How to improve the meat chain: overview of assessment criteria

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Review paper

SUMMARY

This paper gives an overview of present methodologies in assessing the meat chain. Depending on the role in the meat chain, types of assessments and assessment criteria, authors analyzed various schemes and practices that are focused on improving food safety and quality aspects of meat production.

Role of the meat company in the meat chain influences food safety and / or quality criteria that are expected to be implemented. Regarding these requirements, authors recognized various international standards, assessed through accredited and unaccredited schemes. Depending on the type of audits (first, second and third party) authors explored the main participants and their role in the assessment process. Finally, authors analyzed legal requirements and methodologies for assessing legal compliance focused on safety of meat products.

Key words: f*ood safety, quality, assessment, criteria, meat*

INTRODUCTION

Food safety assessments, such as audits and inspections are activities used to verify that a food producer or individual is following specific guidelines, requirements or rules (Powell et al., 2013). Assurance of both food safety and quality in building the trust of consumers are of major importance throughout the food chain (Aggelogiannopoulos et al., 2007). Audit is a systematic, independent and documented process for obtaining audit evidence and evaluating it objectively to determine the extent to which the audit criteria are fulfilled (ISO, 2011). Assessment criteria are requirements used as a reference against which evidence is compared. In the meat industry these criteria are standards, legal requirements or combination of the two.

Since the adoption of ISO 9000 series of standards more than twenty five years ago, certification became a common conformity audit process (Djekic et al., 2011). Certification bodies provide a variety of auditing services against a large number of standards and certification procedures have gained great importance in the international agribusiness sector (Albersmeier et al., 2009).

Audits provide a snap-shot and have limitations based upon audit frequency, auditor competence, audit scope, and audit system (Powell et al., 2013). There is a threat of weak auditing procedures in certification systems indicating differences between various certification bodies where validity and reliability of audits is not guaranteed (Albersmeier et al., 2009). Accreditation is an independent evaluation of certification bodies against ISO 17021 to ensure impartiality, competence and consistency (ISO, 2006). When choosing a certification body, two factors are to be included: recognition of the certification body in terms of their accreditation as well as competence of auditors including auditing and technical skills (IAF, 2011).

Meat inspection is one of the most widely implemented and longest running systems of surveillance in the food chain (Stärk et al., 2014). In the EU, it consists of the inspection of food chain information, ante mortem inspection, post mortem inspection and feedback to farmers (Regulation, 2004b)

The objective of this paper was to give an overview of present methodologies in assessing meat companies depending on their role in the meat chain, types of assessments and assessment criteria.

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Types of assessments
Food safety and/or quality audits
When audit criteria are (management) standards, there are three types of audits classified as first party audits (conducted by the organization itself), second party audits (conducted by customer or other organization having interest) and third party audits (conducted by independent auditing organizations) (ISO, 2011). Role of audit participants depending on the type of audit is presented in Table 1.

Table 1. Role of audit participants depending on the type of audit

	First party	Second party	Third party
Audit client		Customer	Organization (Auditee)
Auditee	Organization (Auditee)	Supplier	Organization (Auditee)
Audit team leader		Working at or subcontracted by customer	Working at or subcontracted by certification body
Auditor(s)			
Audit organization		Customer (outsource company)	Certification body

First party audits are known as internal audits. Auditee (company being audited) is the company that plans audits (audit clients). In such occasions, companies use their own resources (trained employees) to perform these audits. If necessary one of the internal auditors is assigned as audit team leader.

Second party audits are audits when the audit client is the customer aiming to verify effectiveness of a system at the premises of their suppliers (auditee). Sometimes, customers have their own trained auditors they employ to perform these audits. On other occasions, customers make contracts with specialized organization or personnel to perform audits on behalf of the customer.

Third party audit are audits where the auditee is also the audit client. On the other side, certification body uses competent auditors to perform audits. These auditors are either employed by the certification body or are subcontracted.

All actors in the food chain (producers, customers and consumers) consider a certificate as a proof of an implemented and effective system (Djekic et al., 2011; Djekić I., 2006). There are researchers that criticize the certification process emphasizing that certification is a paper-driven process of limited value for the company performance and is used as a marketing tool. However, an independent assessment by an expert provides additional value to the industry it serves as well as supporting and complementing the role of the food-law enforcement agencies (Tanner, 2000). In some cases, audits may be supplemented with microbiological and quality assurance product testing and process inspections by regulatory agencies or industry to help ensure adherence to recognized regulations and good manufacturing practices (Powell et al., 2013).

Audits may provide audited organizations with a unique opportunity to receive advice, new ideas and help from the outside (Djekic et al., 2011). As a result of all audits, an audit report is provided including audit findings and conclusions, positive and negative, and statements about the effectiveness of the management system with requirements of the standard (ISO, 2006). Audit findings can indicate either conformity or nonconformity with audit criteria or opportunities for improvement.

Meat inspections
The main purpose of meat inspection is to ensure safe meat for human consumption (Luukkanen et al., 2015). Its objective is to identify animals that are not fit for human consumption and to remove their carcasses and offal from the food chain, to support animal disease control and contribute information on notifiable diseases and zoonoses, endemic production diseases and animal welfare (Stärk et al., 2014).

The distribution of tasks between official auxiliaries and official veterinarians is in the focus lately since the Regulation (854/2004) enables member states to conduct pilot projects for trying out new approaches in meat inspection, without compromising meat safety (Regulation, 2004b). Official auxiliaries are performed by approved veterinarians designated by the competent authority to carry out specific controls as referred to the EU food hygiene legislation (FVE, 2007). Nowadays two possible meat inspection models are used in the EU. Poultry slaughterhouses may employ official auxiliaries while in red meat slaughterhouses (slaughtering bovines, pigs, horses, sheep and goats) official auxiliaries are employed by the authority or by an independent control body (Luukkanen et al., 2015).

Assessment criteria
Food safety and/or quality standards
In spite of the fact that assessment of Hazard analysis and critical control points (HACCP) is under the jurisdiction of inspection services, mistrust occurred regarding the competence of local inspection services (Barnes and Mitchell, 2000; Gagnon et al., 2000; Lee and Hathaway, 2000). As a business opportunity, certification bodies started providing third party audits and HACCP certification as an added value for meat producers (Tomašević et al., 2013). These audits fall under various food safety schemes performed by certification bodies (Djekic et al., 2014b). These schemes are either unaccredited with self-made guidelines for auditing HACCP based food safety systems or in line with accreditation protocols issued by

accreditation bodies such as the Dutch Accreditation Council, (RvA, 2014).

Besides HACCP certification, the most common certifications in the food industry cover food safety according to standard ISO 22000 and quality management systems (QMS) according to standard ISO 9001 (Djekic et al., 2011). ISO 22000 is a HACCP-type standard based on ISO 9001, developed to assure food safety (Aggelogiannopoulos et al., 2007). Both of the "ISO" standards are developed by the International Organization for Standardization. Nowadays, there is a trend of integrating management systems, mostly in line with the recommendations outlined in PAS 99:2006 Specification of common management system requirements as a framework for integration (PAS, 2006). As a result of implementing more than one standard, certification bodies may perform combined audits of two or more management systems (ISO, 2002). Standards in their scopes specify whether they cover a quality or food safety scheme but in a wider perspective, all schemes can be understood as quality schemes where each quality assurance system is focused on a particular dimension (Raspor, 2008).

Looking at meat safety and quality in a wider perspective, the decision to adopt an assurance scheme is an outcome of requirements of various stakeholders. As a result of the risks in the meat chain, various assurance schemes have been developed and are in use worldwide (Table 2).

Table 2. Overview of various food safety / quality standards present in the meat chain

Role in the meat chain	GFSI recognized	Other schemes in use
Animal farming	SQF Code	Global G.A.P. ISO 9001:2008
Animal conversion	FSSC 22000 Global Red Meat Standard Norma IFS Food FSSC 22000	ISO 9001:2008 ISO 22000:2005
Processing of animal perishable products	FSSC 22000 Global Red Meat Standard Norma IFS Food FSSC 22000 BRC Global Standard for Food Safety	ISO 9001:2008 ISO 22000:2005 HACCP based food safety system
Processing of (mixed) animal and plant perishable products	FSSC 22000 Global Red Meat Standard Norma IFS Food FSSC 22000 BRC Global Standard for Food Safety Norma PrimusGFS	ISO 9001:2008 ISO 22000:2005 HACCP based food safety system
Provision of storage and distribution services	SQF kod BRC Global Standard for Food Safety IFS Logistics	ISO 9001:2008 ISO 22000:2005

One of global organizations that developed guidance on recognizing food safety management systems necessary for safety along the supply chain is the Global Food Safety Initiative (GFSI). Joint with "The Consumer Goods Forum" it comprises of 400 retailers, manufacturers, service providers, and other stakeholders across 70 countries. In the food chain, sales turnover is around 2.5 trillion €. Retailer and manufacturer members directly employ nearly 10 million people with a further 90 million related jobs estimated along the value chain (GFSI, 2015). Regarding the food chain, GFSI recognizes several schemes that are applicable for the meat chain (GFSI, 2013).

Primary production

GFSI recommends only one scheme for farming of animals - SQF Code and its main farming module - Module 5: Food Safety Fundamentals – Good Agricultural Practices for Farming of Animal Products (SQF, 2012). This standard was developed by the Safe Quality Food Institute from the USA. Regarding primary production, it is important to emphasize that HACCP is not yet feasible according to EU regulations (Regulation, 2004a).

Animal conversion is supported by four schemes: FSCC 22000; Global Red meat standard; SQF Code and IFS. The Foundation for food safety certification (FSSC), supported by the Confederation of the FoodDrinkEurope developed FSSC 22000. This scheme contains of a complete certification scheme for food safety systems based on existing standards for certification (ISO 22000, ISO 22003 and technical specifications for sector prerequisite programs). Manufacturers that are already certified against ISO 22000 need an additional review against technical specifications for sector prerequisite programs to meet this certification scheme (FSSC, 2015).

Global red meat standard is a standard developed by the Danish Agriculture & Food Council for the processes of slaughtering, cutting, deboning and sales of red meat and meat products. In contrast to other more generic food industry quality schemes, this standard has been tailored to the specific requirements that apply to the meat industry (GRMS, 2015).

The International Featured standards (IFS) were primarily developed by the associated members of the German retail federation – Hauptverband des Deutschen Einzelhandels – and of its French counterpart – Fédération des Entreprises du Commerce et de la Distribution. IFS Food Standard covers both quality and food safety and is recognized within the scheme for animal conversion (IFS, 2014a)

Meat processing

Processing of animal perishable products is supported by five schemes as follows: FSCC 22000, Global red meat standard, SQF Code (module 9: Food Safety Fundamentals – Good Manufacturing Practices for Preprocessing of Animal Products), IFS Food Standard and BRC Global standard for food safety.

The British Retail Consortium (BRC) developed its global standard and it specifies the food safety, quality and operational criteria required to be in place within a food manufacturing organization to fulfil obligations with regard to legal compliance and protection of the consumer (BRC, 2011).

Processing of (mixed) animal and plant perishable products is supported by six recognized schemes. Five were mentioned above – FSSC 22000, Global Red meat standard, IFS Food Standard, BRC Global Standard for food safety and SQF Code (Module 11: Food Safety Fundamentals – Good Manufacturing Practices for Processing of Food Products). Sixth scheme is the PrimusGFS standard developed by Azzule Systems - provider of global data management solutions throughout all levels of the supply chain (PrimusGFS, 2014).

Storage and distribution of meat

Provision of storage and distribution services in the meat chain is recognized by the SQF Code (Module 12: Food Safety Fundamentals – Good Distribution Practices for Transport and Distribution of Food Products), IFS Logistics and BRC Global Standard for food safety. IFS Logistics is a standard for companies offering logistics services like transport and storage. It covers activities where companies have physical contact with already pre-packaged products such as: transport; packaging of pre-packed food products; and storage and/or distribution. The standard is applicable for packed and also for loose food products and products stored under regulated temperature, like meat (IFS, 2014b).

The most famous quality related standard applicable within the entire food chain is ISO 9001 (ISO, 2008). QMS certification process covers conformity to the requirements of the ISO 9001 standard including performance monitoring, measuring, reporting and reviewing against key performance objectives and targets, legal compliance, operational control, management responsibility, internal auditing and management review (Djekic et al., 2014a). Although the standard is generic and requirements are intended to be applicable to all organizations, regardless of type, size and product provided (ISO, 2008), there have been some intentions to make guidelines such as ISO 15161 Guidelines on the application of ISO 9001 for the food and drink industry (ISO, 2001). However, such trial didn't succeed. Food companies producing food of animal origin with implemented ISO 9001 reported conformity with food quality specifications, improved competitiveness and customer satisfaction. Companies rarely reported significant QMS improvement (Djekic et al., 2014a).

One of expected breakthroughs is the development of specific product based QMS deployed in terms of quality of the products, of the processes and of the systems. Deploying the generic criteria from food industry to specific food sectors becomes a challenge in the 21st century. Kristensen et al. reveal that the main research topics in pork industry evolved from canning technology in 1950s to meat quality management in 2010s (Kristensen et al., 2014). Meat quality management is a discipline in which all available data are used in situ to push forward the right meat quality to the right product specification step by step in order to optimize yield, assure the right quality for the customer and to get the optimal price for the product. Managing meat quality should cover implementing quality tools in concurrence of the researches of various authors emphasizing that lack of these tools results in unsuccessful implementation of the quality assurance systems with limited positive effects on product/process quality and entire QMS (Bayo-Moriones and Merino-Díaz de Cerio, 2001; Djekic et al., 2013; Herath et al., 2007; Sousa and Voss, 2002; Sousa et al., 2005; Zhang, 2000). First step should be the implementation of seven basic tools introduced by Kaoru Ishikawa: flowcharts, check sheets, histograms, Pareto diagrams, cause and effect diagrams, scatter diagrams and control charts (Ishikawa, 1986). Insufficient use of quality tools is in direct correlation with the lack of continual improvement as revealed by the research of Tari et al. (2007).

Legal requirements

Food industry legislation worldwide has HACCP as a mandatory requirement. In most countries, official inspections check the level of implementation of prerequisites and HACCP plans by analyzing various indicators to verify the effectiveness of the food safety (Doménech et al., 2011). However, there are examples when government inspectors have failed to prevent foodborne illness outbreaks (Powell et al., 2013).

Back in the 1970s, UK developed a methodology to assess the hygienic status of meat establishments in a structured manner, known as the Hygiene Assessment Score (MAFF, 1997). It evolved over the decades to the Methodology for official controls in approved meat establishments. It is a hygiene assessment scoring system developed for audit of meat business operators within the UK Veterinary Public Health Program (FSA, 2013). This criteria covers (i) risk factors deployed through potential hazards (microbiological, chemical and physical); (ii) meat company actions deployed with production controls relating to carcass processing, hygienic processing within cutting plants dealing with unprocessed products, hygienic production within cutting plants dealing with processed products, environmental hygiene/good hygiene practice and HACCP practice; (iii) animal

disease; (iv) animal welfare; (v) animal by-products management and TSE/SRM controls.

Similar to the UK, Australia's approach called Meat Hygiene Assessment system is integral to the implementation of a HACCP-based meat safety system and based on the visual monitoring and assessment of hygienic operations in slaughter/dressing performed by the meat company (MHA, 2002). Both of the systems are mainly intended to exporters of meat but may be used by other companies in the meat chain.

Other requirements

Standards covering animal welfare measure conditions that are outcomes of either poor management practices, neglect, abuse of animals, or poorly designed equipment (Grandin, 2010). There are three types of standards covering animal welfare, as follows: welfare standards developed by the World Organization for Animal Health (OIE, 2009a, b); country based laws and standards such as the UK „Farm Animal Welfare Slaughter in United Kingdom„ or the US „Humane Methods of Slaughter Act" and private standards that have been created by either large meat buying customers, livestock producer groups, or scientific societies (Grandin, 2010). The OIE standards give minimum requirements that both the developed and developing countries have agreed on. Some of private standards are stricter than either legislated standards or OIE standards. Animal welfare is highly related to meat quality and the overall productivity, and in particular in the western world there is an increasing awareness about the subject (Kristensen et al., 2014).

Another dimension of assessing meat plants is the religious component. Although there are many slaughter methods that religions and cultures require around the world, two commercially relevant are the "Halal" and "Kosher" methods of slaughter practiced by Muslims and Jews respectively (Farouk, 2013). The "Halal" dietary laws determine which foods are "lawful" or permitted for Muslims and "Kosher" dietary laws determine which foods are "fit or proper" for consumption by Jewish consumers who observe these laws (Regenstein et al., 2003; Regenstein and Regenstein, 1991). Religious slaughter is carried out legally in the EU in licensed slaughterhouses by authorized slaughter-men of the Jewish and Islamic faiths (Velarde et al., 2014).

One common aspect of commercial "Halal" and "Kosher" red meat production is the slaughter of animals without stunning. There is an exception regarding regulations since the legal requirement for stunning does not apply to the slaughter of animals by the Jewish method, by a Jew, licensed by the authority and duly licensed by a Rabbinical Commission, or by the Muslim method, by a Muslim licensed by an appropriate, reco-

gnized, religious authority (Velarde et al., 2014). This method of slaughter is endorsed by the OIE and developed countries yet it remains extremely controversial from an animal welfare point of view (Grandin, 2010).

Halal certification is a process of certifying products or services. The Halal quality standard is applied to the product supply and manufacturing of processed food, cosmetics, pharmaceutical and medical products as well as the logistics of Halal products (Noordin et al., 2014). According to the World Halal Forum Secretariat world halal food and beverage trade is estimated to be approximately 1.4 trillion USD annually with around 111 halal certifiers worldwide (Farouk, 2013). The potential of Kosher market is visible in the USA where consumers spend over 12.5 billion USD annually on 'traditional' kosher food products, with over 8,000 new products introduced into the kosher market annually, (Lubicom, 2011).

Legal requirements vs standards

Main difference between legal requirements and standards is presented in Table 3. Legal requirements regarding food safety in the meat chain are mandatory for meat companies. These requirements concern relevant issues deployed specifically for the meat industry with defined limits and methods how to evaluate/test certain process or product parameters. Assessments are performed by (veterinary) inspection services and they are mostly unannounced. Assessment criteria are the legal requirements.

Table 3. Difference between legal requirements and standards

	Legal requirements	Standards
Adoption	Mandatory	Voluntary
Application	Specific to some food sectors (animal origin food, slaughterhouse, etc.)	Generic for any type of organization in the meat chain
Scope	Defines (legal) limits for some requirements	Gives a framework for managing certain issues (quality / food safety)
Audit methods	Defines methods/methodologies for testing certain issues	Does not prescribe any methods, tests, controls or inspection
Assessors	Inspection services	Trained auditors
Assessment program	Unannounced	Announced (audit program)
Payment	From the budget	By the Auditee
Criteria	Legislation	Standards + legislation

On the other side, implementation of a certain standard is mainly voluntary, or in some cases various business drivers can enforce implementation of international or tailored quality and food safety schemes (Djekic et al., 2011). Standards are mostly generic and applicable to all companies in the food chain, regardless of type, size and product provided. They give frameworks for managing certain issues (quality / food safety) but do not prescribe any specific testing method. These

assessments are performed by trained auditors and are mostly announced and planned.

Although this table gives a possible "division" between the two, it is of common practice that when carrying out inspections and verifying HACCP, the official veterinarian may, according to the Regulation 854/2004 (Regulation, 2004b), take into account all rationale measures taken by the company such as implementation of integrated systems, private control systems, independent external (second and third party audits) or other means. Third-party auditing can assist regulatory agencies by providing the extra assessment and data a regulatory agency might not be able to collect but only if the data is shared with regulatory agencies (Powell et al., 2013).

CONCLUSION

This overview identified two main challenges that arise in the meat chain. First is the development of meat chain tailored criteria that includes current scientific knowledge in food safety and quality. This is expected to become a promising tool for assessing the meat chain. It should include both standards and legal requirements in order to improve the effectiveness of food safety and quality.

Second is the development of a more effective assessment system that should incorporate unannounced visits along the meat chain. Such assessments will provide supplemental information joint with documentation from various audits, regulatory compliance checks, laboratory results and raw product certificates. This is important since the role of assessments is not only to verify the effectiveness of implemented meat management systems (quality and/or food safety), but also to serve for organizational learning and continual improvement.

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Sajam pršuta u Tinjanu
17. i 18. listopada 2015.

— U Tinjan, u općini istarskog pršuta 17. i 18. listopada bit će održan 9. Internacionalni sajam pršuta (ISAP), manifestacija koja zasigurno svake godine obilježi jesen u središnjoj Istri. U središtu pozornosti ove manifestacije je pršut koji Istrijani nazivaju i vijulin. Na ovoj gastro manifestaciji sudjelovat će izlagači iz Hrvatske, Italije, Slovenije, BiH, Španjolske i Austrije, a posjeti je više od 20 tisuća posjetitelja koji uživaju u dobroj zabavi, vrhunskim delicijama i izvrsnoj atmosferi.