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TECHNICAL GUIDANCE PRINCIPLES OF RISK-BASED MEAT INSPECTION AND THEIR APPLICATION

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FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS
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PREFACE

Food safety regulatory authorities are responsible for safeguarding health and fair trade of food by ensuring that food distributed meets relevant food standards. To achieve this, sound food safety policies and risk management activities are required to ensure that food safety issues of highest importance are identified and appropriate control measures are implemented.

The management of food control systems is becoming more complex and countries particularly low and medium income countries (LMICs) face multiple challenges due to emerging parameters such as globalization of food trade, global warming, changing antimicrobial ecology and resistance that are considerably increasing the risk associated with food-borne hazards. To be effective, interventions must be implemented at various points in the food supply chain from production and processing to consumption. This so-called “farm-to-plate” approach to food safety requires full integration of inspection with activities happening both upstream and downstream as well as a strong collaboration between all the government departments, but remains misunderstood in many countries.

Meat inspection that has consisted for years in identifying and removing abnormalities by incision and partial/total condemnation of carcasses and organs during post-mortem examination is now facing several challenges in detecting and controlling emerging hazards such as *Campylobacter*, *Salmonella*, shiga toxin-producing *Escherichia coli* (STEC) and *Listeria monocytogenes*. These pathogens do not generally present clinical symptoms in live animals nor pathological lesions in the carcasses or offal, and therefore cannot be detected by visual, palpation and incision techniques. Therefore, the success of meat inspection systems resides in the capacity of countries to move to a risk-based approach where decisions, standards and inspection activities are based on scientific knowledge of the risks. This new approach is still out of reach for several LMICs due to lack of infrastructure and equipment, and limited access to scientific and technical advice.

To address this challenges and needs for risk-based decision making by national competent authorities the Food and Agriculture Organization of the United Nations (FAO) has led the development of this guidance document. Its origins lie in FAO's work on enabling more inclusive and efficient agricultural and food systems, specifically in strengthening capacities of member countries in designing and implementing national policies, strategies, and regulatory frameworks.

The Principles of Risk-Based Meat Inspection and their Application presents key general principles and highlights the minimum requirements for a properly functioning RBMI system. It is primarily designed for senior management, heads of meat inspection services and competent authorities responsible for decision-making on the establishment of policies and standards, the design and management of inspection programmes, and equivalence agreements with trading partners. It also targets private sector operators, such as meat processors and traders, who are ultimately responsible for the production and marketing of safe and suitable food. It is expected that the publication of this guidance document will bring on board all contributors to the meat value chain and advocate for a shift of attitudes towards acceptance of an evidence-based approach to meat inspection.

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ACRONYMS

ALOP	Acceptable Level of Protection
CAC	Codex Alimentarius Commission
CCPs	Critical Control Points
CFIA	Canadian Food Inspection Agency
DFD	Dark, Firm and Dry
EFSA	European Food Safety Authority
EU	European Union
FAO	Food and Agriculture Organization of the United Nations
FBO	Food Business Operators
FCI	Food Chain Information
GAPs	Good Agricultural Practices
GHPs	Good Hygienic Practices
GMPs	Good Manufacturing Practices
HACCP	Hazard Analysis and Critical Control Points
INAPH	Network for Animal Productivity and Health
LITS	Livestock Identification and Traceability System
NDDB	National Dairy Development Board
OIE	World Organisation for Animal Health
PSE	Pale, Soft and Exudative
RBMI	Risk-Based Meat Inspection
RMF	Risk Management Framework
SIRA	Animal Identification and Registration System
SPS	Sanitary and Phytosanitary Agreements
SSOPs	Sanitation Standard Operating Procedures
STEC	Shiga Toxin-Producing <i>Escherichia coli</i>
TBT	Technical Barriers to Trade
VPPs	Veterinary para-professionals
WHO	World Health Organization
WTO	World Trade Organization



EXECUTIVE SUMMARY

Meat industry is an important sector of the agricultural economy. While meat consumption has been relatively static in the developed world, the annual per capita consumptions have doubled since 1980 in developing countries, because of population growth and trend for people to move to the cities.

Meat inspection is the sanitary control of slaughter animals and meat, the main purpose been to detect and prevent public health hazards such as food-borne pathogens and chemical contaminants in meat. While diseases like tuberculosis and taeniasis (*Taenia saginata*) have been for a long time the major hazards to human, in recent years, a number of agents associated with meat have been identified including *Salmonella*, *Campylobacter*, *Listeria monocytogenes*, and shiga toxin-producing *Escherichia coli* (STEC). These hazards do not generally present clinical symptoms in live animals or pathological lesions in the carcass or/and offal. Therefore, traditional meat inspection, where decisions about disease conditions, abnormalities, and contamination in animals are based on what can be seen, felt, or smelt, is no more suitable to protect effectively human health against meat-borne biological and chemical hazards.

The meat sector is also evolving constantly and changes occur continuously because of new scientific information on meat-borne risks for consumers as well as legislation and control approaches. The success of meat inspection systems depends on the capability and the willingness to move to a risk-based approach. This new approach requires that decisions, standards and inspection activities be based on scientific knowledge of the risks.

The overall objective is to engage senior management in the process of developing and implementing risk-based meat inspection, to communicate key information on the concept and principles of RBMI, and to advocate for a shift of attitudes toward scientific knowledge on risks as being the basis for modern meat inspection.

Specific objectives include:

- > to engage senior management including heads of inspection services in the process of developing and implementing risk-based meat inspection.
- > to communicate key information on the concept and principles of RBMI as well as requirements for a proper functioning RBMI to facilitate decision-making.

- > to bring on board all the contributors to the meat supply chain and advocate for a shift of attitudes toward scientific knowledge on risks as being the basis for modern meat inspection.

The Principles of Risk-Based Meat Inspection and their Application covers raw meat produced from domesticated animals and livestock, from the reception of live animals at the slaughtering establishments up to the shipment of carcasses and by-products. Its focuses on introducing the concept of RBMI and consist of five main chapters. Chapter 1 provides a general introduction. Chapter 2 presents the concept and approaches of meat inspection, including the rationale for adopting an evidence-based system, where decisions, standards and actions are function of specific scientific knowledge of risks. Chapter 3 contains an overview of the procedures for slaughtering and meat inspection, including general principles for the design and construction of meat processing establishments, collection of food chain information (FCI), ante-mortem inspection and post-mortem inspection. Chapter 4 covers the general principles for Good Manufacturing Practices (GMPs), GHPs, and HACCP in meat processing establishments. Chapter 5 presents the regulatory basis for meat inspection, including the legislative framework (Acts, regulations, procedures) and the implementation of meat inspection regulations. It also highlights the specific context of developing and least-developed countries.

CHAPTER 1

INTRODUCTION TO THE GUIDELINES

The meat industry is an important sector of the agricultural economy. While meat consumption has been relatively static in the developed world during the last decades, the annual per capita consumption of meat has doubled since 1980 in developing and least-developed countries, as a result of a growing middle class (i.e. with more disposable income). This represents a significant opportunity for livestock farmers and meat processors in these countries, but also constitutes a big challenge for safe processing and marketing of meat and meat products. In the meat value chain, many different aspects must be considered, including good agricultural practices (GAPs) at the primary production level, and processing technologies and practices – e.g. good hygienic practices (GHPs) and management of inspection activities – during slaughter and processing. In addition, in the changing global environment, meat distribution and international/regional trade, as well as other economic and political issues, have become unavoidable considerations.

Meat inspection is commonly perceived as the sanitary control of slaughtered animals and meat (Herenda *et al.*, 2000), the main purpose of which has been to control important diseases such as tuberculosis and taeniasis and to avoid residues and contaminants in meat. While these two diseases have long been the major hazards to human health, in recent years a number of microbial agents associated with meat have been identified, including *Salmonella*, *Campylobacter* and human pathogenic *E. coli*, such as *E. coli* O157 (Edward *et al.*, 1997). Meat inspection also plays an important role in overall surveillance for certain animal diseases and food-borne hazards.

Assurance of food safety is growing in importance and becoming more complex. Multiple parameters, such as globalization of food trade, global warming and changing microbial ecology and resistance, are having important effects in increasing the risk of food-borne illness (Allard, 2002). To manage the risk adequately, interventions must be implemented at various points in the meat supply chain, from production and processing to consumption. This so called “farm-to-plate” approach to food safety requires full integration of meat inspection with activities happening both upstream (at the primary production level) and downstream (distribution, preparation and handling at home), as well as strong collaboration between all the



government departments involved in the meat value chain (e.g. food production and trade, animal health, public health and consumer protection). In addition, it is important to recognize the dual functions of abattoirs, in serving both public health and animal health objectives. Ante-mortem and post-mortem inspections for animal health surveillance usually take place in the same environment, with activities related to GHPs and Hazard Analysis and Critical Control Points (HACCP).

At present, it is generally agreed that traditional meat inspection procedures, which focus on identifying and removing abnormalities by incision and partial/total condemnation of carcasses and organs during post-mortem inspection, are insufficient to prevent and control the risks of illness associated with consumption of meat (Blaha *et al.*, 2013; EFSA, 2009; Hill *et al.*, 2014). Therefore, the future success of meat inspection systems will depend on capability and willingness to move to a risk-based approach. This new approach requires that decisions, standards and inspection activities be based on scientific knowledge of the risks, quantitative and qualitative information, and an established level of health protection (McKenzie and Hathaway, 2006). Ultimately, it is expected that governments and industry will move from traditional meat inspection towards risk-based meat inspection (RBMI), which takes into account the likelihood of detecting gross abnormalities as well as the chances for cross-contamination.

While there is general agreement that sound scientific risk assessment is an essential part of RBMI, this presents some challenges to most developing and least-developed countries. In many cases, food laws in these countries are weak or there is a significant gap between policy and practice due to lack of infrastructure and human capacity for implementation (Jabbar and Grace, 2012). The prerequisites to overcoming these barriers include: a better understanding of the impacts on both public health and trade; strong support from senior management of inspection services and standard setting bodies; and full engagement of all contributors to the meat value chain.

1.1 SCOPE

The scope of these guidelines covers fresh meat produced from domesticated animals and livestock, from the reception of live animals at the slaughtering establishments to the shipment of carcasses and by-products. Although the “farm-to-plate” approach to food safety and meat inspection is the main driver of the guidelines, the focus is on activities taking place in the slaughterhouses, including meat inspection (ante-mortem and post-mortem), slaughtering environment and operations, and safety and quality management systems (GHPs, HACCP). However, the importance of primary production is also noted, as well as the areas of distribution, trade and handling of meat at home. The guidelines also cover the legislative framework and implementation of meat inspection regulations, considered to be prerequisites for a properly functioning meat inspection system.

The information in this document is supplemented by other guidelines and tools found on the Web sites of the Food and Agriculture Organization of the United Nations (FAO) and the Codex Alimentarius Commission (CAC). These include: *Code of Hygienic Practice for Meat* (CAC/RCP 58-2005); *General Principles of Food Hygiene* (CAC/RCP 1-1969); *Manual for Animal Health Auxiliary Personnel* (FAO, 1983); *Manual on Meat Inspection for Developing Countries* (Herenda et al., 1994); *Good Practices for the Meat Industry* (FAO, 2004); and *Development of Integrated Multipurpose Animal Recording Systems* (FAO, 2016). Linkages are also made to the standards, guidelines and recommendations on the control of biological, chemical and physical hazards important to animal health and public health, through ante-mortem and post-mortem meat inspection, which are contained in the World Organisation for Animal Health (OIE) *Terrestrial Animal Health Code* (OIE, 2017a).

The meat sector is evolving constantly and changes occur continuously as a result of new scientific information on meat-borne risks for consumers as well as new approaches to legislation and control. Therefore, these guidelines are not designed to be definitive or exhaustive. Rather, they have been developed to provide a better understanding of RBMI and complementary guidance for its implementation in developing countries. The document is prepared in such a way that it can be updated. Where appropriate, annexes to these guidelines will be further developed to provide more technical and scientific information.

1.2 OBJECTIVES

An important function of meat inspection is to ensure that consumers have access to safe and wholesome meat and meat products. The main objectives of these guidelines are:

- > to engage senior management, including heads of inspection services, in the process of developing and implementing RBMI;
- > to communicate key information on the concept and principles of RBMI, as well as requirements for a properly functioning Risk Management Framework (RMF) and decision-making;
- > to bring on board all contributors to the meat value chain and advocate for a shift of attitudes towards acceptance of an evidence-based approach to meat inspection.

The specific objectives of these guidelines are:

- > to provide developing countries with approaches and guidance to develop and implement RBMI;
- > to help both public and private sectors upgrade from traditional meat inspection that focuses on animal and carcass inspection for gross abnormalities;
- > to provide a better understanding of the legislative framework and implementation of meat inspection regulation;
- > to enable initiation of plans and road maps at national and regional levels for implementation of RBMI.

1.3 TARGET AUDIENCE

The guidelines are primarily designed for senior management, heads of meat inspection services and competent authorities responsible for decision-making on the establishment of policies and standards, the design and management of inspection programmes, and equivalence agreements with trading partners.

The document presents key general principles and highlights the minimum requirements for a properly functioning RBMI system. Veterinary para-professionals (VPPs), meat inspectors and workers in animal health and meat processing departments could use these guidelines to raise their awareness of the scientific and regulatory foundations of RBMI. The document also targets private sector operators, such as meat processors and traders, who are ultimately responsible for the production and marketing of safe and suitable food.

1.4 CONTENTS AND USE OF THE MANUAL

The guidelines focus on providing an introduction to the concept of RBMI and consist of five main chapters. Chapter 1 provides a general introduction. Chapter 2 presents the concept and approaches of meat inspection, including the rationale for adopting an evidence-based system, where decisions, standards and actions are based on specific knowledge of risks. Chapter 3 contains an overview of the procedures for slaughtering and meat inspection, including general principles for the design and construction of meat processing establishments, collection of food chain information (FCI), ante-mortem inspection and post-mortem inspection. Chapter 4 covers the general principles for Good Manufacturing Practices (GMPs), GHPs, and HACCP in meat processing establishments. Chapter 5 presents the regulatory basis for meat inspection, including the legislative framework (Acts, regulations, procedures) and the implementation of meat inspection regulations. It also highlights the specific context of developing and least-developed countries.



CHAPTER 2

CONCEPTS AND APPROACHES OF MEAT INSPECTION

2.1 ROLES AND RESPONSIBILITIES

Meat inspection involves collaboration by a variety of stakeholders (governments, industry, consumers). Within this environment of shared responsibilities, the ultimate goal is to ensure human and animal health through the enforcement of national and international food safety and inspection standards.

Industry

The primary responsibility for safe and suitable food lies with industry (i.e. all those businesses that make commercial gains from producing, processing and selling food). Processors are responsible for ensuring that the processing establishment's location, construction and nature of operation are in accordance with all applicable regulations. This is generally achieved by adopting GAPs and GMPs, as well as food safety assurance programmes to ensure that food products are safe and wholesome.

Government

Governments are responsible for setting food safety and inspection standards and policies, as well as for their administration and enforcement. Depending on the administrative structure of the country, these roles and responsibilities could be shared between different ministry departments or between the federal government, provinces/states and municipalities.

Veterinary services play a central role in the implementation of meat inspection systems. These services were historically set up to control livestock diseases at farm level, but veterinarians are also actively involved in slaughterhouses, to provide epidemiological surveillance for animal disease and to ensure the safety and wholesomeness of meat through ante-mortem and post-mortem inspection.

In addition to veterinarians, several other professional groups (e.g. Veterinary para-professionals, butcher, municipal authorities) are involved in supporting integrated food safety activities, including meat inspection in many countries.

Consumers

Consumers are the important final link in the food chain to ensure safe food consumption. The actions undertaken by government authorities and industry to exert regulatory control over the safety and quality of meat could be significantly undermined without the full engagement of consumers and people handling and preparing meat at home. National authorities are expected to consider developing food safety public education strategies, to provide basic knowledge on food safety risks and practices to avoid these risks.

BOX 2.1

LIST OF IMPORTANT STAKEHOLDERS PLAYING A ROLE IN MEAT INSPECTION

- > Animal health and public health authorities
- > Regional government authorities
- > Standard setting bodies
- > Farmers and transporters
- > Processors
- > Retail and food services
- > Independent verification bodies (competent bodies)
- > Consumer protection associations
- > Scientific community
- > Academia

2.2 BASIC MEAT INSPECTION

2.2.1 PURPOSE OF MEAT INSPECTION

Slaughterhouse inspection of live animals (ante-mortem) and their carcasses (post-mortem) plays a key role in both the surveillance network for animal diseases and zoonoses and ensuring the safety and wholesomeness of meat and meat by-products for their intended uses (OIE, 2017b). The purpose of meat inspection has been summarized by Van Logtestijn (1993) as: i) removal of grossly abnormal products from the meat chain; ii) prevention of the distribution of infected meat that could give rise to disease in humans; and iii) assistance in the detection and eradication of certain diseases of livestock. As such, meat inspection plays a significant role in both animal and human health protection.

BOX 2.2

FUNCTION OF MEAT INSPECTION PROGRAMMES

- > Registration and licensing of operators under food safety Acts and regulations
- > Ante-mortem and post-mortem examination and inspection of animals and meat
- > HACCP system and control programme verification
- > Ensuring humane conditions for handling and slaughtering of food animals
- > Ensuring compliance in the importation of meat under national food safety and inspection legislation.

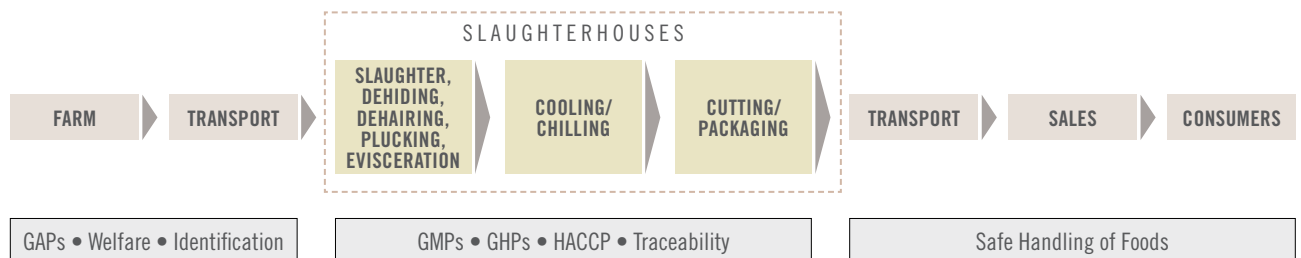
2.2.2 INTEGRATED FARM-TO-TABLE CONCEPT

2.2.2.1 Overview of the farm-to-table meat value chain

The farm-to-table concept considers the entire meat value chain as a continuum, starting at primary production and ending at the consumer's table, rather than a succession of individual steps (Figure 2.1).

Farmers are expected to conceive and implement GAPs in such areas as general farm management practices, animal health management, animal feeding and watering, as well as sustainable environment and infrastructure maintenance (Box 2.3). Food Business Operators (FBO), such as managers of slaughterhouses and meat processing plants, are required to implement and maintain GMP/GHP procedures based on HACCP principles. Consumers are the end-point of the meat value chain and are also responsible for the safety of the meat that they buy and prepare. They should understand the importance of handwashing prior to handling of foods, knowing appropriate cooking and storage temperatures and reading safe handling information on food labels (Allard, 2002). This could be achieved through the development and implementation of national consumer education programmes that include the basics of food safety (e.g. cleaning, separating raw meat and poultry from cooked and ready-to-eat products, cooking to safe internal temperature, good chilling practices) and food poisoning.

FIGURE 2.1 SIMPLIFIED MEAT FARM-TO-TABLE CHAIN



2.2.2.2 Importance of primary production

Many aspects of primary production can be at risk of contamination by biological, chemical and/or physical agents. These agents may enter food-producing animals and animal products through a wide variety of exposure points in the food chain, with consequent potential risks for consumers (FAO and OIE, 2010). A guide to good farming practices for animal production for food safety has been elaborated by FAO and OIE to help competent authorities assist farmers to fully assume their responsibilities at the primary production stage of the food chain (Box 2.3).

BOX 2.3

EXAMPLES OF RECOMMENDED GOOD PRACTICES AT PRIMARY PRODUCTION (OIE, 2010)

General farm management:

- > Maintain awareness and compliance with all legal obligations relevant to livestock production
- > As far as practicable, keep records of animal populations on the farm, changes to feeding and health regimes, origin and use of feeds, drugs, disinfectants
- > Identify animals on an individual or group basis to facilitate the ability to trace animals
- > Implement good hygiene and disease prevention measures
- > Train farm workers on husbandry measures and techniques

Animal health management:

- > Address biohazards and physical hazards

Veterinary medicine and biologicals:

- > Maintain awareness and compliance with restrictions on medicines and biologicals for use in livestock
- > Maintain required storage conditions for veterinary medicines and biologicals
- > Keep all the treated animals on farm until the relevant withdrawal times have expired

Animal feeding and watering:

- > Acquire feed from suppliers who follow recognized GMPs
- > Ensure that only water of known and acceptable biological and mineralogical quality is used for watering stock
- > Ensure that antibiotics are not used in feed for growth-promoting purposes
- > Ensure that ruminant protein is not fed to ruminants
- > Where appropriate, manage pastures by adjusting stocking rates and rotation to maintain healthy and productive livestock and reduce parasite burdens

Environment and infrastructure:

- > Ensure that, where animals are confined, the housing or pens are constructed such that the basic needs of the animals are fulfilled, especially with regard to ventilation, drainage and manure removal
- > Ensure that building and perimeter fences are constructed so that contact with other livestock and wild animals is minimized
- > Maintain adequate separation between clean and contaminated material (e.g. feed and manure)

Animal and product handling:

- > Ensure that all animals destined for slaughter are clean, healthy and fit to travel and have not had recent contact with diseased stock or infectious material
- > Allow for short-duration feeding regimes aimed at reducing the shedding of harmful bacterial by animals destined for slaughter
- > Ensure that no animal destined for slaughter has been subjected to treatment for which the withdrawal period has not elapsed

It is desirable that farmers implement all the measures recommended in the guide. However, they need to be adapted to specific production systems, particularly in developing countries, where smallholder systems such as backyard farming, extensive farming systems and agro-pastoralism are prevalent. Competent authorities at country or regional levels are encouraged to:

- > Consult with appropriate stakeholders, including farmers, to establish the applicability and relevance of the measures recommended in the guide;
- > Decide on the level of priority to be assigned to the measures;
- > Develop a specific code of practices and implementation methodology based on the general principles elaborated in the guide to good farming practices.

Primary production also represents the starting point for traceability in the meat value chain. Traceability enables food products to be traced back to their source throughout all stages of production and thus therefore, allows actions to be taken promptly and effectively in order to prevent contaminated or poor quality products from reaching consumers (FAO, 2016). In most of the mid- and low-income countries, traceability systems are uncommon, due to a multitude of capacity development constraints. However, success stories have been reported in Botswana, India, Namibia and Uruguay, where different forms of animal identification systems are implemented to facilitate international trade of live animals and meat (Box 2.4). For better management of risk in the meat value chain and effective RBMI, animal identification systems at the primary production level should be expanded to more developing countries. These should be linked to monitoring and surveillance data collected in the slaughterhouses and stored in a shared space such as an FCI database accessible to relevant stakeholders.

BOX 2.4

EXAMPLES OF ANIMAL IDENTIFICATION SYSTEMS IN MID- AND LOW-INCOME COUNTRIES

Botswana. In 2004, Botswana developed and implemented an advanced livestock identification and traceability system (LITS) that satisfies European Union (EU) export requirements.

India. The National Dairy Development Board (NDDB) in India has developed an integrated animal recording system, referred to as the Information Network for Animal Productivity and Health (INAPH). This system, which includes animal identification and registration, has been developed primarily for the purpose of performance recording (including artificial insemination, milk production, progeny testing, ration balancing, veterinary treatment, diagnosis, testing and disease outbreaks).

Namibia. In 1999, Namibia introduced the Fan Meat Scheme, which is managed by the Meat Board of Namibia. Under this scheme, it is mandatory for commercial farms to identify each animal with an ear tag displaying a unique identification number. The system was developed to satisfy standards required to export meat to the EU and South Africa.

Uruguay. Since 1974, Uruguay has operated a group traceability system. In September 2006, the government introduced the Animal Identification and Registration System (SIRA) under Law No. 17 997 of 2 August 2006. This was followed by mandatory individual cattle traceability requirements under Decree 266/2008.

2.3 RISK-BASED MEAT INSPECTION (RBMI)

2.3.1 CONCEPT OF RBMI

In traditional meat inspection, inspectors make judgments about disease conditions and abnormalities on the basis of what they can see, feel and smell, a process known as organoleptic inspection. These practices have been focused on detecting zoonotic agents (e.g. *Mycobacterium*, *Cysticercus*, *Trichinella*) and animal health-related conditions such as emaciation, oedema, abscesses, colour changes and bruises (Frederiksson-Ahomaa, 2014). However, they are not suitable for detecting and controlling many frequently occurring meat-borne hazards such as *Campylobacter*, *Salmonella*, and shiga toxin-producing *Escherichia coli* (STEC), which do not generally present clinical symptoms in live animals nor pathological lesions in the carcasses or offal (Jalakas *et al.*, 2014), and therefore cannot be detected by visual, palpation and incision techniques. For example, live bovine animals that faecally shed the high-priority bovine meat-borne hazards, pathogenic STEC and/or *Salmonella* spp., usually do not show any visible symptoms, and their carcasses usually show no signs of contamination.

BOX 2.5

KEY WEAKNESSES OF TRADITIONAL MEAT INSPECTION SYSTEMS

- > Absence or non-harmonized collection of Food Chain Information (FCI) to allow the ranking and identification of high-risk farms with respect to potential presence of high-priority meat-borne hazards (*Salmonella* spp., *T. saginata* and pathogenic STEC);
- > Current ante-mortem and post-mortem macroscopic inspection are not able to detect any of the identified high-priority meat-borne biological hazards;
- > Manual handling of meat, including use of palpation/incision techniques, during post-mortem inspection may increase the spread of hazards by cross-contamination;
- > Official inspections of production and processing operations are equally distributed without taking into consideration the level of risk associated with each of them.

In the last decade, many regulatory authorities, mostly in developed countries, have adapted and modernized their meat inspection practices to adopt a more risk-based approach, where decisions, standards and control activities are based on specific knowledge of the risks, including those caused by emerging hazards. It is a prevention-oriented inspection system based on risk analysis principles along the entire meat chain from the farm (primary production) until the carcasses leave the slaughterhouse.

RBMI requires that all the biological and chemical risks that should be addressed by meat inspection be identified, ranked and prioritized. Parameters such as incidence and severity of disease and consumption patterns of the type of meat (e.g. animal species, wild animals versus domestic) are taken into consideration in RBMI. This approach aims to ensure better protection against meat-borne biological and chemical hazards. RBMI also allows for continuous improvement and

allocation of limited resources to higher-risk activities and sectors. The collection of information from monitoring activities that are part of RBMI (farm records, veterinary documentation and drug use, slaughter check results) facilitate analysis of trends and the identification of low- and full-compliance operations.

2.3.2 GENERAL PRINCIPLES OF RISK ANALYSIS

In order to apply the guidelines in this document to RBMI, it is important to understand the principles of food safety risk analysis. It is also recommended to read the FAO/WHO guidance document entitled *FAO/WHO framework for developing national food safety emergency response plans* (FAO/WHO, 2010) and the FAO/WHO document entitled *Food safety risk analysis: a guide for national food safety authorities* (FAO/WHO, 2006) for more details.

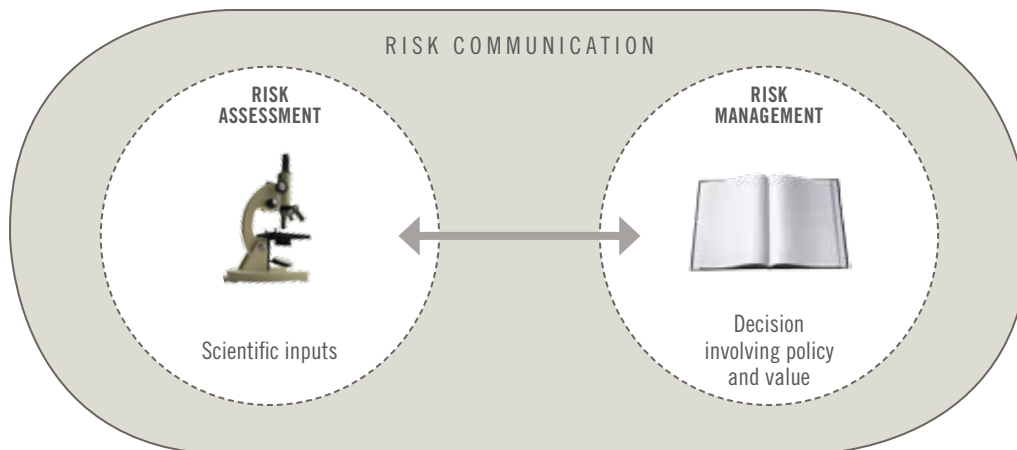
Risk analysis is a process consisting of three separate but integrated components – risk assessment, risk management and risk communication – which has the overall objective of ensuring the protection of public health (CAC/GL-30) (Figure 2.2).

BOX 2.6

COMPONENTS OF RISK ANALYSIS

- > **Risk Assessment** – A scientifically based process consisting of the following steps: (i) hazard identification; (ii) hazard characterization; (iii) exposure assessment; and (iv) risk characterization;
- > **Risk Management** – The process of weighing policy alternatives in the light of the results of risk assessment and, if required, selecting and implementing appropriate control options, including regulatory measures;
- > **Risk Communication** – The interactive exchange of information and opinions concerning risk and risk management among risk assessors, risk managers, consumers and other interested parties.

FIGURE 2.2 GENERIC COMPONENTS OF RISK ANALYSIS

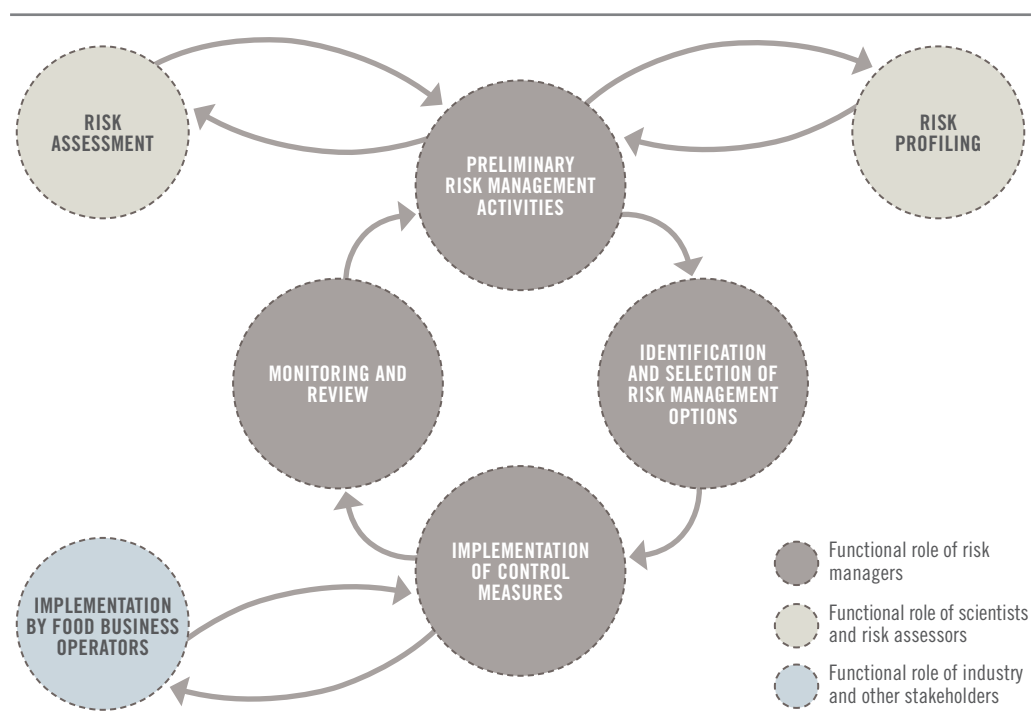


2.3.3 APPLICATION OF FOOD SAFETY RISK ANALYSIS IN MEAT INSPECTION

It is important to create a practical process for application of the different components of food safety risk analysis by the competent authority and other interested parties. Whatever the aspect of meat hygiene under review, establishment of a strategic, organizational and operational context for utilizing the different components is essential to achieving successful risk-based outcomes.

The CAC states that the three components of risk analysis “*should be applied within an overarching framework for management of food-related risks to human health*” (Codex, 2008). The Risk Management Framework (RMF) follows a structured approach and can be applied in four steps: primary risk management activities; identification and selection of risk management options; implementation and control measures; and monitoring and review (Figure 2.3).

FIGURE 2.3 ROLE OF RISK MANAGERS IN THE APPLICATION OF THE GENERIC RMF



(Adapted from FAO, 2007).

Once a food safety issue has been identified, the preliminary risk management activities include the establishment of a risk profile to provide as much information as possible on the issue, in order to allow for risk ranking or risk prioritization among different food safety issues (McKenzie and Hathaway, 2006). In meat inspection, specific activities within the RMF include identification and ranking/prioritization of major hazards and abnormalities detectable in animals, carcasses and tissues during ante- and post-mortem inspection. If deemed necessary by risk managers, a risk assessment can be commissioned to determine an appropriate measure of the risk, based on available scientific information and/or opinion of experts.

Risk assessment will also indicate whether the hazard could be eliminated and, if not, what control measures could be implemented. This preliminary step is followed by the identification and selection of risk management options, implementation of controls, and monitoring and review by gathering and analyzing data.

BOX 2.7**PRIMARY RISK MANAGEMENT ACTIVITIES**

- > **Risk ranking** is the systematic analysis and ordering of food-borne hazards and/or foods in terms of the public health risks, as assessed by likelihood and severity of adverse impacts in a target population;
- > **Risk prioritization** is the systematic analysis and ordering of food-borne hazards (or food safety issues) based on a consideration of public health impacts (resulting from risk ranking), and other factors such as social, economic or political;
- > **Risk profiling** is the process of describing a food safety problem and its context in order to identify those elements of the hazard or risk that are relevant to various risk management decisions.

2.3.4 DECISION FACTORS

Risk management decision-making is a process of weighing alternatives in the light of the results of risk assessment and, if required, selecting and implementing appropriate control measures, based on their effectiveness in reducing the public health risk. The results of risk assessment can be presented in the format of a risk assessment matrix to facilitate their understanding by risk managers. This consists of a simple table where the risks are grouped based on their likelihood of occurrence and the severity of adverse effects (Figure 2.4).

FIGURE 2.4 GENERAL RISK ASSESSMENT MATRIX

LIKELIHOOD/PROBABILITY	Almost certain	MEDIUM RISK	HIGH RISK	CRITICAL
	Possible	LOW RISK	MEDIUM RISK	HIGH RISK
	Rate	LOW RISK	LOW RISK	MEDIUM RISK
		Insignificant	Moderate	Catastrophic
		SEVERITY/IMPACT ON THE CONSUMER'S HEALTH		



It is important to recognize that “zero risk” is rarely attainable because most hazards of significance in the meat value chain are very difficult to completely eliminate. In almost all cases, risk managers will need to consult with all the stakeholders and agree on an Acceptable Level of Protection (ALOP) (CAC, 2014), which will constitute the target for all the selected control measures (e.g. incidence of a disease in an entire population per year, public health risk per edible portion of a food, number of illnesses per million servings of a particular food).

The selection of control measures to achieve a level of protection is also influenced by a range of other factors, such as economic, political, social and environmental. For example, a risk of low likelihood and high severity may not be seen by risk managers as having the same importance as a risk of high likelihood and low severity even if they have similar ranking on the risk assessment matrix.

BOX 2.8

OTHER FACTORS THAT MAY INFLUENCE RISK MANAGEMENT DECISION-MAKING

- > Economic losses related to products being removed from domestic and export markets due to food safety concerns;
- > Food security, including concerns about utilization, food access and food availability (e.g. decrease in availability due to condemned meat and meat products);
- > Consumer perceptions and acceptance of food safety risks and political considerations (e.g. concerns expressed by lobby groups);
- > Cost, feasibility and practicality of the risk management options and control measures (e.g. capacity of the food control authorities in terms of infrastructure, technical expertise and staff).

The success of this process requires the presence at national levels of a food safety system and adequately functioning food control programmes, which constitute the foundations of the RMF.

2.3.5 MONITORING, REVIEW AND RECORD-KEEPING

Monitoring is the ongoing gathering, analysing and interpreting of data related to the implementation of control measures (CAC, 2008). It is an essential component of the RMF because it makes it possible to establish a baseline for assessing the effectiveness of new control programmes and to inform managers' decision-making on the steps to be taken to further improve risk mitigation and public health protection (Korkeala and Lunden, 2014).

BOX 2.9

EXAMPLES OF MONITORING PROGRAMMES IN SLAUGHTERHOUSES

- > Monitoring to demonstrate process control: This requires development and implementation of procedures to prevent meat contamination and includes sampling and analysis for pathogenic microorganisms (e.g. *Salmonella*, *Campylobacter*) and indicators of faecal contamination (e.g. generic *E. coli*)
- > Animal health and disease monitoring by examination: This involves examination of animals before and after slaughter, during ante-mortem inspection by official veterinarians and post-mortem inspection by VPPs under the supervision of official veterinarians. Findings and conditions that could affect public and animal health are recorded in a database and can be shared with relevant authorities and stakeholders.
- > Residue monitoring and control: This requires development of sampling and testing programmes to monitor the presence of intentionally added food additives, pesticides and veterinary drugs, or contaminants formed during production or processing.
- > Monitoring of antimicrobial resistance: This is achieved by isolating bacteria (e.g. *Campylobacter*, *Salmonella*) from animals in the abattoirs and assessing the prevalence of antimicrobial resistance in these bacteria.

In addition to monitoring programmes, when risk management options and control measures are implemented through meat inspection and quality control activities, a large amount of data is generated in the slaughterhouses (Table 2.1). These data are generated at all steps, from transport of the live animals to the transport of carcasses and meat products at the end of processing. For example, information such as animal density, death rate, transport temperature and time can be collected during transport. Similarly, records can be collected of abnormalities as well as condemnation rates and causes generated during ante-mortem and post-mortem inspection.

The database created constitutes an important tool for competent authorities to evaluate and improve meat inspection procedures (e.g. improvement of animal cleanliness and slaughter hygiene, prevention of chemical and drug residues, prevention of antimicrobial resistance) (Table 2.1). In the context of RBMI, it allows for trend analysis and ranking of food safety issues and allocation of limited resources to places/activities where loss of control is more likely to occur. For example, in response to inspection findings, evidence of non-compliance could lead to a modulation of the intensity of enforcement actions based on the findings. That is, less intense inspection (e.g. low frequency) will be required when good control measures are in place, whereas intensified inspection will be needed in situations where evidence of control is not found.



TABLE 2.1 USEFULNESS AND IMPACT OF MONITORING DATA IN MEAT INSPECTION

AREA	IMPACT
FOOD SAFETY	<ul style="list-style-type: none"> > Improvement of animal cleanliness and slaughter hygiene > Prevention of zoonoses > Prevention of chemical and drug residues > Monitoring and prevention of antimicrobial resistance
MEAT QUALITY	<ul style="list-style-type: none"> > Improvement of slaughter hygiene > Prevention of meat that is Dark, Firm and Dry (DFD) or Pale, Soft and Exudative (PSE)
ANIMAL HEALTH	<ul style="list-style-type: none"> > Prevention of contagious and non-contagious animal diseases
ANIMAL WELFARE	<ul style="list-style-type: none"> > Detection of welfare problems in primary production, stunning and transport.
RISK-BASED MEAT INSPECTION	<ul style="list-style-type: none"> > Improved assessment of food safety risks > Better decision-making on meat inspection resource allocation

Capacity development in RBMI should include the development of a sustainable system that allows for collection, recording and sharing of all the information among competent authorities and all the interested stakeholders, including public and private decision-makers and agricultural planners when developing strategies to improve food safety and security. Such systems can be set up manually in small-scale establishments or by the use of computerized tools in larger slaughterhouses that have technical resources and qualified personnel. Developing a data collection and recording system as part of meat inspection activities also creates an opportunity to establish linkages with animal identification systems being developed in many countries at the primary production level to facilitate traceability of issues occurring at the slaughterhouses to sources at the farms.

BOX 2.10**KEY REQUIREMENTS FOR DATA COLLECTION AND RECORDING**

- > Availability of a system that allows the collection and storage of all the data collected during meat inspection activities. The system should be easy to use and suitable for data-sharing;
- > Methodologies and procedures in place to ensure the reliability and quality of the data collected;
- > Qualified staff trained on the approaches and tools for data collection and recording;
- > Harmonization of the codes and criteria used for decision-making in meat inspection and GHP/HACCP-related activities at the country level to allow comparison of different production and processing facilities.



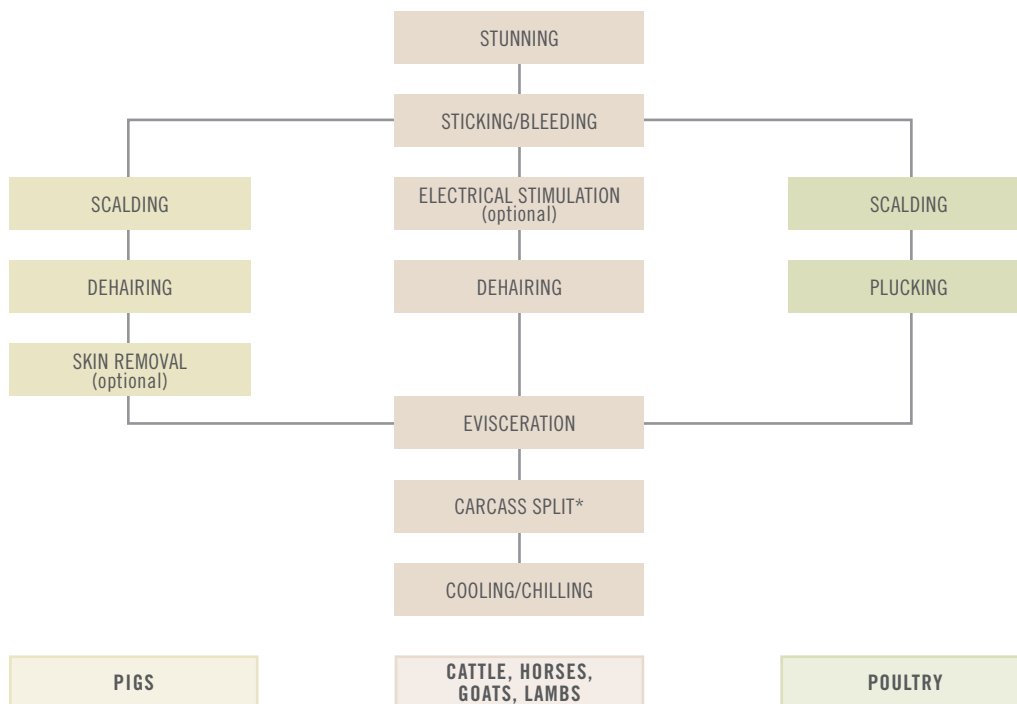
CHAPTER 3

SLAUGHTERING AND INSPECTION PROCEDURES

3.1 SLAUGHTERING PROCEDURES

Slaughtering is the killing by exsanguination of animals for human consumption. The operations of slaughtering are basically the same for all the animal species: animals are transported from the farm to the slaughterhouse and moved through the stages of stunning, bleeding, dressing, evisceration and cooling/chilling (Figure 3.1). Except for poultry, which are generally dead after stunning, animals are still alive during stunning and bleeding. Therefore, these two steps are particularly critical from the animal welfare point of view.

FIGURE 3.1 GENERAL OPERATIONS OF ANIMAL SLAUGHTERING



* Large animals (cattle, horses, dromedaries, etc.)

3.1.1 STUNNING

Stunning is the method by which animals are rendered insensible before slaughter and remain insensible until fully bled out. It is critical for animal welfare and it is imperative that the method used does not inflict pain. In countries where stunning is not applied (e.g. for religious reasons), abattoir staff should be trained to perform slaughter in a manner that minimizes stress for the animal.

Several stunning methods are available, including mechanical (penetrating and non-penetrating captive bolt guns), electrical (dry electrodes, water bath) and controlled atmosphere (carbon dioxide, carbon dioxide with inert gases, or inert gases alone). More details on stunning methods and processes are available in the FAO document, *Good Practices for the Meat Industry* (FAO, 2004d). It is the responsibility of the slaughterhouse management to select an appropriate method under the supervision of the competent authority.

When electrical stimulation is used, it is generally applied after stunning. This process accelerates the natural processes leading to *rigor mortis* and avoids cold-shortening, a quality-related issue that occurs if the temperature inside the muscle falls below 7-10°C before the onset of *rigor mortis*.

3.1.2 STICKING AND BLEEDING

Bleeding is the part of the slaughter process where the main blood vessels of the neck are severed in order to allow blood to drain from the carcass, resulting in the death of the animal from cerebral anoxia (Bucher and Scheibl, 2014). The main purpose is to remove quickly as much blood as possible. The knife that is used must be clean and sharp and, following sticking, the animal must be allowed to bleed to death before any further dressing procedure is carried out (FAO 2004d).

BOX 3.1

GENERAL PRINCIPLES FOR STUNNING AND STICKING/BLEEDING

- > The equipment used for stunning must be suitable for the purpose and meet the current minimum requirements;
- > Sticking and bleeding must be carried out without delay to ensure the animal dies through loss of blood before it regains consciousness;
- > No scalding (hogs) or dressing procedure should be performed until bleeding is complete and the animal is dead;
- > The establishment personnel involved must have relevant skills and competencies in the humane killing of animals.

3.1.3 SCALDING AND DEHAIRING/DEFEATHERING

Pork and poultry carcasses are subjected to scalding during processing. The purpose is to heat animal carcasses (e.g. by hot water or steam treatments) to loosen the hairs or feathers in the follicles in order to facilitate their removal (Irshad and Arun, 2013). Time and temperature are two important parameters that need to be monitored to ensure the effectiveness of dehairing or defeathering. Also, during the scalding process, carcasses may come in contact with or indirectly contaminate each other by introducing pathogenic bacteria such as *Salmonella* and *Campylobacter* in the scalding water. Therefore, the frequency of scalding water replacement should be appropriately determined during the identification of the critical control points (CCPs) and the establishment of critical limits should be appropriately monitored.

Following scalding, dehairing of pig carcasses and defeathering of poultry carcasses are performed either manually or mechanically, using machines with rotating fingers. Some slaughterhouses also use singeing, which consists of burning the remaining hair, soft feathers and lowermost parts of the skin. In some countries, singeing is even used instead of dehiding for beef and small ruminant carcasses.

3.1.4 DEHIDING

Dehiding is the removal of the skin or the hide. Prior to dehiding, several operations are carried out in different orders and may also vary from country to country. These include cutting of horns, removal of hoofs, cutting of the rear end of the rectum around the anus, and removal of head, genitals and udders (Puolanne and Ertbjerg, 2014). Then the skin is cut from the anus hole to the throat (flaying) and fixed to hide-pulling equipment for removal.

BOX 3.2

GOOD HYGIENIC PRACTICES FOR CARCASS DRESSING

- > The outer side of the hide must never touch the skinned surface of the carcass;
- > As little blood as possible should come into contact with the hide or skin;
- > Operators must not touch the skinned surface with the hand that was in contact with the skin;
- > When singeing is used, the selection of the material generating the fire should be done carefully to avoid contamination of carcasses by chemical residues.

3.1.5 EVISCERATION

Evisceration is the removal of the viscera, including edible offal, heart, intestines, paunch, liver, lungs, spleen and pancreas. Kidneys usually stay attached to the carcass and are removed after post-mortem inspection (Puolanne and Ertbjerg, 2014). In order to prevent contamination, care should be taken not to puncture any viscera or organs such as urinary bladder, gall bladder or uterus.



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3.1.6 ANTIMICROBIAL INTERVENTIONS

In the slaughter process, GHPs are essential to ensure the prevention or minimization of microbial contamination. Where GHPs alone do not achieve that goal, application of additional interventions may be considered (FAO/WHO, 2016). Examples of carcass decontamination interventions include hot water washes and steam pasteurization, organic acid (e.g. lactic acid, acetic acid) and other chemical washes (e.g. peroxyacetic acid and acidified sodium chloride) (Wheeler *et al.*, 2014). It is the responsibility of the FBOs to choose the appropriate intervention based on regulatory considerations, cost and technical requirements. Important elements to consider when selecting the type of intervention are listed in the FAO and WHO expert meeting report on “Interventions for the Control of Non-typhoidal *Salmonella* spp. in Beef and Pork” (FAO/WHO, 2016).

3.1.7 COOLING/CHILLING

At the end of the slaughtering process, carcasses should be cooled as soon as possible to limit microbial growth and to extend the shelf-life of the meat. Chilling can be defined as the fundamental operation of applying cold to meat to reduce its temperature quickly (FAO, 1991). While air chilling remains the most common system, other types of chilling, such as immersing in ice water, are available, especially for poultry. After chilling, the carcasses, parts of carcasses and offal can be stored at cold temperature (chilled storage) until shipment and/or consumption.

BOX 3.3

GOOD HYGIENIC PRACTICES FOR CARCASS CHILLING

- > Chilling should be carried out quickly at the end of the slaughtering process and the chilled state must be maintained until consumption;
- > Slaughterhouses should have cold chambers available where chilling takes place, as well as rooms for cold storage of carcasses, offal and meat waiting for evaluation;
- > Control of chilling temperature, air speed and relative humidity are important to prevent the growth of microbes, including many pathogens.

In locations where refrigeration systems are not available, such as villages, meat should be put on sale or reach the consumers as soon as possible, within a day of slaughter. In addition, GHPs should be reinforced to reduce contamination and growth of microorganisms (e.g. protection against insects, rodents, dust). This includes requiring clean clothing and strict personal hygiene for staff.

3.2 ANTE-MORTEM INSPECTION

3.2.1 PURPOSE OF ANTE-MORTEM INSPECTION

Ante-mortem inspection is described as the primary component of meat hygiene before slaughter (OIE, 2017b). It covers important aspects related to public health, animal health and animal welfare, and should be performed on all animals prior to slaughter. The principles presented in this section are supplemental to the objectives of the *Code of Hygienic Practice for Meat* (CAC, 2005).

3.2.2 PROCEDURE OF ANTE-MORTEM INSPECTION

General ante-mortem inspection procedures are described in the FAO *Good Practices for the Meat Industry* (FAO, 2004e) and the *Code of Hygienic Practice for Meat* (CAC/RCP 58-2005). The inspection includes: confirmation that animals are properly identified; the detection of abnormalities; the evaluation of cleanliness; and oversight of animal welfare requirements. Ante-mortem inspection should be carried out by a competent, qualified veterinarian (CAC, 2005) and has two important components: i) the screening and segregation of animals suspected of being diseased or in an unsatisfactory condition; and ii) veterinary examination and diagnosis of the screened-out animals.

It is the responsibility of competent authorities in the country to establish public health and animal health objectives based on local conditions and to develop ante-mortem inspection procedures and tests accordingly. All the decisions should be guided to the extent possible by a risk-based approach and current scientific knowledge and practice.

BOX 3.4

KEY FACTORS FOR RISK-BASED ANTE-MORTEM INSPECTION

- > Existence of procedures for confirmation of a proper animal identification system in order to ensure traceability in the food chain;
- > Ongoing tailoring of procedures based on information received from primary production;
- > Existence of a system for information collection and sharing with primary production for continuous improvement of the FCI system, and the safety and suitability of animals presented for slaughter;
- > Development and implementation of monitoring programmes for animals presented for slaughter (e.g. clinical symptoms of disease, specific meat-borne pathogens, drug residues);
- > Capacity development in the analysis of relevant information and development of options to support continuous revision and update of ante-mortem procedures.

3.2.3 DECISIONS OF ANTE-MORTEM INSPECTION

BOX 3.5

ANTE-MORTEM JUDGEMENT CATEGORIES (FAO, 2004E)

- > Passed for slaughter;
- > Passed for slaughter subject to a second ante-mortem inspection after an additional holding period, e.g. when animals are insufficiently rested or are temporarily affected by a physiological or metabolic condition;
- > Passed for slaughter under special conditions, i.e. deferred slaughter as “suspects”, where the competent person undertaking ante-mortem inspection suspects that post-mortem inspection findings could result in partial or total condemnation;
- > Condemned for public health reasons, i.e. due to meat-borne hazards, occupational health hazards or likelihood of unacceptable contamination of the slaughter and dressing environment following slaughter;
- > Condemned for meat suitability reasons;
- > Emergency slaughter, when an animal eligible for being passed under special conditions could deteriorate if there were a delay in slaughter; and
- > Condemned for animal health reasons, as specified in relevant national legislation, and disposed of accordingly.

3.3 POST-MORTEM INSPECTION

3.3.1 PURPOSE OF POST-MORTEM INSPECTION

All slaughtered animals should be subjected to post-mortem inspection, which should occur as soon as practicable after slaughter. Post-mortem inspection procedures and judgements, as determined by the competent authority, should be science-driven and risk-based. They should take into account all relevant information from the primary production level and the ante-mortem inspection to make a judgement on the safety and the suitability of parts intended for human consumption (CAC, 2005).

3.3.2 POST-MORTEM INSPECTION PROCEDURES AND TECHNIQUES

The techniques used for traditional post-mortem meat inspection have been summarized by Berardinelli *et al.* (2014) and include:

- > **Visual inspection**, which is the observation of the carcass and organs and the evaluation of their appearance;
- > **Palpation**, which is an examination by touch of the meat and organs. It provides information concerning the consistency and the integrity of examined tissues;



- > **Incision**, which involves sectioning of tissues by knife. The use of this technique can be mandatory for various tissues, according to legislation. However, in cases such as the presence of abscesses or fecal contamination, incision increases the risk of contamination or soiling the meat;
- > **Olfaction**, which is based on the sense of smell and provides information related to abnormal odours.

These techniques require advanced scientific and technical skills in areas such as anatomy, pathology and epidemiology. The knowledge and skills required for VPPs or meat inspectors and abattoir technical staff should be determined by national competent authorities.

3.3.3 POST-MORTEM INSPECTION DECISIONS

The guidelines for judgements and disposition of edible parts should be provided by competent authorities and should be based on science. These decisions are primarily based on the food-borne risks for human health (i.e. safety characteristics). Judgments regarding suitability characteristics should reflect acceptability to consumers and the need to preserve the economics of the food supply and food security, especially in developing countries.

BOX 3.6**POST-MORTEM JUDGEMENT CATEGORIES (CAC, 2005)**

- > Safe and suitable for human consumption;
- > Safe and suitable for human consumption, subject to application of a prescribed process, e.g. cooking, freezing;
- > Held on suspicion of being unsafe or unsuitable, pending the outcome of further procedures and/or tests;
- > Unsafe for human consumption but able to be used for some other purpose – e.g. pet food, feed and feed ingredients, industrial non-food use – providing there are adequate hygiene controls to prevent any transmission of hazards or illegal re-entry to the human food chain;
- > Unsafe for human consumption and requiring condemnation and destruction;
- > Unsuitable for human consumption and requiring condemnation and destruction; and
- > Unsafe for animal health reasons, as specified in national legislation, and disposed of accordingly.

Meat passed as safe and suitable for human consumption should be: (i) removed without delay from the dressing area; (ii) handled, stored and transported in a manner that will protect it from contamination and deterioration; (iii) held under conditions that reduce its temperature and/or water activity as quickly as possible, unless cut up or de-boned pre-*rigor mortis*; and (iv) held at temperatures that achieve safety and suitability objectives.

3.3.4 REQUIREMENTS FOR PARTS OF ANIMALS DEEMED UNSAFE OR UNSUITABLE FOR HUMAN CONSUMPTION

Routine slaughter activities produce significant amounts of materials not destined for human consumption. These are defined as parts of animals deemed unsafe or unsuitable for human consumption and called animal by-products. These materials generally include blood, feet, fat, horns, hooves, hide, hair, feathers, stomach, intestines and stomach contents. The management of animal by-products is critical because of their impact on the environment and their possibility to spread pathogenic agents (Prieto and Garcia-Lopez, 2014) and they should be removed as soon as possible from the food chain.

Special hygiene measures that prevent cross-contamination to meat and other edible parts and prevent any possibility of substitution should be applied to operations involving animal by-products (CAC, 2005). They should be placed without delay into specifically identified chutes, containers, trolleys or other handling facilities and identified by means appropriate to the type and end use of the tissue. In the case of condemned materials, they should be handled in rooms reserved for that purpose and conveyed in a secure manner to a place of disposal (e.g. rendering station).



CHAPTER 4

GENERAL PRINCIPLES FOR GHPs AND HACCP IN MEAT PROCESSING ESTABLISHMENTS

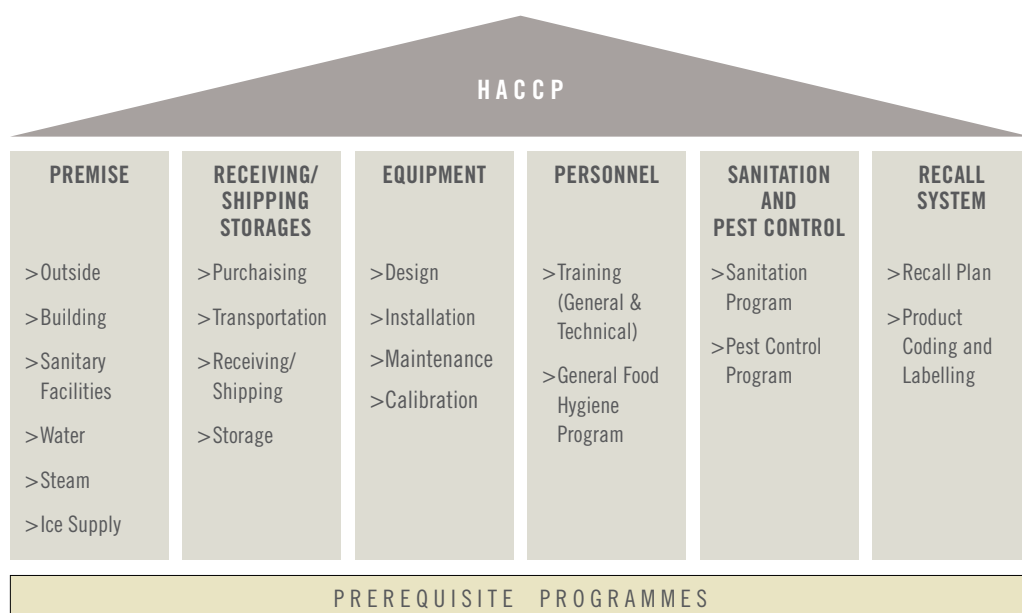
4.1 INTRODUCTION TO GHPs, PREREQUISITES AND HACCP PLANS

To ensure the protection of public health, measures additional to conventional meat inspection are crucial at the slaughterhouse to counter the threats posed by latent zoonoses and by healthy or asymptomatic food-producing animal carriers of bacterial pathogens responsible for human illnesses (Zweifel and Stephan, 2014). In most cases, these animals do not present clinical or pathological anatomical signs detectable at ante-mortem or post-mortem inspection. In addition, in the meat processing environment, significant microbial contamination of carcasses and meat can occur, with considerable opportunity for spread of bacteria. The microorganisms may originate from the animal itself (e.g. hide, skin, feet, content of the gastrointestinal tract) or result from cross-contamination by environmental sources such as floor, walls, equipment, knives and workers). The focus, therefore, should be on preventive systems such as the HACCP system.

4.2 PREREQUISITE PROGRAMMES

Prior to application of HACCP to any sector of the food chain, that sector should have in place prerequisite programmes, such as GHPs according to the Codex *General Principles of Food Hygiene*, the appropriate Codex *Codes of Practice*, and appropriate food safety requirements. These prerequisite programmes to HACCP, including training, should be well established, fully operational and verified in order to facilitate the successful application and implementation of the HACCP system. They should be considered by competent authorities as foundations of a proper functioning RBMI system (Figure 4.1).

FIGURE 4.1 SCHEMATIC REPRESENTATION OF HOW HACCP BUILDS ON PREREQUISITE PROGRAMMES



4.2.1 PREMISES

Meat processing establishments such as abattoirs should be located, designed and constructed so that contamination of meat is minimized to the greatest extent practicable. This includes proper choice of location (in an area free from airborne contaminants, prevalence of pests and likelihood of flooding), the layout and materials used and the equipment installed. If animals are slaughtered in places that are frequently polluted with blood, intestinal contents and dirty effluents, and that are not protected against insects, rodents and dogs, the meat produced will quickly deteriorate because of the bacterial load and could cause food poisoning. It is the responsibility of each country to adopt an approach based on specific local conditions for establishing slaughterhouses. Some general requirements are listed in Box 4.2.

The principles presented in this section are supplemental to the objectives of the *General Principles of Food Hygiene* (CAC, 2003) and the *Code of Hygienic Practice for Meat* (CAC, 2005).

BOX 4.1**GENERAL REQUIREMENTS FOR PREMISES**

- > The building facility is located away from or protected against potential sources of external contaminants that may compromise the safety of meat;
- > The surrounding roadways are free of debris and refuse, adequately drained and maintained to minimize environmental hazards;
- > There is physical separation of areas for holding items designated as dirty (live animals, inedible by-products) and as clean (edible meat);
- > The processing line is designed so that there is a constant progression of animals in a manner that does not cause cross-contamination;
- > Workrooms, structures and equipment are designed and constructed to allow effective cleaning and monitoring of their hygiene status;
- > Adequate facilities are provided to secure storage of chemicals (e.g. cleaning materials, lubricants, branding ink) and other hazardous substances so as to prevent accidental contamination.

BOX 4.2**DESIGN AND CONSTRUCTION OF LAIRAGE ROOMS**

- > There should be a physical separation between lairage and areas of an abattoir where edible material may be present;
- > There should be appropriate facilities to allow ante-mortem inspection to take place;
- > Floors should be paved or slatted and allow good drainage.

BOX 4.3**GENERAL RECOMMENDATIONS FOR THE DESIGN AND CONSTRUCTION OF OFFAL ROOMS**

- > A suitable red offal area and facilities should be available, adequately separated from unclean areas, for the hygienic dressing of red offal, including hearts, tongues, livers and kidneys;
- > Where green offal is prepared for human consumption, suitable facilities, physically separated from other rooms in the slaughterhouse, should be provided.

BOX 4.4**GENERAL RECOMMENDATIONS FOR LIGHTING AND VENTILATION**

- > Adequate natural or artificial light should be provided such that food colour is not altered and the intended production and inspection activities can be effectively conducted;
- > Adequate means of natural or mechanical ventilation should be provided to minimize airborne contamination of food, to control ambient temperatures, to control odours which might affect the suitability of food and to control humidity, where necessary.

BOX 4.5

GENERAL RECOMMENDATIONS FOR SANITARY FACILITIES

- > Washrooms with hot and cold or warm potable running water, soap dispensers, soap and sanitary hand drying equipment or supplies and cleanable waste receptacles should be provided. Handwashing notices should be posted in appropriate areas;
- > Where appropriate, areas of the establishment should be provided with an adequate number of conveniently located hands-free handwashing stations;
- > Where appropriate, areas of the establishment should be provided with sanitizing installations, such as for sanitizing hands, boots and operational equipment (e.g. knives).

BOX 4.6

GENERAL RECOMMENDATIONS FOR WATER, ICE, STEAM SUPPLY

Equipment should be installed that provides:

- > An adequate and easily accessible supply of hot and cold potable or “fit-for-purpose” water at all times;
- > Hot potable water for effective sanitizing of equipment, or an equivalent sanitation system;
- > Potable or “fit-for-purpose” water at a temperature appropriate for handwashing;
- > In case of poultry undergoing immersion chilling, immersing water that meets hygiene criteria specified by the competent authority.

4.2.2 TRANSPORTATION, RECEIVING, STORAGE

4.2.2.1 Transportation of slaughter animals

The transport of live animals is part of a series of events required to get the animals from the farm to the slaughterhouse. If carried out without necessary care, this can lead to very stressful conditions to the animals and result in negative impacts on the quality of the meat. Examples of these low-quality meats are Pale, Soft and Exudative (PSE) pork meat from animals subjected to relatively short-term stress, and Dark, Firm and Dry (DFD) meat occurring after longer-term stress, especially in beef (Smulders *et al.*, 2014).

Among the methods of transportation, road motor and rail transport appear more versatile and generally constitute the first choice in many countries. In developing countries, however, because of the low levels of infrastructure and poor maintenance of road networks, animals are often moved to the slaughterhouse on foot, especially cattle, sheep and goats.

Whatever the method used, once the decision to transport the animals is made, the welfare of these animals becomes the most important consideration and is a shared responsibility of various people, including the competent authorities, the owners of the animals, the buying and selling agents, the transport companies, vehicle owners and drivers, and the managers of the slaughterhouses. It is the responsibility of

the competent authorities at the country level to establish minimum standards for animal welfare, facilities, containers, vehicles and competence of animal handlers, to implement these standards, and to have in place a system for monitoring and evaluating their effectiveness.

Examples of best practices and principles for transportation of slaughter animals are presented in Box 4.8. More details are available in the OIE *Terrestrial Animal Health Code* (OIE, 2016) and the FAO *Good Practices for the Meat Industry* (FAO, 2004)

BOX 4.7

BEST PRACTICES FOR TRANSPORTATION OF LIVE ANIMALS

- > For reason of hygiene and welfare, an inspection for fitness to travel should be performed by a competent person (veterinarian) to identify and separate animals suffering from contagious diseases and animals that are ill or injured;
- > Transport times and journey lengths should be kept to a minimum. If the journey is prolonged, animals should be rested and watered, and if necessary fed, at intervals;
- > Adequate space and headroom should be provided for animals to stand in a natural position;
- > During loading and unloading, people handling animals should be skilled and have a good understanding of animal welfare and how to move animals using the principles of natural animal behaviours.

4.2.2.2 Receiving slaughter animals

The humane handling and slaughtering requirement comes into effect when the animals arrive at the slaughterhouse. It is the responsibility of the competent authorities and the slaughterhouse managers to ensure that written animal welfare procedures are in place and implemented, taking into consideration the specific conditions of each country. Examples of provisions include the procedures for the proper unloading, holding and movement of the animals in the abattoir, and the requirements for segregation and handling of sick and injured animals.

Receiving of live animals is also the step where FCI – that is, information shared between primary production and the slaughterhouses – can be collected. This information plays an important role in identifying animal health and welfare as well as meat safety and quality issues (Jalakas *et al.*, 2014).

BOX 4.8

EXAMPLES OF INFORMATION COLLECTED THROUGH THE FCI

- > Farmer identification details: name, address, phone number;
- > Identification numbers for animals: individuals or herd/flock/cage;
- > Health status of the farm or regional animal health status;
- > Veterinary medicinal products or other antimicrobial treatments administered to the animals including date of administration and withdrawal periods.

The FCI form can also include feedback information from slaughterhouse to farmers such as ante-mortem and post-mortem findings. It is desirable that competent authorities work with relevant stakeholders to develop appropriate FCIs.

4.2.2.3 Transportation and storage of meat

Following the recommendations of the *General Principles of Food Hygiene* (CAC, 2003) and the *Code of Hygienic Practice for Meat* (CAC/RCP 58-2005), meat should be transported and stored under conditions that prevent microbial contamination and growth. These control measures should be in place even where adequate hygiene control measures have been taken earlier in the food chain.

BOX 4.9

GENERAL REQUIREMENTS FOR HYGIENIC TRANSPORTATION OF MEAT

Carriers used for the transport of meat and rooms for storage of meat:

- > Are designed, constructed, maintained and cleaned to prevent contamination, damage and deterioration of meat;
- > Are equipped, where applicable, to maintain the meat in a refrigerated or frozen state;
- > Are not used for the transport of any material or substance that might adulterate the meat.

4.2.3 EQUIPMENT

Equipment and containers are important elements in the slaughterhouse environment, particularly when they come into contact with meat. They should be designed, constructed and installed to ensure that they can be adequately cleaned, disinfected and maintained to avoid the contamination of food (CAC, 2003). Therefore, in the prerequisite programme, the following two aspects of the equipment should be well understood and monitored adequately: the design and installation; and the maintenance and calibration. It is the responsibility of the managers of slaughterhouses to ensure that a written programme for preventive maintenance and calibration exists and that it is implemented and monitored.

BOX 4.10

ELEMENTS OF A MAINTENANCE AND CALIBRATION PROGRAMME

- > List of equipment requiring maintenance and/or calibration;
- > Schedules and frequencies of preventive maintenance and calibration activities;
- > Detailed procedures for maintenance and calibration;
- > Record-keeping.

4.2.4 PERSONNEL

One of the major risks of food contamination originates from the working practices of food handlers and the potential for transfer of pathogens they carry on or in their bodies to the meat during the handling process. Appropriate personal hygiene practices are required to prevent general contamination or cross-contamination. It is important for every slaughterhouse to have a written general food hygiene programme as well as a training programme to ensure that all the employees acquire appropriate skills. These programmes need to be implemented and monitored appropriately.

BOX 4.11

ELEMENTS OF A GENERAL FOOD HYGIENE PROGRAMME

- > Good Manufacturing Practices (GMPs) and Good Hygienic Practices (GHPs) (e.g. methods of handwashing, correct use of protective clothing, hygienic handling of food);
- > Procedures for visitors during production;
- > Personal health status (e.g. persons who come into direct or indirect contact with edible parts of animals or meat in the course of their work must advise management when known to be suffering from a disease likely to be transmitted through food).

Technical training is also necessary for proper implementation of any programme or procedure of the prerequisite programmes or to ensure appropriate knowledge of meat science and meat inspections (e.g. pathological signs on carcasses and organs, biochemistry of animal tissues and evolution from muscle to meat, meat microbiology, sampling techniques).

4.2.5 SANITATION AND PEST CONTROL

Improper or inadequate sanitation can lead to the contamination of the meat. Every slaughterhouse should have in place and implement a written sanitation programme or Sanitation Standard Operating Procedures (SSOPs).

BOX 4.12

KEY ELEMENTS OF A SANITATION PROGRAMME

- > Sanitation schedule and frequency for all the rooms, equipment and containers;
- > Cleaning and sanitation procedures, including for specific equipment used in the slaughter and dressing of carcasses such as knives, saws, machine cutters, evisceration machines;
- > List of chemicals and concentration levels required;
- > Record-keeping.



Similarly, pests (e.g. insects, rodents and birds) can contaminate food, ingredients, packaging materials and food contact surfaces. It is essential for meat processing establishments, including abattoirs, to have and implement a written pest control programme as described in the *General Principles of Food Hygiene* (CAC, 2003) and the *Code of Hygienic Practices for Meat* (CAC, 2005).

BOX 4.13

KEY ELEMENTS OF A PEST CONTROL PROGRAMME

- > Schedule and frequency of pest control activities;
- > Pest control procedures for the interior and the exterior of the establishment;
- > List of chemicals required and the methods of proper handling and application;
- > Record-keeping.

4.2.6 RECALL

The purpose of a recall is to stop the delivery and sale of products suspected to pose a safety risk to consumers. It is the responsibility of managers of meat processing establishments to have in place a documented recall plan which includes methods to trace the products and a step-by-step procedure. Implementation of the recall is done under the supervision of competent authorities.

The effectiveness of food recall depends widely on the maintenance of an appropriate product identification system, which is complementary and should be connected to the animal identification system at the primary production step. Both animal and product identification are key elements of the traceability system.

4.3 HACCP PLANS

The Hazard Analysis and Critical Control Point (HACCP) system is a science-based and systematic approach which identifies specific hazards and measures for their control to ensure the safety of food (CAC, 2003). The main goal of applying HACCP plans in abattoirs is to ensure that animals are slaughtered and dressed under conditions that ensure the meat will carry minimal public health risk. The HACCP approach is based on seven principles as shown in Table 4.1 (FAO, 2004a). The application of HACCP follows a logical sequence of steps including a decision tree for the identification of critical control points (CCPs).

TABLE 4.1 PRINCIPLES OF HACCP

PRINCIPLE	GENERAL SCOPE
1. HAZARD ANALYSIS	Identification of all likely public health hazards associated with the operation, assessment of the risk of their occurring, identification of related control measures.
2. IDENTIFICATION OF CRITICAL CONTROL POINTS (CCPS)	Identification of those process steps at which control can be applied to prevent or eliminate a food safety hazard or reduce it to an acceptable level.
3. ESTABLISHING CRITICAL LIMITS AT EACH CCP	Defining the line between acceptable and unacceptable operations criteria at individual CCPs.
4. MONITORING OF EACH CCP	Establishing the system for monitoring whether hazards are effectively controlled at all the CCPs.
5. CORRECTIVE ACTIONS AT EACH CCP	Development of actions/procedures to prevent transfer of hazards posing unacceptable risks to consumers if CCPs get out of control.
6. HACCP VERIFICATION/ VALIDATION	Proof that all the measures are working and that all hazards are effectively controlled.
7. HACCP DOCUMENTATION	Description of procedures as well as practical, record-based proof that the checking/action activities are carried out and are effective.

BOX 4.14

DEFINITIONS (CAC/RCP 1-1969)

- > **Control measure:** Any action and activity that can be used to prevent or eliminate a food safety hazard or reduce it to an acceptable level;
- > **Corrective action:** Any action to be taken when the results of monitoring at the CCP indicate a loss of control;
- > **Critical Control Point (CCP):** A step at which control can be applied that is essential to prevent or eliminate a food safety hazard or reduce it to an acceptable level;
- > **Critical limit:** A criterion which separates acceptability from unacceptability;
- > **Monitor:** The act of conducting a planned sequence of observations or measurements of control parameters to assess whether a CCP is under control;
- > **Validation:** Acquisition of evidence that the elements of the HACCP plan are effective;
- > **Verification:** The application of methods, procedures, tests and other evaluations, in addition to monitoring to determine compliance with the HACCP plan.

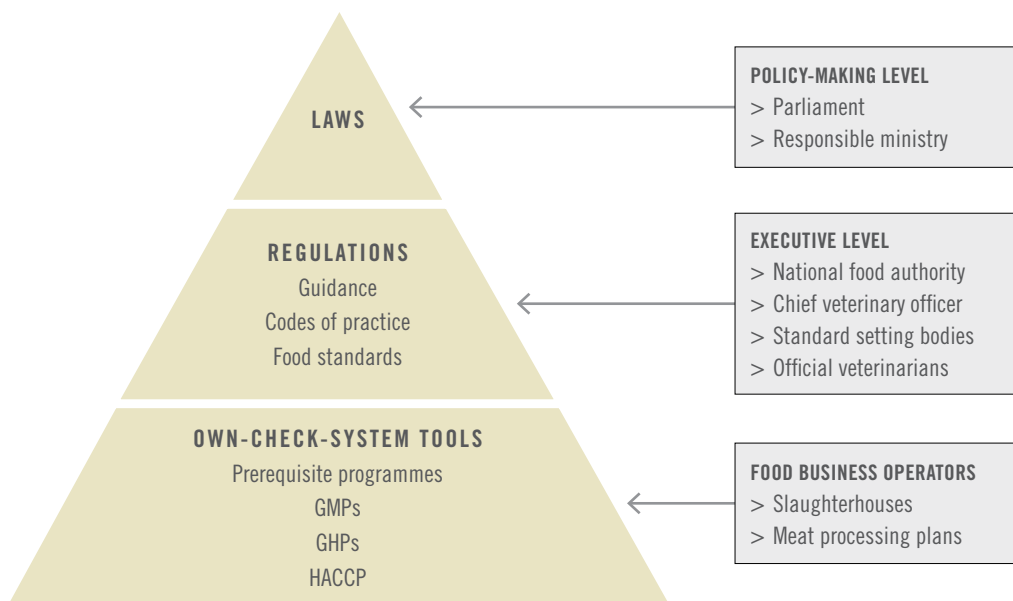


CHAPTER 5

MEAT INSPECTION LEGISLATION

Meat inspection and control at the slaughterhouses are usually regulated by domestic legislation. Legislation should also identify/establish the national authority or authorities in charge of meat control and define the main principles and requirements for official controls to be undertaken in order to ensure meat safety, meat quality, animal health and animal welfare at slaughterhouses. A country's regulatory framework for meat inspection is part of a vast category of topics that can be considered as "veterinary legislation" (OIE, 2017). Food safety legislation and, more specifically, legislation regarding slaughterhouses, encompasses a number of legally binding instruments that are necessary to establish rules for the regulation of slaughterhouses, slaughtering procedures, and meat inspection and control (Figure 5.1).

FIGURE 5.1 INSTRUMENTS OF MEAT INSPECTION LEGISLATION



The legal framework governing meat safety and control is country-specific and depends primarily on the institutional set-up and the national regulatory framework for food safety and veterinary health. The national legal system influences the content and structure of the legislation. In this framework, primary legislation is normally approved by the legislative branch of the state, while regulations are normally developed by the executive branch of the state (Figure 5.1). Regulations are designed to guide the activities of the regulated parties and to ensure uniform application of the law. Additional tools (procedures and programmes) are developed by the FBOs, under the supervision of the competent authority to facilitate the implementation of the regulatory requirements.

BOX 5.1

DEFINITIONS

- > **Legislation:** Set of laws and regulations in force within a country;
- > **Law or Act (strict sense):** Regulatory instrument approved by a legislative body in accordance with the law-making procedures provided in the constitution; food safety laws include all legislation that has an impact, directly or indirectly, on food safety;
- > **Regulation:** Set of rules prescribed by the competent authority, as prescribed in the constitution and/or in primary legislation, generally by the executive body.

5.1 DEVELOPING NATIONAL MEAT INSPECTION LEGISLATION

The national regulatory framework for meat inspection should address different types of issues related to the meat chain value, including authorization and registration of slaughterhouses, transportation of live animals and acceptance into the slaughterhouse, animal welfare in slaughterhouses, ante- and post-mortem inspections, substances used for meat processing, slicing and primary processing (such as food additives), monitoring and control of residues of contaminants and veterinary drugs in meat, and how meat is prepared, treated and placed into the market, including food hygiene.

The way meat inspection is regulated is often complex and varies considerably from country to country. In many cases, meat inspection legislation is developed within a broader regulatory framework consisting of general laws covering sectorial activities such as food safety and quality, veterinary legislation or general agriculture, and implemented through regulations addressing different aspects of the meat value chain (e.g. licensing, slaughter process, inspection, labelling).

The process of developing meat inspection legislation involves three important stages. First, in some countries, a necessary first step to draft a regulatory framework is the development of a policy, which includes the main policy objectives that the government wants to pursue for the sector. Other countries might not need a framework policy to enact legislation, but even in these countries legislation must be underpinned by national policy objectives informed by science-based technical

decisions and an assessment of national capacities. The national policy objectives will help in determining the regulatory failure that needs to be addressed or, in other words, why the existing legislation is not sufficient to meet the policy and regulatory objectives. This will provide the basis for working on regulatory reform.

In determining the regulatory objectives of meat inspection legislation, countries should use as a basis the international and regional reference standards and/or regulations, with special attention to the standards approved by the CAC and the OIE.

A second necessary step to develop national meat inspection legislation is to prepare a sound assessment of existing national legislation, taking into consideration the various legal instruments that may have an impact on meat inspection and control. In this domain, relevant national legislation might include, among other areas: (i) food safety legislation, from general public health legislation to specific hygiene implementing rules; (ii) veterinary legislation, including provisions on animal welfare, ante- and post-mortem inspections; and/or (iii) legislation governing the mandate of local authorities to authorize or inspect slaughterhouses and meat shops. The legal assessment will help to define the scope of the new or revised meat inspection legislation and to avoid regulatory gaps and overlaps.

The third key element of the regulatory drafting process is participation. It is crucial that all relevant stakeholders are consulted and given a role in the identification of the key regulatory objectives or the proposed legislation. Involving stakeholders will facilitate consensus building. Stakeholders should have the time and the opportunity to discuss and understand the new or revised regulatory objectives included in legislation, and this will facilitate compliance and implementation. Furthermore, this process would help in drafting legislation that is feasible and realistic, hence contributing to implementation and the rule of law.

5.2 INTERNATIONAL CONTEXT

Countries must make sure their legislation is aligned with the international and regional agreements and conventions to which they are signatory members. World Trade Organization (WTO) agreements – in particular the one on Sanitary and Phytosanitary Measures (SPS) and the one on Technical Barriers to Trade (TBT) – created a system that governs the development and application of international food safety and quality standards. More specifically, the SPS agreement encourages members to base their national sanitary and phytosanitary measures on the international standards, guidelines and recommendations of the CAC for food safety and the OIE for animal health.

In addition to the SPS agreement under the WTO, the TBT agreement is established to ensure that technical regulations and standards (e.g. labelling, packaging, testing and certification procedures) are not prepared and adopted in a way that creates unnecessary obstacles for international trade.

BOX 5.2

EXAMPLES OF INTERNATIONAL AGREEMENTS AND STANDARDS RELEVANT TO MEAT INSPECTION

World Trade Organization (WTO)

- > Sanitary and Phytosanitary (SPS) agreements
- > Technical Barriers to Trade (TBT) agreements

Codex Alimentarius (CAC)

- > Codex guidelines, standards and recommendation for food safety

World Organisation for Animal Health (OIE)

- > OIE guidelines, standards and guidelines for animal health

5.3 CONTEXT OF DEVELOPING AND LEAST-DEVELOPED COUNTRIES

Once the above-mentioned three steps have been accomplished (sound policy and regulatory objectives, national legal assessment and participatory process), it is important that the regulator determines the different regulatory options available to meet the identified objectives, and the economic and social impact of each option.

To define the best regulatory approach to address a failure or meet an objective, it is important, especially in developing countries, to pay attention to the national capacity to implement the legislation, and the potential costs that legislation could create for both the operators and the state. In fact, strict rules that are fully compliant with the international reference standards but do not take into consideration the national capacities might lead to poor legal enforcement, which would put the rule of law at risk. The lack of infrastructure (laboratories, standard setting bodies, inspection services) and inadequate equipment in the slaughtering establishments and processing areas to implement GMPs and HACCP programmes, might be a key constraint to implementing regulatory requirements. In addition, several competent authorities in developing and least-developed nations have limited access to scientific and technical advice to support the development and implementation of risk-based regulations.

RBMI implies making choices between conflicting policy goals. This is often challenging for developing countries where policy goals for food safety and public health protection have to integrate the need for food security (e.g. availability of sources of protein). For example, a post-mortem inspection decision of total condemnation of a pork or beef carcass could be changed to partial condemnation in situations where the availability of meat is critical, provided efficient salvation treatments exist (e.g. use of heat treatment or freezing for beef or pork carcasses infected by *Cysticercus bovis* or *C. cellulosae*).

BOX 5.3**KEY CONSIDERATIONS IN MAKING NATIONAL FOOD LAWS (VAPNEK AND SPREIJ, 2005)**

- > Identifying and analysing the existing constellation of legal provisions covering the subject area to determine the range of reforms that will be necessary. This includes the constitution, which serves as the supreme law that defines how the legislative, executive and judicial functions and responsibilities are assigned.
- > Recognizing the influence of international interests and commitments on national food legislation objectives. A country which has signed any international agreements or joined any international organizations relevant to food, and more specifically meat, will have international obligations which should be reflected in the national food laws.
- > Considering the fact that meat inspection Acts and regulations are part of a national legal framework for food that also includes numerous other interrelated pieces of legislation that address food control, food safety, food trade and food security. This also includes subsidiary legislation, such as ministerial, provincial and municipal regulations.
- > Understanding conflicting goals between the desire to protect public health and the need to facilitate trade and to ensure food security.
- > Allowing input from technical experts and giving relevant stakeholders the opportunity to express their views and to participate in the process.

5.4 ELEMENTS THAT SHOULD BE INCORPORATED IN MEAT INSPECTION LEGISLATION

It is the responsibility of the competent authorities to ensure that all the activities related to meat inspection are addressed within the country legislation. Whether meat inspection is regulated within broader food legislation or constitutes a stand-alone law with subsequent regulations for its implementation, it should contain the following key elements: (i) general provisions; (ii) licensing; (iii) slaughter process; (iv) import and export; (v) laboratories and inspection; and (vi) penal provisions and prosecution.

BOX 5.4

KEY ELEMENTS OF MEAT INSPECTION LEGISLATION AND ARRANGEMENT

Chapter 1. General provisions (definitions, scope, inspectors)

- > Definitions of terms
- > Scope
- > Competent authorities /governance

Chapter 2. Licensing

- > Slaughterhouses and meat business operators
- > Prohibition to operate an establishment
- > Procedure to get a license

Chapter 3. Slaughter process

- > Prohibition of slaughter outside of official slaughterhouses
- > Documentation and traceability requirements
- > Animal welfare
- > Hygiene, disease control and biosecurity
- > Ante-mortem inspection
- > Post-mortem inspection

Chapter 4. Import and export

- > Import
- > Export

Chapter 5. Laboratories and inspections

- > Laboratories
- > Power of inspectors
- > Obligation to cooperate
- > Inspection reports
- > Duty not to disclose confidential information

Chapter 6. Offences and sanctions

- > Offences and sanctions
- > Prosecution

Chapter 7. Final provision

- > Regulations
- > Expiration

When applicable, there should also be a provision for hunted game. In many countries, meat from non-domesticated animals represents a large portion of the meat supply and an important sector of the economy.

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TECHNICAL GUIDANCE

PRINCIPLES OF RISK-BASED MEAT INSPECTION AND THEIR APPLICATION

The meat industry is a very important contributor to the agricultural economy of most countries and particularly the developing countries. Also, meat and meat products are concentrated sources of high quality protein and their amino acid composition usually compensates for shortcomings in the staple food. They supply easily absorbed iron and assist the absorption of iron from other foods as well as zinc, and are rich sources of some of the vitamins in the B group. By providing such nutrients, meat consumption can alleviate common nutritional deficiencies.

The meat sector is evolving constantly and changes occur continuously as a result of new scientific information on meat-borne risks for consumers as well as legislation and control approaches. The success of meat inspection systems depends on capability to adopt risk-based approaches, where decisions, standards and inspection activities are based on scientific knowledge of the risks. However, this new approach is still out of reach for several LMICs due to lack of infrastructure and equipment, and limited access to scientific and technical advice.

The Principles of Risk-Based Meat Inspection and their Application presents key general principles and highlights the minimum requirements for a properly functioning RBMI system. These include concept and approaches of meat inspection, including the rationale for adopting an evidence-based system, overview of the procedures for slaughtering and meat inspection, general principles GMPs, GHPs, and HACCP, as well as the regulatory basis for meat inspection.

This work was undertaken by the Food and Agriculture Organization of the United Nations (FAO) in response to the needs expressed by several member countries for support in the development of their meat inspection systems. The information herein is useful for senior management, heads of meat inspection services, competent authorities responsible for decision-making on the establishment of policies and standards, as well as private sector operators, such as meat processors and traders.

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