformance products	8.27	0.016	4	Agree
21	The implementation of ISO 22000 improves final product	5.82	0.055	-	-
22	There is a traceability system help to pull or recall products when it need it	0.43	0.513	-	-
Axis		38.33	0.000	4	Agree