Sudan University for Science and Technology

College of Graduate Studies

The Emerging of Co-regulation to Enforce Food Safety Regulations in Khartoum State

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BSc. Science – Chemistry

Khartoum University / 2010

A Thesis Submitted in Fulfillment of the Requirement for The Degree of Master in Total Quality Management and Excellence

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October/2016

بسم الله الرحمن الرحيم

قال تعالى: "وأحسن كما أحسن الله إليك"

قال رسول الله صلى الله عليه وسلم: " ان الله يحب اذا عمل أحدكم عملا أن يتقنه"

Dedication

This thesis dedicated to my parents for their endless love and encouragement.

Acknowledgement

I would first like to thank God, without his blessing and graces, thesis study would not have been possible.

Second thanks for Sudan University for Science and Technology, that give me the opportunity to have my master degree in total quality management and exellence and to conduct this research study.

Immeasurable appreciation and deepest gratitude for the help and support are extended to the following persons who way or another have contributed in making the study possible:

My thesis supervisor Prof. Mohammed Abd El-Salam Abdallah of Dean of College of Graduate Studies at Sudan University for Science and Technology, I am gratefully indebted to his for his very valuable comments, suggestions and provision that benefited in success of finishes this study.

Dr. Khalid Abdallah, advisor and statistician, the expert who were involved in the validation survey and the analysis of the research data Without his participation and input, the validation survey and the data analysis could not have been successfully conducted.

Prof. Amel Bakhet, the Dean of Deanship of Scientific Research as the second reader of this thesis, and she consistently allowed this paper to be my own work, but steered me into the right direction whenever she thought I needed it.

Mr. Shawgi Gharib Mahmoud who have always been a father, support and whose good examples have taught me to work hard for the things that I aspire to achieve.

Abstract

This research explores the co-regulation scheme in the ministry of Agriculture Animal Resource and Irrigation in Khartoum. The exploratory research has been conducted as the first research that discuss the co-regulation scheme in Khartoum since the co-regulation has been established.

In the context of food safety, the text explores the co-regulation scheme in food regulatory process in the ministry of Agriculture Animal Resource and Irrigation,
the co-regulation enforcement regime, and studying the ability of the ministry to adopt HACCP as a mandatory regulatory tool to enhance regulation compliance during a period of time from October 2016 to December 2016.

This study uses two qualitative methods to conduct this exploratory study, which are focus group of administrators and inspectors followed by an in-depth interview with General manager of the ministry.

The main finding shows the Co-regulation appear as direct command and control intervention for meat and poultry, that support the self-regulations (voluntary codes of practices) to fulfill regulatory policy objectives. Hazard Analysis Critical Control Point HAACP is the preferable standard in meat industry to be adopted as a mandatory regulation to enhance food safety regulation compliance. We recommended the further studies to evaluate the cost of the effectiveness of co-regulation and the extend level of regulation compliance.

مستخلص البحث

اللوائح المشتركة تطورت كأداة قانونية مهمة لتعزيز المطابقة للقوانين، وفي سياق سلامة الأغذية وقوانين سلامة الغذاء قمنا بعمل اول دراسة استكشافية لمناقشة نظام اللوائح المشتركة في وزارة الزراعة والثروة الحيوانية والري في الخرطوم، حيث قمنا بعمل دراسة استكشافية لنظام اللوائح المشتركة في القوانين الغذائية ونظام التنفيذ لقوانين اللوائح المشتركة وقابلية الوزارة لتبني نظام تحليل المخاطر والنقاط التحكم الحرجة كأداة قانونية لتعزيز المطابقة لقوانين سلامة الأغذية، في الفترة من اكتوبر 2016 م الى ديسمبر 2016 م .حيث استخدمت طريقتين من طرق التحليل الكمي استبيان لمجموعة من الاداريين والمفتشين الوزارة ومعاينة مع المدير العام للوزارة.

اظهرت النتائج ان اللوائح المشتركة تظهر في شكل القيادة والسيطرة المباشرة مع دعم الأنظمة الذاتية (الممارسات التطوعية) للمؤسسات الخاصة التي تهدف لتحقيق اهداف السياسات القانونية، وأن مواصفة سلامة الغذاء " تحليل المخاطر ونقاط التحكم الحرجة" HAACP هي المواصفة المناسبة التي يمكن ان تعتمد كلائحة لتعزيز المطابقة لقوانين سلامة الغذاء، ونوصي الدراسات اللاحقة بتقييم تاثير كفاءة اللوائح المشتركة على التكلفة ومدى المطابقة للقوانين.

Contents

List of Tables:

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List of Figures:

Introduction

The political and economic demands for more effective food safety controls have being created, because the increased of recorded incidence of food-borne illness linked to food in a number of industrial countries. "Consequently, government oversight of food safety has increased substantially in the last decade, including the introduction of ex ante direct regulations and ex post indirect controls" (Henson and Caswell, 1999). The substantially developing of private food mechanism control play an important role in the supply of higher quality, safer food. The result is a complex network of both public and private incentives to implement enhanced food safety controls.

"However, since the 1990s food safety regulations have evolved worldwide and food operators have frequently been given more responsibility to monitor the safety of their products" (Henson and Caswell, 1999; Loader and Hobbs, 1999; Segerson, 1999; Henson and Hooker, 2001; Codron et al., 2007). "New governance structures have emerged that employ greater coordination between public agents and food firms. By governance structures, we mean coordination schemes (novel regulatory tools) between private and public agents that are intended to facilitate the compliance of food operators with food safety regulation. These new governance structures may be analyzed as co-regulation programs for food safety" (Garcia-Martinez et al., 2007)".

There is a growing literature on co-regulation but relatively little discussion has been focused on potential complementarities in the operations of regulatory agencies. In the context of the United States, Coglianese and Lazer (2003) develop a framework to analyze the conditions under which ‘‘management based regulation’’ will likely prove effective and explore the choices regulators confront in designing these systems". Fairman and Yapp (2005) focus on ‘‘enforced self-regulation’’ in the United Kingdom, particularly for small and medium-sized enterprises, investigating the impact of enforcement mechanisms on the compliance process. They show that the main drivers of compliance is the means of enforcement. Using Eijlander’s (2005) definition of co-regulation, Garcia-Martinez et al. (2007) review all modes of co-regulation that appear in food safety regulatory processes from the regulatory standard setting process, process implementation (the standard design stage) to the enforcement regime (monitoring and enforcement). In their framework, enforced self-regulation systems will appear as schemes of co-regulation because in them public authorities always coordinate at a more intensive level with firms. They illustrate their analysis with case studies from North America and Europe. Garcia-Martinez et al. draw two principal conclusions: (1) the emergence of co-regulation depends on the institutional environment and (2) co-regulation appears to play a greater role in enforcement regimes than in the design of regulatory processes. Here we

explore the use of new co-regulation schemes focusing on a specific type of co-regulation where regulations are set and designed by public authorities and then enforced by the coordinated actions of public authorities and food operators or ‘‘enforced self-regulation’’. We look at this type of co-regulation primarily from the point of view of regulatory agencies in Ministry of Agriculture Animal Resource and Irrigation - Khartoum. We provide a broader context for the definition of co-regulation and discusses rationales for its emergence as a means of giving more responsibility to food operators. We present a conceptual model for enforcement (philosophy, strategy and practices) of food safety regulations adapted from Mayand Burby (1998). to explore the enforcement regime in the regulatory agency to provide effective food safety control system at Ministry of Agriculture Animal Resource and Irrigation - Khartoum. Then we discuss the ability to mandatory adopt Hazard Analysis Critical Control Point (HACCP) systems to control and reduce the incidence of pathogens is included in proposed regulations for safety in meat products.
To Explore the co-regulation scheme in the ministry, and the co-regulation enforcement regime, and the ability of the ministry to mandatory adopt HACCP as regulatory tool to enhance regulation compliance, the research question to be addressed in this thesis is:

What is the co-regulation scheme and enforcement regime in the ministry of Agriculture Animal Resource and Irrigation?

Research objectives:
In exploring the research question, the following objectives will be met:

- The coordination level between the regulatory agency and private sectors for an effective food safety control system
- The co-regulation enforcement regime for an effective food safety control system and to enhance regulatory compliance.
- And how enforcement regime will induce changes in the enforcement practices of the regulatory agency.
- The ability to adopt **Hazard analysis critical control (HACCP)** system to control and reduce the incidence of pathogen (regulatory intervention combines control of process and product) to enhance food safety compliance and for effective food safety control system.

CHAPTER ONE

1. Literature review:

1.1. Co-ordinated approach to food safety

"For any given food safety problem, the level of public intervention may range from doing nothing – leaving the market to find the requisite solution – to direct regulation (Better Regulation Task Force, 2003)". In-between, there is a wide range of options including self-regulation (the voluntary codes of practices) co-regulation (statutory or government backed codes of practices or action plans) education and information and the incentive based structure. The main goal of these options is to protect consumer from food-borne illness outbreaks by enhance the food safety regulation compliance. "Determining consumer derived demand for quality from other motivations for regulatory activity is an on-going challenge" (Caswell and Joseph, 2006).

Hence, the analysis of co-regulation of food safety focuses on four stages in the food safety regulatory processes where greater coordination of public and private efforts may yield as effective and efficient of food safety controls: (i) setting food safety standards; (ii) process implementation; (iii) enforcement; and (iv) monitoring (Mariana Garcia Martinaz, Andrew Fearne, Julie A. Caswell, Spencer Hanson (2007)

The type of food safety regulation or/and co-regulation required will vary depending on where a company is in the food chain and what products it you produce. Specifically, certain food sectors carry higher risks of food-borne illness than others (e.g. fresh meat versus canned soups), so will attract greater regulatory attention.

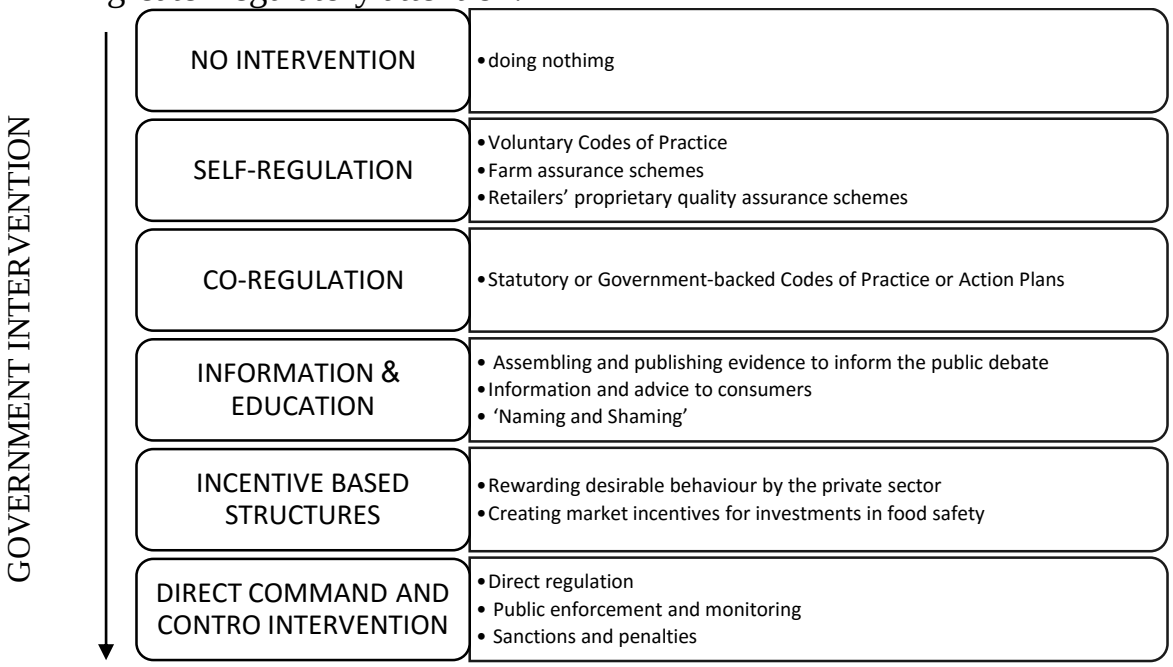

Fig. 1.1. Options for public intervention. Source: own elaboration.

1.2. Regulatory standard-setting process

"In recent years, governments have progressively employed risk assessment methodologies to provide standardized, science-based and 'objective' evaluations of specific risks. This is followed by risk management decisions that seek to identify appropriate regulatory interventions. Risk management involves careful analysis of the benefits and costs of alternative regulatory interventions. This plays a similar role to risk assessment in disciplining decision-making, providing empirical support for the regulatory options chosen and enhancing transparency of the policy process" (Caswell, 1998, 2004). Then it followed by Risk Impact Analysis (RIA) that provide systematical analysis of technical problems associated with the compliance and/or excessive increase in the cost of production. That is allows a degree of transparency in the regulation process, so policy-makers can make better decisions (Mariana Garcia Martinaz, Andrew Fearne, Julie A. Caswell, Spencer Hanson (2007).

1.3. Process implementation

The process implementation is the determination in which way the food safety regulatory requirement is implemented and in the specific modes through which implementation is induced and facilitated. "The recent evolution of EU food safety legislation provides a good example of this. Following the application of new EU food hygiene regulations from 1 January 2006, responsibility for the production of safe food lies more explicitly with food business operators, a requirement that is already contained in current legislation and is underpinned in General Food Law.1 All food business operators are required to have controls that demonstrate they are managing food safety within their business" (Mariana Garcia Martinaz, Andrew Fearne, Julie A. Caswell, Spencer Hanson (2007)). "This legislative framework represents a shift from a prescriptive 'command and control' approach towards an 'enforced self-regulatory' approach" (Braithwaite, 1982), in order to fulfil of regulator's policy objectives by regulator imposing a requirement to food operator to determine and implement their own internal rules and procedures. The regulator is then responsible for approving these internalized rules and monitoring compliance. Some shifts of responsibility towards food business, but at the same time flexibility to implement a system of food safety control that reflect their own particular circumstances as in US, from predominantly prescriptive process and product standard approaches to more flexible and performance-based standards that provide greater choices for businesses in the mode of implementation. The Pathogen Reduction/Hazard Analysis and Critical Control Points (PR/HACCP) rule requires meat plants to identify critical control points (CCPs), take responsibility for implementation and control of their HACCP programs, maintain performance records and adopt plans for action should processes get out of control, team of Food Safety and

Inspection Service (FSIS) process control inspectors enforces these regulations by determining whether sanitation and process control systems are working to prevent adulteration (Mariana Garcia Martinaz, Andrew Fearne, Julie A. Caswell, Spencer Hanson (2007)).

1.4. Enforcement

"A key factor influencing the degree to which food safety regulations achieve their desired aim is the rate of compliance among food businesses. Distinct inspection regimes influence behavior in different ways. If the aim is to win the ‘‘hearts and minds’’ of food business operators and their employees to encourage well-embedded and lasting changes to practices, enforcement officers may concentrate on promoting good practice through advice and education rather than enforcement action. This requires a set of prevailing incentives to upgrade food safety controls over and above the potential enforcement actions of regulatory officials. Regulatory incentives may take the form of positive gains from the adoption of enhanced food safety controls, for example through enhanced efficiency or ‘peace of mind’, and/or of negative consequences from non-compliance in the form of sanctions such as fines or repercussions in the form of declining market share and/or exclusion from markets. In general, incentives to comply with regulatory food safety standards have focused on enhancing the costs of non-compliance‹ whether real or perceived, for example through warnings backed up by the threat of action through the courts. A more positive (and potentially more effective) strategy may be to promote the potential gains from compliance through enhanced business performance‹ a co-regulatory approach that has been largely overlooked. Reputational sanctions may also be used through the publication of recall information and/or ‘naming and shaming’ firms that supply products that violate legal standards" (Mariana Garcia Martinaz, Andrew Fearne, Julie A. Caswell, Spencer Hanson (2007)).

1.5. Monitoring of business performance

"To maintain compliance with food safety regulations requires on-going monitoring and evaluation of business performance. There is increasing recognition that inspections can be an inefficient and resource-intensive form of enforcement action, particularly in the case of low and/or chronic food safety risk and businesses with consistently high rates of compliance. Other mechanisms may be more effective, for example provisions of advice aimed at continual improvements in performance (Hampton, 2004).

There are co-regulation opportunities for government agencies to rely more on private mechanisms of food safety control, including compliance with private codes of practice and implementation of systems such as the new ISO 22000 series. For example, compliance with such norms may enable enforcement officials to distinguish between high and low risk establishments and focus inspection efforts accordingly. This relies on the

trust of enforcement officials in the efficacy of private mechanisms to assess and maintain compliance with private norms and the degree to which these accord with legal food safety requirements" (Mariana Garcia Martinaz, Andrew Fearne, Julie A. Caswell, Spencer Hanson (2007)).

1.6. A framework for analyzing co-regulation in regulatory enforcement regimes

"Regulation may be ex-ante in the form of regulatory standards and enforcement or ex post in the form of liability. We focus on ex-ante regulation. Fig. 1.1 presents an analytical framework for mapping and assessing changes in ex-ante enforcement regimes adapted from May and Burby (1998). May and Burby (1998) divide the enforcement regime for ex ante regulation into three part " (Elodie Rouviere, Julie A. Casewell (2012)).

1.6.1. "Enforcement philosophy: the role an agency plays in inducing companies to comply with regulatory requirements. May and Burby (1998) distinguish between reactive and proactive approaches. The two differ in their purpose and how public authorities react when they detect that a regulatory offence has occurred. A reactive approach seeks to identify food operators that do not comply with regulations and penalize them with sanctions. A proactive approach seeks to implement measures. That are necessary to avoid a breach of the regulation, including، for example, education and coaching. It is a preventive approach to inducing compliance from firms.

1.6.2. Enforcement strategy: how the agency combines its practices in order to induce company compliance. Enforcement strategies are classified into two broad categories. Strict enforcement relies on strict application of rules, with inspections carried out in order to punish major regulatory offences. Creative strategies promote compliance through, for example, the use of market incentives or relaxed inspections.

2.2.3. Enforcement practices: the different sets of practices available to regulatory agencies to enforce regulations. These are discussed in detail below.

As shown in Fig. 1.2, the framework puts analysis of enforcement practices at the center. Again following May and Burby, we use analysis of the observed enforcement practices implemented by a regulatory agency to draw conclusions about the underlying enforcement philosophy and strategy. The major classes of enforcement practices analyzed are inspections, information, and sanctions.

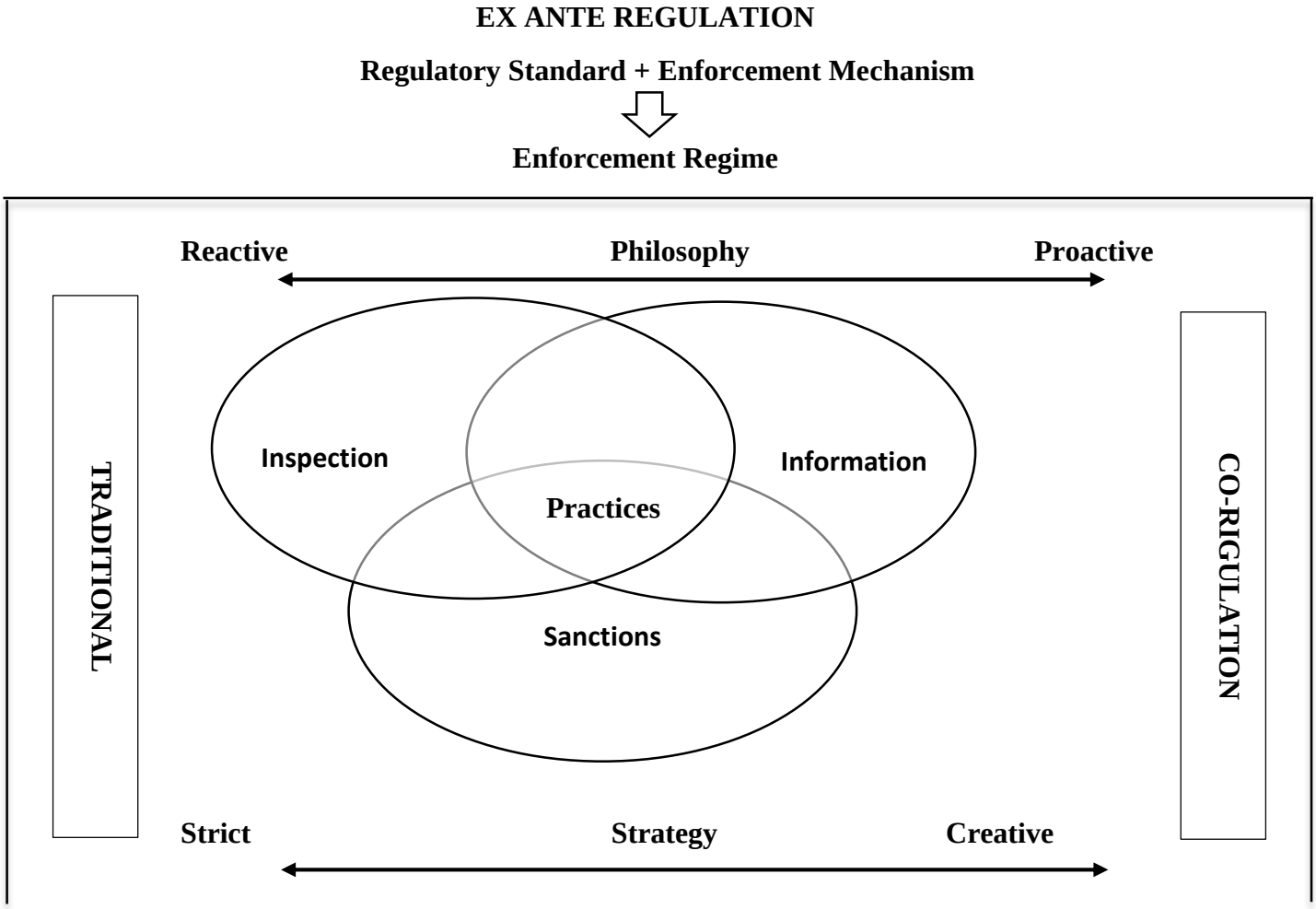

Fig. 1.2: a frame work for analyzing co-regulation in enforcement regime (adapted by the authors from May and Burby (1998)).

2.2.3.1. Inspections:

There are two types of inspections that a public agency can implement for enforcement of food safety regulations. First, official inspections can be performed by regulatory agencies through formal and random or scheduled on-site visits. The focus of these inspections may be product or process-oriented. Product-oriented inspections focus on the safety level of the product (e.g., pathogen counts for products at different stages of the supply chain, the level of pesticide residues in produce) and occur before or after the release of the product on the market. Process-oriented inspections focus on the procedures that food operators have implemented to prevent food safety failure. Inspections are intended to deter food operators from failing to perform the appropriate procedures.

Second, official inspections may be carried out through self-reporting or registration. Self-reporting allows for second level inspections where regulatory agencies evaluate a firm's compliance by monitoring its records. Based on individual records, enforcement agencies can assess a firm's internal rules (testing, corrective procedures, and actions taken) and check

whether firms have implemented their quality/safety management system correctly. Under registration, regulatory agencies implement third level inspections where they assess food operators' compliance through formal verifications made by third party accreditors. Enforcement agencies may support such third party accreditation bodies by issuing quality labels or signals for firms that have achieved a certain standard (e.g., organic production).

2.2.3.2. Information

The source of a firm's non-compliance often is a lack of knowledge and understanding of regulation principles and compliance processes (Fearne et al., 2005). Reliable information and education/ training programs may be a good means to achieve high rates of compliance (Fearne et al., 2004) by promoting the potential gains in business performance from compliance (Fearne et al ،.Technical support programs are designed to help food operators find and implement effective ways to achieve the required food safety level at least cost. Information programs take multiple forms that may be used separately or in combination: diffusion of up-dated regulations, coaching and training programs, and education programs. Regulatory agencies can also use information disclosure to consumers or others along the supply chain as a market mechanism to encourage the adoption of compliant practices by food operators.

For example, awards and labels can be used as positive market signals. These market signals are also useful in reducing information asymmetry between parties and facilitating customer decision making when faced with the credence attributes of food products. Depending on consumer awareness, market mechanisms based on information could provide significant incentives to food operators that wish to preserve or build their market shares and reputation.

2.2.3.3. Sanctions

We distinguish between three types of sanctions. All are generally used in connection with inspection practices. Repressive sanctions: Regulatory agencies can use penalties, prosecution, and recalls to punish intransigent food operators for committing an offence or repeatedly breaching regulations. Sanctions for non-compliance may include the closure of facilities, seizure of products, and disqualification from the market. Informative sanctions: Following a breach in regulations, enforcement agencies may mandate certain corrective actions in order to motivate food operators to comply. There may be a hierarchical spectrum of sanctions depending on the severity of the regulatory offence. Less severe violations may result in advice, notices, and warnings being given to encourage non-compliant firms to reach compliance through corrective actions. These

corrective actions can be imposed by the authorities and/or left to the discretion of food operators Sanctions through negative information provided to consumers: Regulatory agencies can display the results of official inspections and findings in order to disclose information about food operators to their customers. These are often referred to as ‘‘naming and shaming’’ programs. The names of non-diligent companies are posted on the Internet, in newspapers, or at places of business. Another example is obliging food operators to display inspection results to keep customers informed. This is the purpose of the ‘‘scores on doors programs’’ that the United Kingdom Food Safety Agency has been implementing for food service establishments since 2006.

As noted above, the combination of enforcement practices implemented by a regulatory agency can be used to analyze both the enforcement philosophy and strategy. As shown in Fig. 1.2, we characterize a traditional enforcement scheme as one that uses inspections and repressive or negative information sanctions as the predominant enforcement practices. This is indicative of a reactive enforcement philosophy and a strict enforcement strategy. We characterize a co-regulation scheme as one that uses information approaches and informative sanctions predominantly. This indicates a proactive enforcement philosophy and a creative enforcement strategy. From a policy perspective, the degree of shift in an enforcement regime towards co-regulation can be evaluated by comparing the suite of enforcement practices used before and after the change. This evaluation using the framework presented in Fig. 1.2 allows an understanding of the actual design versus the rhetorical representation of enforcement regimes and serves as a foundation for assessing the impacts of enforcement changes"(Elodie Rouviere, Julie A. Casewell (2012)).

1.7. Adoption of Hazard Analysis Critical Control Point (HACCP)

The current system of meat inspection in Sudan is a system science based on detection of the food safety hazards in meat products. The adoption of new approach that rely on science-based risk assessment and prevention rather than on detection of hazards it will be more effective in enhance food safety regulation compliance. The preventive approach is codified in a set of principles known as the Hazard Analysis Critical Control Point (HACCP) system, which was developed by industrial engineers in the food processing industry. (Laurian J. Unnevehr :md Helen H. Jensen Working Paper 96-WP 152 February 1996)

"This new approach has been embraced by USDA's Food Safety and Inspection Service (FSIS) In the proposed regulation for pathogen reduction (USDA/FSIS). Meat packers and processors would be required to put HACCP plans in place, to conduct periodic tests for microbial pathogens,

and we reduce the incidence of pathogens". (Laurian J. Unnevehr :md Helen H. Jensen Working Paper 96-WP 152 February 1996)

1.7.1. The HACCP approach:

"HACCP is widely recognized in the food industry as an effective approach to establishing good production, sanitation, and manufacturing practices that produce safe foods" (Pierson and Corlett). "HACCP systems establish process control through identifying points in the production process that arc most critical to monitor and control HACCP's preventive focus is seen as more cost-effective than testing a product, and then destroying or reworking it "(ICMFS). "The system can he applied to control any stage in the food system, and is designed to provide enough feedback to direct corrective activities.

Seven principles are involved in developing and operating a HACCP program" (NACMCF):

1 Assess the hazard, list the steps in the process where significant hazard can occur and describe the prevention measures;
2 Determine critical control point(CCPs) in the process:
3 Establish critical limits for each CCP;
4 Establish procedures to monitor each CCP;
5 Establish corrective actions to be taken when monitoring indicates a deviation from the CCP limits:
6 Establish recordkeeping for the HACCP system: and
7 Establish procedures to verify that the HACCP system is working correctly

By focusing inspection at CCPs, HACCP improves the scientific basis for safety and control processes. A CCP is "any point in the chain of food production from raw materials to finished product where the loss of control could result in unacceptable food safety risk" (Pierson and Corlett)

CCPs are very demanding in required resources and information. Monitoring of CCPs is done best by using indicators that can be measured easily. This focus on measurable indicators provides a more cost-effective approach to control than product sampling and testing, which is more expensive and may not provide timely results. HACCP can be viewed as a disembodied technological change because it is the application of new information and organization to the production process." (Laurian J. Unnevehr :md Helen H. Jensen Working Paper 96-WP 152 February 1996)

CHAPTER TWO

2. Materials and Method:

2.1. Methodology:

Chapter three details the methodology used in the study. As this is an exploratory study with two qualitative method used are focus group followed by in-depth interview with General manager.

2.1.1. Focus group:

Focus group are effective method of qualitative data collection and offer many benefits for this study, because very effective way of gaining insight and exploring issue addressed.

In this exploratory study we study focus group of administrations and inspectors group with total of 30 participations.

2.1.2. General Manager In-depth Interview:

Interview used to gain deeper inside into issues identified in the focus group.

2.2. Limitation of this study:

There are number of limitation of this study:

2.2.1. Geography: Ministry of Agriculture Animal Resource and Irrigation – in Khartoum state, that is not represented all states of Sudan.

2.2.2. Target administrations: the inspection administration of meat factories and chopping labs, and control and monitoring administration, in the ministry.

2.3. Hypothesis Statement:

2.3.1. The emergence of co-regulation as a novel regulatory tool to enhance compliance from food operators in enforcement of food safety regulations

2.3.2. There is a Change of enforcement practices regime for the regulatory agency from reactive approach to proactive approach

2.3.3. The adoption of HACCP as mandatory regulation in meat industry to enhance food regulation compliance

2.4. Study Design:

An exploratory research at Ministry of Agriculture Animal Resource Irrigation – Khartoum with two qualitative method used are focus group of admins and inspectors interviewed by a questionnaire then followed by in-depth interview with general manager to fill in the gaps of information and clearly ideas and concepts gleaned from the focus group aids in strengthening the finding of the study.

We adopt an exploratory approach to examine the level of co-regulation schemes and how enforcement regime will induce changes in the

enforcement practices of the regulatory agency at Ministry of Agriculture Animal Resource and Irrigation – Khartoum. Then we provide a suggestion to mandatory adopt Hazard Analysis Critical Control Point (HACCP) systems to control and reduce the incidence of pathogens. is included in proposed regulations for safety in meat products.

2.5. Subjects:

General manager and Focus group of inspectors and admin in inspection and control and monitoring departments at the Ministry of Agriculture Animal Resource Irrigation – Khartoum administration (N=30).

2.6. Questionnaire Design

A 3-part questionnaire was developed to:

- Explore co-regulation in regulatory enforcement regimes
- Explore the enforcement regime for the regulatory agency.
- Explore the ability to Adopt of HACCP to enhance an effective food safety control system and to enhance compliance from food operators in enforcement of Sudanese food safety regulations

Part one: A 5-point Likert-type rating scale, ranging from one (1) “strongly disagree” to five (5) “strongly agree”, was used The Cronbach alpha reliability for the was 0.79
Part two: A 5-point Likert-type rating scale, ranging from one (1) “strongly disagree” to five (5) “strongly agree”, was used The Cronbach alpha reliability for the was 0.80
Part three: A 5-point Likert-type rating scale, ranging from one (1) “strongly disagree” to five (5) “strongly agree”, was used The Cronbach alpha reliability for the was 0.87
A copy of questionnaire is placed in the appendence.

2.7. Data Collection:

The questionnaire was placed in the department of meat factories and all the inspectors and admin were noticed. All the inspectors and admins placed completed questionnaires in designated sealed boxes.

2.8. Statistical Analysis

SPSS version 13.0 for Windows was used for all data analyses. Descriptive statistics including frequencies, modes, percentage and then chai-square value non-parametric test were calculated for all variables as appropriate.

2.9. In-depth interview:

Several areas of additional interested where identified, these are included the concept of Co-regulation, and the enforcement practices. The questions are designed to encourage the follow of information and to insure that they are focused on issues and topics related to the research question.
A copy of in-depth interview is placed in the appendence.

CHAPTER THREE

3. Results

3.1. Descriptive Data

Inspectors and admins returned 23 questionnaires for a 76.6 % response rate. Demographic characteristics of Inspectors and admins are presented in Table 3.1.1.

Table 3.1.1. Demographic Characteristics of Inspectors and admins (N = 23)

#	characteristic		Frequency	Total	Percentage %	Total %
1	**Sex**	Male	5	23	21.7	100
		Female	18		78.3	
2	**Education**	Diploma		23		100
		Bachelor	18		78.3	
		Master	5		21.7	
		PhD				
		Other				
3	**Background**	Veterinary	14	23	60.9	100
		Agriculture				
		Food Technology				
		Food Production	8		34.8	
		Other	1		4.3	
4	**Experience**	Graduated	2	23	8.7	100
		3 -5 years	14		60.9	
		5 – 10 years	2		8.7	
		10 – 15 years	5		21.7	
		More than 15 years				
5	**Job**	Admin	7	23	30.4	100
		Inspector	16		69.6	
6	**Department**	Meat manufacturing inspection administration	16	23	69.6	100
		Control and monitoring administration	7		30.4	

From table (3.1) we note that:

- Most of the individual study are females by (18) and with (78.3%) while the total number of males (5) by (21.7%).

- The educational level of most individual study is (bachelor degree) by (18) and with (78.3%), followed by whom educational levels (master degree) by (5) with (21.7%) while the total number of whom educational levels (under graduate) is (8) by (11.4%).
- Most of the individual background is Veterinary by (14) and with (60.9%), followed by whom background is Food production (8) and with (34.8%), followed by one individual is background is other (unknown) and with (4.3%).
- The experience level of the most individual (3-5 years) by (14) with (60.9%), followed by (10-15 years) by (5) with (21.7%), followed by equal percentage of (fresh graduated and 5 – 10 years) (2) with (8.7%).
- We note that the occupation of most individual study are (inspectors) by (16) and with (69.6%), followed by whom occupations (admin) by (7) with (30.4%).
- Most of the individual department is Meat manufacturing inspection administration by (16) with (69.6%), followed by Control and monitoring administration by (7) with (30.4%).

3.2. Results of Statistical Testing

Table 3.2.1 shows the frequencies, mode and the percentage for responses to the three parts of the questionnaire
"Strongly agree 1, Agree 2, neither agree nor disagree 3, disagree 4, strongly disagree 5."

	Statements	Frequency		%	Mode
1	The government intervention is no intervention – doing nothing.	1	2	8.7	4
		2	1	4.3	
		3	7	30.4	
		4	10	43.5	
		5	3	13	
2	The government intervention is the Self-regulation (Voluntary codes of practices such as Food safety management system)	1	4	17.4	2
		2	10	43.5	
		3	5	21.7	
		4	4	17.4	
		5	0	0	
3		1	8	34.8	2

	The government intervention is Co-regulation (statutory or government backed codes of practices or action planes)	2	14	60.9	
		3	1	4.3	
		4	0	0	
		5	0	0	
4	The government intervention is the Information and education (Assembling and publishing evidence to inform the public debate, Information and advice to consumers "Naming and Shaming"	1	9	39.1	2
		2	13	56.5	
		3	0	0	
		4	0	0	
		5	1	4.3	
5	The government intervention is the Incentive based structures (rewarding desirable behavior by the private sector, creating market incentives for investment in food safety)	1	6	26.1	3
		2	6	26.1	
		3	7	30.4	
		4	4	17.4	
		5	0	0	
6	The government intervention is the Direct command and control intervention (direct regulation, public enforcement and monitoring, sanctions and penalties).	1	13	56.5	1
		2	7	30.4	
		3	2	8.7	
		4	1	4.3	
		5	0	0	
7	The food safety regulation and inspection procedure based on the detection of the food safety hazards.	1	8	34.8	1
		2	7	30.4	
		3	4	17.4	
		4	4	17.4	
		5	0	0	
8	The food safety regulation and inspection procedure Science based risk assessment and prevention method	1	6	26.1	2
		2	8	34.8	
		3	6	26.1	
		4	3	13.0	
		5	0	0	
9	regulatory impact analysis RIA is required when new food safety regulation is adopted	1	7	30.4	3
		2	5	21.7	
		3	10	43.5	
		4	1	4.3	
		5	0	0.0	
10	a Cooperation between the public and private sectors in the process of creating new rules.	1	3	13.0	2
		2	12	52.2	
		3	6	26.1	
		4	1	4.3	
		5	1	4.3	
11	The cooperation between private and public sector in the field of regulation may result in various forms of governance, such as	1	4	17.4	2
		2	15	65.2	
		3	2	8.7	
		4	2	8.7	

	agreements, conventions and even regular legislation	5	0	0.0	
12	The primary responsibility for food safety lies with the private sector.	1	3	13.0	4
		2	1	4.3	
		3	0	0.0	
		4	17	73.9	
		5	2	8.7	
13	The definition of basic standards, monitoring and policing is the responsibility of the public sector	1	14	60.9	1
		2	6	26.1	
		3	0	0.0	
		4	3	13.0	
		5	0	0.0	
14	a coordination between the public and private efforts that provide effective food safety control in setting food safety standard	1	6	26.1	2
		2	8	34.8	
		3	6	13.0	
		4	5	21.7	
		5	1	4.3	
15	a coordination between the public and private efforts that provide effective food safety control in process implementation	1	8	34.8	2
		2	10	43.5	
		3	2	8.7	
		4	3	13.0	
		5	0	0	
16	a coordination between the public and private efforts that provide effective food safety control in enforcement	1	7	30.4	1
		2	7	30.4	
		3	2	8.7	
		4	7	30.4	
		5	0	0.0	
17	a coordination between the public and private efforts that provide effective food safety control in monitoring	1	6	26.1	2
		2	9	39.1	
		3	1	4.3	
		4	5	21.7	
		5	2	8.7	
18	The producing and/or stimulating the generation of voluntary codes of ‘good practice 'in the Sudanese food safety standard	1	7	30.4	2
		2	8	34.8	
		3	6	26.1	
		4	1	4.3	
		5	1	4.3	
19	All food business operators are required to have controls that demonstrate they are managing food safety within their business with the regulator imposing a requirement on businesses to determine and implement their own internal rules and procedures in order to fulfil the regulator’s policy objectives	1	6	26.1	2
		2	13	56.5	
		3	2	8.7	
		4	2	8.7	
		5	0	0.0	
20		1	10	43.5	1

	Regardless of the mechanism of enforcement, it is evident that access to reliable information and advice is a vital component of any strategy aimed at achieving high rates of compliance.	2	10	43.5	
		3	3	13.0	
		4	0	0.0	
		5	0	0.0	
21	Public can authorities rely on private actors in food safety controls	1	5	21.7	3
		2	2	8.7	
		3	6	26.1	
		4	6	26.1	
		5	4	17.4	
22	Incentives for and the types of regulation required will vary depending on where a company is in the food chain and what products it you produces	1	4	17.4	2
		2	8	34.8	
		3	5	21.7	
		4	5	21.7	
		5	1	4.3	
23	co-regulation is an approach in which a mixture of instruments is brought to bear on a specific problem	1	6	26.1	2
		2	10	43.5	
		3	6	26.1	
		4	1	4.3	
		5	0	0.0	
24	Co-regulation is Industry self-regulation that government oversees and/or ratifies.	1	2	8.7	2
		2	11	47.8	
		3	7	30.4	
		4	1	4.3	
		5	2	8.7	
25	Co-regulation is Regulation can be perceived as consisting of a continuum ranging from detailed command and control regulation to pure self-regulation	1	6	26.1	2
		2	11	47.8	
		3	5	21.7	
		4	1	4.3	
		5	0	0.0	
26	Enforcement strategy approach is An approach seeks to identify food operators that do not comply with regulations and penalize them with sanctions.	1	9	39.1	1
		2	9	39.1	
		3	3	13.0	
		4	2	8.7	
		5	0	0.0	
27	Enforcement strategy approach is An approach seeks to implement measures. That are necessary to avoid a breach of the regulation, including، for example, education and coaching.	1	8	34.8	1
		2	8	34.8	
		3	4	17.4	
		4	3	13.0	
		5	0	0.0	
28	Official inspections can be performed by regulatory agencies through formal and random or scheduled on-site visits.	1	11	47.8	1
		2	10	43.5	
		3	1	4.3	
		4	1	4.3	
		5	0	0.0	

29	In official inspection can be performed Product-oriented inspections focus on the safety level of the product (e.g., pathogen counts for products at different stages of the supply chain, the level of pesticide residues in produce) and occur before or after the release of the product on the market.	1	9	39.1	1
		2	9	39.1	
		3	2	8.7	
		4	3	13.0	
		5	0	0.0	
30	In official inspection can be performed Process-oriented inspections focus on the procedures that food operators have implemented to prevent food safety failure.	1	6	26.1	2
		2	13	56.5	
		3	3	13.0	
		4	1	4.3	
		5	0	0.0	
31	Official inspection can be performed by both process and product oriented	1	11	47.8	1
		2	10	43.5	
		3	2	8.7	
		4	0	0.0	
		5	0	0.0	
32	Official inspections may be carried out through Self-reporting inspection: By monitoring its records. Based on individual records, enforcement agencies can assess a firm's internal rules (testing, corrective procedures, and actions taken) and check whether firms have implemented their quality/safety management system correctly.	1	5	21.7	2
		2	11	47.8	
		3	2	8.7	
		4	3	13.0	
		5	2	8.7	
33	Official inspections may be carried out through Self-registration inspection: Assess food operators' compliance through formal verifications made by third party accreditors.	1	6	26.1	2
		2	9	39.1	
		3	5	21.7	
		4	3	13.0	
		5	0	0.0	
34	In food safety certified firm the official inspections can be performed by regulatory agencies through formal and random or 3scheduled on-site visits.	1	5	21.7	2
		2	11	47.8	
		3	5	21.7	
		4	2	8.7	
		5	0	0.0	
35	In food safety certified firm the official inspections may be carried out through self-reporting or registration.	1	4	17.4	2
		2	7	30.4	
		3	6	26.1	
		4	2	8.7	
		5	4	17.4	
36	The source of a firm's non-compliance Lack of knowledge regulation principles and compliance processes.	1	9	39.1	1
		2	5	21.7	
		3	3	13.0	
		4	5	21.7	
		5	1	4.3	

37	The source of a firm's non-compliance Not clear understanding of regulation principles and compliance processes.	1	6	26.1	2
		2	10	43.5	
		3	4	17.4	
		4	2	8.7	
		5	1	4.3	
38	The high rates of compliance can achieved through Training, coaching and education programs	1	14	60.9	1
		2	7	30.4	
		3	2	8.7	
		4	0	0.0	
		5	0	0.0	
39	The high rates of compliance can achieved through Sanctions	1	6	26.1	2
		2	11	47.8	
		3	2	8.7	
		4	4	17.4	
		5	0	0.0	
40	The high rates of compliance can achieved through Quality or Compliance label through health inspector	1	3	13.0	2
		2	12	52.2	
		3	2	8.7	
		4	3	13.0	
		5	3	13.0	
41	Repressive sanctions: Regulatory agencies can use penalties, prosecution, and recalls to punish intransigent food operators for committing an offence or repeatedly breaching regulations.	1	9	39.1	1
		2	9	39.1	
		3	4	17.4	
		4	1	4.3	
		5	0	0.0	
42	Informative sanctions: Following a breach in regulations, enforcement agencies may mandate certain corrective actions in order to motivate food operators to comply.	1	3	13.0	2
		2	11	47.8	
		3	7	30.4	
		4	1	4.3	
		5	1	4.3	
43	Sanctions through negative information provided to consumers: Regulatory agencies can display the results of official inspections and findings in order to disclose information about food operators to their customers. These are often referred to as ‘‘naming and shaming’’ programs	1	1	4.3	3
		2	5	21.7	
		3	10	43.5	
		4	5	21.7	
		5	2	8.7	
44	The direct command and control intervention for meat and poultry industry have Standards for performance such pathogen count for products at some stage of marketing channel	1	8	34.8	2
		2	11	47.8	
		3	1	4.3	
		4	1	4.3	
		5	2	8.7	
45	The direct command and control intervention for meat and poultry industry have Processing Standards to improve final product by	1	7	30.4	2
		2	14	60.9	
		3	2	8.7	

	specifying procedure to be followed n production	4	0	0.0	
		5	0	0.0	
46	The direct command and control intervention for meat and poultry industry have Standards for both performance and processing	1	8	34.8	2
		2	11	47.8	
		3	3	13.0	
		4	1	4.3	
		5	0	0.0	
47	The direct command and control intervention for meat and poultry industry have Disclosure of information, for example: producers require to provide information about any pathogen reduction process	1	4	17.4	1
		2	11	47.8	
		3	2	8.7	
		4	6	26.1	
		5	0	0.0	
48	Hazard Analysis Critical Control Point HACCP is the preferable standard in meat industry	1	14	60.9	1
		2	5	34.8	
		3	1	4.3	
		4	0	0.0	
		5	0	0.0	
49	Pathogen Reduction - Hazard Analysis Critical Control Point PR-HAACP is the preferable standard in meat industry	1	10	43.5	1
		2	10	43.5	
		3	2	8.7	
		4	1	4.3	
		5	0	0.0	
50	The form of Co-regulation can be performed in Sudan, in meat industry sector could be Mandatory food safety standards, governments can pursue co-regulation through producing and/or stimulating the generation of voluntary codes of 'good practice'.	1	10	43.5	1
		2	6	26.1	
		3	3	13.0	
		4	4	17.4	
		5	0	0.0	
51	The form of Co-regulation can be performed in Sudan, in meat industry sector could be Institutional structures for co-regulation through consultation and stakeholder input to the regulatory process are limited. Where consultation does occur the mode is passive rather than active.	1	5	21.7	2
		2	12	52.2	
		3	4	17.4	
		4	2	8.7	
		5	0	0.0	
52	The form of Co-regulation can be performed in Sudan, in meat industry sector could be as standards compliance stekers on the products	1	5	21.7	2
		2	11	47.8	
		3	5	21.7	
		4	2	8.7	
		5	0	0.0	
53	the mandatory implementation of food safety standard will enhance compliance to meat industry food safety regulation	1	7	30.4	2
		2	13	56.5	
		3	3	13.0	
		4	0	0.0	

		5	0	0.0	
54	The inspection in HACCP implementing firm is by Determining whether sanitation and process control system are working to prevent 2adulteration.	1	7	30.4	2
		2	14	60.9	
		3	2	8.7	
		4	0	0.0	
		5	0	0.0	
55	The inspection in HACCP implementing firm is by Auditing procedures and records.	1	6	26.1	2
		2	14	60.9	
		3	1	4.3	
		4	1	4.3	
		5	1	4.3	
56	the degree of product and process compliance in HACCP implementing firm against not implementing firm is excellence	1	3	13.0	2
		2	7	30.4	
		3	7	30.4	
		4	3	13.0	
		5	3	13.0	
57	The enforcement strategy of The mandatory implementation of HACCP in meat industry is by training, coaching and education	1	7	30.4	2
		2	14	60.9	
		3	1	4.3	
		4	1	4.3	
		5	0	0.0	
58	The enforcement strategy of The mandatory implementation of HACCP in meat industry is by sanctions and penalty.	1	5	21.7	2
		2	8	34.8	
		3	2	8.7	
		4	7	30.4	
		5	1	4.3	
59	The enforcement strategy of The mandatory implementation of HACCP in meat industry is by training, coaching, education and sanctions and penalty	1	8	34.8	2
		2	13	56.5	
		3	1	4.3	
		4	1	4.3	
		5	0	0.0	
60	The monitoring strategy of The mandatory implementation of HACCP in meat industry is by inspections	1	10	43.5	2
		2	11	47.8	
		3	1	4.3	
		4	1	4.3	
		5	0	0.0	
61	The monitoring strategy of The mandatory implementation of HACCP in meat industry is by Provisions of advice aimed at continual improvements in performance	1	6	26.1	2
		2	14	60.9	
		3	2	8.7	
		4	1	4.3	
		5	0	0.0	
62	The monitoring strategy of The mandatory implementation of HACCP in meat industry	1	3	13.0	4
		2	4	17.4	
		3	6	26.1	
		4	7	30.4	

	is by Rely more on private mechanisms of food safety control, HACCP.	5	3	13.0	
63	The implementation of food safety co-regulation across a number of key product sectors is shifting the responsibility for the monitoring of food safety to business operators	1	6	26.1	1
		2	6	26.1	
		3	4	17.4	
		4	4	17.4	
		5	3	13.0	
64	the obstacles to emerge a co-regulation in Sudan is cost	1	4	17.4	2
		2	10	43.5	
		3	5	21.7	
		4	3	13.0	
		5	1	4.3	
65	the obstacles to emerge a co-regulation in Sudan is the lack of trust between public a private sector	1	6	26.1	2
		2	7	30.4	
		3	5	21.7	
		4	3	13.0	
		5	2	8.7	
66	the obstacles to emerge a co-regulation in Sudan is unavailability of competence inspectors	1	4	17.4	4
		2	4	17.4	
		3	4	17.4	
		4	7	30.4	
		5	4	17.4	

Source: prepared by researchers, using SPSS, 2016

Table 3.2.2. shows the chai-square values, P-values, mode and the trends:

To answer the questions of the study and verification of hypotheses will be calculated Mode for each of the phrases in the questionnaire and which show views of individuals the study, which was given Grade (1) as a weight for each answer " Strongly agree ", and grade (2) as a weight for each answer "agree " grade (3) as a weight for each answer " Nether agree or disagree ", grade (4) as a weight for each answer, " Disagree " and grade (5) as a weight for each answer " Strongly Disagree."

To know Trends, answer, by calculated Mode. and then it will use the Chi-square test to know the significance of differences in answers.

- with (p-value < 0.05), this indicates that there are significant differences at the level (5%) between answers of study individuals and in favor of agree.
- with (p-value > 0.05), this indicates that there are no significant differences at the level (5%) between answers of study individuals.

Statement	Chi-square value	p-value	Sig	Mode	Trend
1	12.435	0.014	*	4	Disagree
2	4.304	0.230	NS	2	-
3	11.043	0.004	*	2	Agree
4	9.739	0.008	*	2	Agree
5	0.826	0.843	NS	3	-
6	15.783	0.001	*	1	Agree
7	2.217	0.529	NS	1	-
8	2.217	0.529	NS	2	-
9	7.435	0.059	NS	3	-
10	18.522	0.001	*	2	Agree
11	20.304	0.000	*	2	Agree
12	29.696	0.000	*	4	Disagree
13	8.435	0.015	*	1	Strongly agree
14	6.348	0.175	NS	2	-
15	7.783	0.051	*	2	Agree
16	3.261	0.353	NS	1	-
17	8.957	0.062	NS	2	-
18	9.826	0.043	*	2	Agree
19	14.043	0.003	*	2	Agree
20	4.261	0.119	NS	1	-
21	2.435	0.656	NS	3	-
22	5.478	0.242	NS	2	-
23	7.087	0.069	NS	2	-
24	15.913	0.003	*	2	Agree
25	8.826	0.032	*	2	Agree
Axes	234.917	0.000	*	-	Agree
1	7.435	0.059	NS	1	-
2	3.609	0.307	NS	2	-
3	15.783	0.001	*	1	Strongly Agree
4	7.435	0.059	NS	1	-
5	14.391	0.002	*	2	Agree
6	6.348	0.042	NS	1	-
7	12.435	0.014	NS	2	-
8	3.261	0.353	NS	2	-
9	7.435	0.059	NS	2	-
10	3.304	0.508	NS	2	-
11	7.652	0.105	NS	1	-
12	11.130	0.025	*	2	Agree
13	9.478	0.009	*	1	Strongly Agree
14	7.783	0.051	NS	2	-
15	15.043	0.005	*	2	Agree
16	8.130	0.043	*	1	Strongly agree
17	16.348	0.003	*	2	Agree
18	10.696	0.030	*	3	Neither
Axes	201.079	0.000	*	-	Agree

1	18.522	0.001	*	2	Agree
2	9.478	0.009	*	2	Agree
3	10.913	0.012	*	2	Agree
4	7.783	0.051	NS	2	-
5	11.043	0.004	*	1	Strongly agree
6	12.652	0.005	*	1	Strongly agree
7	5.000	0.172	NS	1	-
8	9.870	0.020	*	2	Agree
9	7.435	0.059	NS	2	-
10	6.609	0.037	*	2	Agree
11	9.478	0.009	*	2	Agree
12	28.087	0.000	*	2	Agree
13	4.174	0.383	NS	2	-
14	19.957	0.000	*	2	Agree
15	8.087	0.088	NS	2	-
16	17.870	0.000	*	2	Agree
17	15.783	0.001	*	2	Agree
18	18.217	0.000	*	2	Agree
19	2.870	0.580	NS	4	-
20	1.565	0.815	NS	1	-
21	9.826	0.043	*	2	Agree
22	3.379	0.442	NS	2	-
23	1.565	0.815	NS	4	-
Axes	299.322	0.000	*	-	Agree

Source: prepared by researchers, using SPSS, 2017

*indicates there is significance, and NS indicates that there is no significance.

From table above:

Hypothesis A: The value of chi-square is (234.917), the p-value is (0.000> 0.05) this indicates that there are significant differences at the level (5%) between answers of study individuals and in favor of Agree.

Hypothesis B: The value of chi-square is (201.079), the p-value is (0.000> 0.05), this indicates that there are significant differences at the level (5%) between answers of study individuals and in favor of Agree.

Hypothesis C: The value of chi-square is (299.322), the p-value is (0.000> 0.05). this indicates that there are significant differences at the level (5%) between answers of study individuals and in favor of Agree.

For more details, pleases refer to table 3.2.2

3.3. Results of the General Manager Interview:

Key findings:

- The enforcement system is refunded, command and control that enforced self-regulation in which regulator imposing process and product standards on business to determine and implement their own internal rules to fulfill the regulator's policy objectives.
- The number of admins and inspectors in the administration of both meat factories and chopping labs and control and monitoring is 30.
- Co-regulation its self-regulation.
- The level government intervention is between direct command and control to self-regulation.
- The predominant approach is enforced by inspection and sanctions.
- Repressive Sanctions
- The certified food operator's firms have the ability to control and manage food safety, and we as regulator's body we encourage them but still we need to look inside the firm and assess the degree of comply with food safety regulations (process-product inspections).
- The self-reporting inspection it's not our concern it's concern of the certification body (3rd party audit) that assess the degree of compliance with food safety standard that firm comply.
- Stimulating or producing codes of good practices as HACCP standard performance and process standards will be a great shift in the regulation process that provide effective control in food safety regulation and enhance the comply with regulation.

CHAPTER FOUR

4. Discussion:

The coordinated approach to food safety regulation in the ministry of … is ranging between direct command and control (direct regulations, public enforcement and monitoring, and sanctions and penalties) and self-regulation (voluntary codes of practice to determine and implement their internal rules in different private sectors) with one main goal to protect consumer from food-borne illness and food-borne illness outbreaks by enhance the food safety regulation compliance as the result shows.

The exploratory study of Co-regulation in the ministry focus on the four stages of the regulatory process, as the result shows (i)Setting food safety standard: The setting-standard process based on Risk assessment methodology, is used to provide standardized science based and objective evaluation of the risks, then followed by risk management decision that seek to identify appropriate regulatory intervention, it's a reactive approach of detection of food safety in the ministry. "Regulatory Impact Assessment (RIA) for new or revised legislation or rules is a common feature in many industrialized countries, including the UK and US. Further, existing legislation may be subject to periodic assessment through post-implementation reviews and policy evaluation, as in the case of the UK. RIA is a point for co-regulation to enter as the government consults with interested parties in developing its analyses assessment through post-implementation reviews and policy evaluation (Garcia-Martinez, M., Fearne, A., Caswell, J., Henson, S., 2007)". But the ministry believes that the coordination between public and private sector efforts that provide effective food safety control in setting standard may appear as conferences or agreements, the degree of regulation intervention will vary as where the company is in food chain and what products are produces. (ii)Process implementation: The co-regulation level in The process implementation appears as that all business operators are required to have controls that demonstrate they are managing food safety within their business in the same time determine and implement their own internal rules and procedures to fulfill the regulator's policy objective.

From the results the regulatory agency they agreed on the concept of coordination between public and private sector efforts that provide effective food safety control in process implementation as producing or stimulating of voluntary codes of practices (process + product standards). "Some shift in focus of regulation is also visible in the US, from predominantly prescriptive process and product standard approaches to more flexible and performance-based standards that provide greater choices for businesses in the mode of implementation. The Pathogen Reduction/Hazard Analysis and Critical

Control Points (PR/HACCP) rule requires meat plants to identify critical control points (CCPs), take responsibility for implementation and control of their HACCP programs, maintain performance records and adopt plans for action should processes get out of control (Garcia-Martinez, M., Fearne, A., Caswell, J., Henson, S., 2007)". (iii) Enforcement: As the results shows Regardless of the mechanism of enforcement, it is evident that access to reliable information and advice is a vital component of any strategy aimed at achieving high rates of compliance. a coordination between the public and private efforts that provide effective food safety control in enforcement, as they believed in the ministry but actually the enforcement mechanism is by official inspection and strict sanctions that what applied in the ministry. "The UK has a compliance-based enforcement system with an emphasis on preventing harm from occurring, as opposed to a deterrent-based strategy, achieved through a tiered inspection regime. The work of enforcement officers is to encourage compliance by first promoting best practice among food business operators through education, training and advice. However, if an offence is detected, enforcement follows a hierarchy of progressively more onerous action including an improvement notice, formal caution, closure of food business, prosecution, and disqualification. In the US, food safety enforcement relies substantially on voluntary compliance, with the exception of meat and poultry that are subject to continuous inspection by the FSIS. For HACCP enforcement, FSIS examines recorded information and conducts scheduled and unscheduled spot checks of plant procedures (Garcia-Martinez, M., Fearne, A., Caswell, J., Henson, S., 2007)". (iv) Monitoring: As the result shows the ministry believes that a coordination between the public and private efforts that provide effective food safety control in monitoring. As the results shows Public authorities cannot rely on private actors in food safety controls in the same time the ministry encourage them to have their internal rules to comply with food safety regulation (self-regulation). "At the current time, regulatory authorities in Canada at both the federal and provincial levels base their inspection efforts on some form of risk assessment that involves the monitoring of on-going food safety standards relative to regulatory requirements. For example, while there is a minimum level of inspection required of all food premises, beyond this level the frequency of inspection is based on an assessment of risk, predominantly according to the outcome of the previous inspection. The progressive implementation of HACCP across the food processing sector in Canada, most immediately in the meat and poultry sectors, will undoubtedly contribute to this trend (Garcia-Martinez, M., Fearne, A., Caswell, J., Henson, S., 2007)".

Enforcement Regime: As results shows the Enforcement philosophy in the ministry is a reactive approach that seeks to identify food operators that do not comply with regulations and penalize them with sanctions (Direct command and control), and the enforcement strategy its strict enforcement relies on strict application of rules, also there is a believe in the ministry that is necessary to avoid a breach of the regulation by education and coaching. "The approach in France is characterized by a creative enforcement strategy and a proactive enforcement philosophy that is more oriented toward compliance. For participating companies, the enforcement of safety regulation focuses more on prevention rather than on punishment and deterrence. The enforcement approach is preventive because it intervenes prior to the occurrence of safety offences (through training and education programs) and provides incentives (the use of a logo, relaxed inspections) to firms that participate in the program. The role of the regulatory agency has shifted toward co-regulation by providing assistance, incentives, and support to food operators for respecting regulations (Elodie Rouviere, Julie A. Casewell (2012)".

Enforcement practices in the ministry as the results shows (i)Inspection: Official inspections are performed by regulatory agencies through formal and random or scheduled on-site visits, its process and product oriented inspections focus on the safety level of the product (e.g., pathogen counts for products at different stages of the supply chain) and on the procedures that food operators have implemented to prevent food safety failure, in some sites (slaughterhouses) the inspector officer is a resident and apply process-product oriented inspection daily and put conformity stekers after the conformity of the product. As it is cleared by the interview with General manager the official inspection Self-reporting inspection (monitoring its records) and check whether firms have implemented their quality/safety management system correctly and self-registration inspection (checking the certification records), it doesn't apply in the ministry because the inspection regulation provide clear and direct regulation rules that guide inspector to inspect the process and product in way that provide clear judging in how the food safety regulation compliance process go in the private sector. Otherwise in the food safety certified firm the certification may provide trust on the compliance but doesn't replace the randomly or formal official inspection. (ii)Information: As the results shows the source of non-compliance is the lack of knowledge in regulation principles and compliance process in the food operators firms so the resident inspector may increase the rate of compliance by training and coaching, in other hand the conformity stekers provide the awareness to consumer of how the product is safe to consumed. By increasing the awareness of food safety regulations and procedures it will effectively increase the rate of compliance. (iii) Sanction: as the results

shows the type of sanction applied in the ministry is Repressive Sanctions Regulatory agencies can use penalties, prosecution, and recalls to punish intransigent food operators for committing an offence or repeatedly breaching regulations. The Informative Sanctions Following a breach in regulations, enforcement agencies may mandate certain corrective actions in order to motivate food operators to comply also applied, but the naming and shaming programs (sanction through negative information) are not accepted and forbidden in the ministry.

HACCP: The exploratory result shows the preferable standards to be apply as mandatory standards that combine (process + product) standards is Hazard Analysis Critical Control Points (HACCP) in meat industry, that will enhance compliance to food safety regulation and provide international confidence in the Sudan meat products, and also agreed the obstacles to emerge such a regulations form is the high cost the lack of trust between public and private sectors to have more food safety responsibility.

As the result shows the enforcement philosophy of such regulation will be by proactive approach that seeks to implement measures that are necessary to avoid a breach of the regulation by education training and coaching to both public and private sector to ensure the effective implementation of such regulation standards. The enforcement strategy will be creative strategy to promote compliance through market incentives. But the enforcement practices still with random and schedule inspection (process-product oriented inspections), regressive sanction to whom not comply and monitoring by provide advice of continual improvement.

Conclusions

The emerging of co-regulation in the enforcement of food safety regulations at Ministry of Agriculture Animal Resource and Irrigation – Khartoum appear as direct command and control intervention that encourage self-regulations (voluntary codes of practices) its characterized by a strict enforcement strategy and a reactive enforcement philosophy that is more oriented toward compliance. The enforcement approach is traditional enforcement scheme that used inspection and repressive sanctions as the predominant enforcement practices based process and product standards approach.

Hazard Analysis Critical Control Point HAACP is the preferable standard in meat industry to be adopted as a mandatory regulation to enhance food safety regulation compliance and to move from product and process standards approaches to more flexible and performance based-standards.

Recommendations for Further Research

Further research should undertake to evaluate the effect of co-regulation on cost effectiveness and the levels of regulation compliance, and also evaluation the need to mandatory implement HACCP standard as mandatory food safety regulation in meat and poultry industry, and how the implementation of HACCP and Pathogen reduction HACCP standards will effect on food safety regulations compliance.

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Appendences:
Questionnaire:

A. The emergence of co-regulation as a novel regulatory tool to enhance compliance from food operators in enforcement of food safety regulations is applied in Sudan

QA1 The government intervention is no intervention – doing nothing.

QA2 The government intervention is the Self-regulation (Voluntary codes of practices such as Food safety management system)

QA3 The government intervention is Co-regulation (statutory or government backed codes of practices or action planes)

QA4 The government intervention is the Information and education (Assembling and publishing evidence to inform the public debate, Information and advice to consumers "Naming and Shaming"

QA5 The government intervention is the Incentive based structures (rewarding desirable behavior by the private sector, creating market incentives for investment in food safety)

QA6 The government intervention is the Direct command and control intervention (direct regulation, public enforcement and monitoring, sanctions and penalties).

QA7 The food safety regulation and inspection procedure based on the detection of the food safety hazards.

QA8 The food safety regulation and inspection procedure Science based risk assessment and prevention method

QA9 regulatory impact analysis RIA is required when new food safety regulation is adopted

QA10 a Cooperation between the public and private sectors in the process of creating new rules.

QA11 The cooperation between private and public sector in the field of regulation may result in various forms of governance, such as agreements, conventions and even regular legislation

QA12 The primary responsibility for food safety lies with the private sector.

QA13 The definition of basic standards, monitoring and policing is the responsibility of the public sector

QA14 a coordination between the public and private efforts that provide effective food safety control in setting food safety standard

QA15 a coordination between the public and private efforts that provide effective food safety control in process implementation

QA16 a coordination between the public and private efforts that provide effective food safety control in enforcement

QA17 a coordination between the public and private efforts that provide effective food safety control in monitoring

QA18 The producing and/or stimulating the generation of voluntary codes of ‘good practice 'in the Sudanese food safety standard

QA19 All food business operators are required to have controls that demonstrate they are managing food safety within their business with the regulator imposing a requirement on businesses to determine and implement their own internal rules and procedures in order to fulfil the regulator’s policy objectives

QA20 Regardless of the mechanism of enforcement, it is evident that access to reliable information and advice is a vital component of any strategy aimed at achieving high rates of compliance.

QA21 Public can authorities rely on private actors in food safety controls

QA22 Incentives for and the types of regulation required will vary depending on where a company is in the food chain and what products it you produces

QA23 co-regulation is an approach in which a mixture of instruments is brought to bear on a specific problem

QA24 Co-regulation is Industry self-regulation that government oversees and/or ratifies.

QA25 Co-regulation is Regulation can be perceived as consisting of a continuum ranging from detailed command and control regulation to pure self-regulation

B. there is a Change of enforcement practices for the regulatory agency from punishment to prevention based on incentives and information programs

QB1. Enforcement strategy approach is An approach seeks to identify food operators that do not comply with regulations and penalize them with sanctions.

QB2. Enforcement strategy approach is An approach seeks to implement measures. That are necessary to avoid a breach of the regulation, including, for example, education and coaching.

QB3. Official inspections can be performed by regulatory agencies through formal and random or scheduled on-site visits .

QB4. In official inspection can be performed Product-oriented inspections focus on the safety level of the product (e.g., pathogen counts for products at different stages of the supply chain, the level of pesticide residues in produce) and occur before or after the release of the product on the market.

QB5. In official inspection can be performed Process-oriented inspections focus on the procedures that food operators have implemented to prevent food safety failure.

QB6. Official inspection can be performed by both process and product oriented

QB7. Official inspections may be carried out through Self-reporting inspection: By monitoring its records. Based on individual records, enforcement agencies can assess a firm's internal rules (testing, corrective procedures, and actions taken) and check whether firms have implemented their quality/safety management system correctly.

QB8. Official inspections may be carried out through Self-registration inspection: Assess food operators' compliance through formal verifications made by third party accreditors .

QB9. In food safety certified firm the official inspections can be performed by regulatory agencies through formal and random or 3scheduled on-site visits .

QB10. In food safety certified firm the official inspections may be carried out through self-reporting or registration .

QB11. The source of a firm's non-compliance Lack of knowledge regulation principles and compliance processes.

QB12. The source of a firm's non-compliance Not clear understanding of regulation principles and compliance processes.

QB13. The high rates of compliance can achieved through Training, coaching and education programs

QB14. The high rates of compliance can achieved through Sanctions

QB15. The high rates of compliance can achieved through Quality or Compliance label through health inspector

QB16. Repressive sanctions: Regulatory agencies can use penalties, prosecution, and recalls to punish intransigent food operators for committing an offence or repeatedly breaching regulations.

QB17. Informative sanctions: Following a breach in regulations, enforcement agencies may mandate certain corrective actions in order to motivate food operators to comply .

QB18. Sanctions through negative information provided to consumers: Regulatory agencies can display the results of official inspections and findings in order to disclose information about food operators to their customers. These are often referred to as ‘‘naming and shaming’’ programs

C. The adoption of HACCP as mandatory regulation in meat industry to enhance food regulation compliance.

QC1. The direct command and control intervention for meat and poultry industry have Standards for performance such pathogen count for products at some stage of marketing channel

QC2. The direct command and control intervention for meat and poultry industry have Processing Standards to improve final product by specifying procedure to be followed n production

QC3. The direct command and control intervention for meat and poultry industry have Standards for both performance and processing

QC4. The direct command and control intervention for meat and poultry industry have Disclosure of information, for example: producers require to provide information about any pathogen reduction process

QC5. Hazard Analysis Critical Control Point HACCP is the preferable standard in meat industry

QC6. Pathogen Reduction - Hazard Analysis Critical Control Point PR-HAACP is the preferable standard in meat industry

QC7. The form of Co-regulation can be performed in Sudan, in meat industry sector could be Mandatory food safety standards, governments can pursue co-regulation through producing and/or stimulating the generation of voluntary codes of ‘good practice .’

QC8. The form of Co-regulation can be performed in Sudan, in meat industry sector could be Institutional structures for co-regulation through consultation and stakeholder input to the regulatory process are limited. Where consultation does occur the mode is passive rather than active .

QC9. The form of Co-regulation can be performed in Sudan, in meat industry sector could be as standards compliance stekers on the products

QC10. the mandatory implementation of food safety standard will enhance compliance to meat industry food safety regulation

QC11. The inspection in HACCP implementing firm is by Determining whether sanitation and process control system are working to prevent 2adulteration.

QC12. The inspection in HACCP implementing firm is by Auditing procedures and records.

QC13. the degree of product and process compliance in HACCP implementing firm against not implementing firm is excellence

QC14. The enforcement strategy of The mandatory implementation of HACCP in meat industry is by training, coaching and education

QC15. The enforcement strategy of The mandatory implementation of HACCP in meat industry is by sanctions and penalty.

QC16. The enforcement strategy of The mandatory implementation of HACCP in meat industry is by training, coaching, education and sanctions and penalty

QC17. The monitoring strategy of The mandatory implementation of HACCP in meat industry is by inspections

QC18. The monitoring strategy of The mandatory implementation of HACCP in meat industry is by Provisions of advice aimed at continual improvements in performance

QC19. The monitoring strategy of The mandatory implementation of HACCP in meat industry is by Rely more on private mechanisms of food safety control, HACCP.
QC20. The implementation of food safety co-regulation across a number of key product sectors is shifting the responsibility for the monitoring of food safety to business operators
QC21. the obstacles to emerge a co-regulation in Sudan is cost
QC22. the obstacles to emerge a co-regulation in Sudan is the lack of trust between public a private sector
QC23. the obstacles to emerge a co-regulation in Sudan is unavailability of competence inspectors

General Manager Interview:

Q1 What is the type enforcement system applied in the ministry?
Q2 How many inspectors and admins in the departments of inspection administration of meat factories and chopping labs and control and monitoring administration?
Q3 What is the definition of co-regulation in your opinion?
Q4 What is the level of government intervention you think?
Q5 The predominant approach with process and product standards to the implementation of regulatory food safety requirement in the ministry, what kind of enforcement it used?
Q6 What type of sanctions commonly used in the ministry?
Q7 What is your opinion about the certified food operator's firms?
Q8 Do they have your confidence to have food safety responsibility?
Q9 Do you believe on official inspection Self-reporting inspection (monitoring its records) and check whether firms have implemented their quality/safety management system correctly?
Q10 Stimulating or producing codes of good practices as HACCP standard performance and process standards what is your opinion about it?

Table 4.1. Demographic Characteristics of Inspectors and admins (N = 23)

Table 4.2 shows the frequencies, mode, and percentage for responses to the three parts of the questionnaire.

Table 4.3 shows the chai-square value, P-value, mode and trends.

Table 4.4 interpretation of the statistical results.

Fig. 1.1. Options for public intervention

Fig. 1.2: a frame work for analyzing co-regulation in enforcement regime (adapted by the authors from May and Burby (1998)).