

Integration of ISO 22000 (2018) and HAS 23000 through Management System Audit: Case Study in Corned Beef Producer

Irma Rosiana Elizabeth^{1*}, Nugraha Edhi Suyatma², Nancy Dewy Yuliana³, Raafqi Ranasasmita⁴
Syahnada Jaya Syaifullah⁵

¹Master Program of Food Technology, Department of Food Science and Technology, Faculty of Food Technology, IPB University, Bogor 16680, Indonesia.

^{2,3}Department of Food Science and Technology, Faculty of Food Technology, IPB University, Bogor 16680, Indonesia.

³Halal Science Center IPB University, IPB Baranangsiang Campus, Bogor 16144, Indonesia

^{1,2,3,4}The Assessment Institute for Foods, Drugs, and Cosmetics, the Indonesian Council of Ulama, Jl Pemuda No 5 Bogor 16161, Indonesia

⁵Department of Plant and Environmental Sciences, Section for Plant Glycobiology. Thorvaldsensvej 40. 1871 Frederiksberg C. Copenhagen University, Denmark.

e-mail: irma@halalmui.org^{*1}, nugrahaedhi@apps.ipb.ac.id², nancy_dewi@apps.ipb.ac.id³, raafqi@halalmui.org⁴, jaya@plen.ku.dk⁵

*Corresponding Author

Received: August 04, 2021; **Accepted:** August 20, 2021

Abstract: Integrated Management System (IMS) based audit can assist the internal and external auditor to conduct an audit effectively and efficiently while checking compliance of Food Safety Management System and Halal Assurance System in the food industry. Corned beef is a product categorized as critical both in terms of halal and food safety. Implementing a food safety management system and halal assurance in corned beef industries is a challenge for producers and external auditors from inspection agencies. Based on the requirements equality approach, an Integrated Management System can be developed, referring to ISO 22000 : 2018 and HAS 23000. This research aims to combine the requirements of ISO 22000 : 2018 and HAS 23000 to be used for audit activity, as well as formulating recommendations for the corned beef producers in both requirements based on a new version of ISO 22000 : 2018. According to the analysis of requirements equality on each requirement objective, there are 14 of 30 sub-clauses of ISO 22000 : 2018 that can be integrated with 9 HAS criteria. There are 2 HAS criteria that cannot be integrated with sub-clauses of ISO 22000 : 2018, namely criteria number 4 material and 5 product. When the IMS clauses are used in audit to one of corned beef company, the percentage of compliance with the IMS requirements is 90.6% in PT XYZ. The nonconformities related to ISO 22000 : 2018 found on a new clause that has not existed in the previous version ISO 22000: 2005. This gap creates some recommendations for PT XYZ. However, IMS based audit makes the audit for halal and food safety compliance be more effective that can combine checking of food safety and halal in one audit. Furthermore, IMS based audit makes the audit be more time efficient, by reducing the mandays.

Keywords: HAS 23000, Integrated Management System, ISO 22000 : 2018

1. Introduction

Safe and halal food is essential for consumers, especially in Indonesia as the country with the largest Muslim population. According to the food law No. 18 year of 2012, the terms safe and halal food cannot be separated in the concept of food safety. The food industries implement food safety management systems, such as ISO 22000 and the Halal Assurance System (HAS) following HAS 23000, to ensure compliance with the definition of food safety based on food law No. 18 year 2012. In the ISO 22000 food safety management system, adequate supervision at each food chain needs to be considered because food safety hazards can occur at any stage of the food chain. It has an equal concern with the halal assurance system. The halal assurance system is an integrated management system developed, implemented, and maintained to manage materials, production process, products, human resources, and procedures to maintain the sustainability of halal production process following HAS requirements (LPPOM MUI, 2012). Based on the requirements equality approach, an Integrated Management System (IMS) can be developed, which refers to the management system requirements of ISO 22000 and HAS 23000 (Ivada, 2015).

One of the processed meat products that are widely sold in the market is corned beef, which is beef that is preserved with the addition of salt and packaged in cans (Patriani et al., 2020). Corned beef is a product which categorized as critical both in terms of halal and food safety (LPPOM MUI, 2012; BPOM, 2017). Corned beef is classified as a low acid canned food, which must comply with the Risk Management Program regulation commercial sterile products (BPOM, 2019c). Various risks that cause corned beef to be non-halal and unsafe can occur during the production process. The non-halal corned beef products can occur due to non-halal ingredients and facilities contaminated with filth (LPPOM MUI, 2012). Based on data from the Central Agency on Statistics (BPS) in 2018, the national beef production reached 496,000 tons. However, this amount is not proportional to the national needs for beef. The scarcity of raw materials can lead to the risk of food adulteration (Khan et al., 2020). The results of the supervision by BPOM from January to July 2005 found that 86 of the 726 samples or 12% of processed livestock-based products do not meet the requirements. Some non-conformances are seen, such as borax and formalin content, microbial contamination (Total Plate Count [TPC], *Coliform*, *E. coli*, *S. aureus*, *Salmonella*) exceeding the food safety limit, and nutritional value that do not meet the regulation (protein, carbohydrate, fat, water, and starch). As many as 2.3% of the 86 samples that do not meet the requirements are corned beef products (Suratmono, 2005; Rohaman & Siregar, 2020). It shows us that implementing a food safety management system and halal assurance system in the corned beef industry is a challenge for producers and external auditors from third-party inspection agencies.

An Integrated Management System (IMS) can assist producers in fulfilling food safety and halal assurance requirements that are effective and efficient in terms of expense, human resources, and time. In addition, IMS can also assist external auditors through IMS-based audits so that the audit is more synergized and effective in improving audit performance, reliability, and quality (Villar, 2012). Considering the benefits, research on the integrated management system that incorporates HAS 23000 and ISO 22000 has been carried out (Ivada, 2015; Fajri, 2020). However, there has not been a study to integrate HAS 23000 with ISO 22000 : 2018, which is an updated version of ISO 22000 : 2005 used in other research. In 2021, ISO 22000-certified company shall implement 2018 version of ISO 22000 according to 3 years transition period from the time the latest 2018 revision of ISO 22000 was published.

HAS 23000 has 11 criteria as requirements. They are criteria of halal policy, halal management team, training and education, material, product, production facility, procedure of critical activities, traceability, handling of nonconformance product, internal audit, and management review (LPPOM MUI, 2012). ISO 22000 : 2018 has 10 clauses, but clauses 1 to 3 are not part of the requirements. The requirements start from clause number 4 until 10. They are clauses of the context of the organization, leadership, planning, support, operation, performance evaluation, and improvement. Seven clauses of ISO 22000 : 2018 contain 30 sub-clauses. Eleven criteria of HAS and 30 sub-clauses of ISO 22000 : 2018 were further analyzed to create IMS clauses. This study aims to combine the requirements of ISO 22000 : 2018 and HAS 23000 to be used for audit activity by both internal auditors and external auditors from inspection agencies. The IMS clauses were used in IMS audit to one beef producer PT XYZ as a model, then formulate recommendations for corned beef producers to fulfill halal and food safety requirements.

2. Materials and Methods

2.1. Mapping and Integration of ISO 22000:2018 and HAS 23000

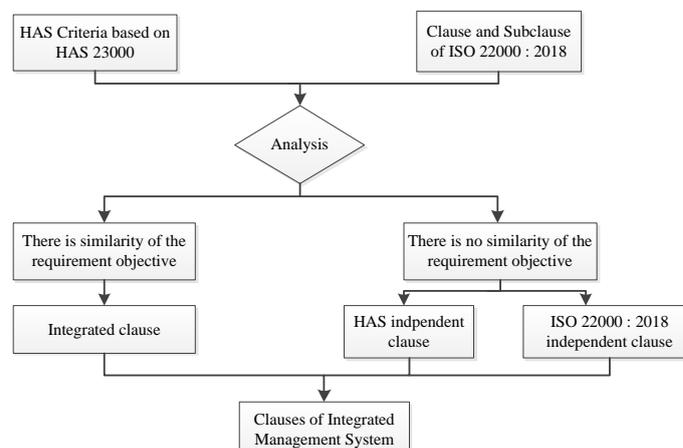


Figure 1. Flow of clauses integration

The initial stage of this study is mapping the requirements based on each clause of ISO 22000 : 2018 and HAS criteria based on HAS 23000. The clauses that can be integrated are determined based on an analysis of requirements equality according to each requirement objective. If the clause has a different objective, it will be made as a different clause, as an independent HAS 23000 clause or an independent ISO 22000 : 2018 clause. The flow of the integration is described in Figure 1.

2.2. *Compliance Assessment of IMS clauses*

The audit was conducted based on gap analysis and risk-based audit. The risk factor in terms of food safety in corned beef production was analyzed before the audit. It is identified based on the literature data, previous research, and relevant regulation from the authorized government. The identified risk factor will be used as the reference during compliance checking, especially for operation clauses on ISO 22000:2018. The fulfillment of the IMS clause was assessed qualitatively and quantitatively. The qualitative assessment was conducted using the gap analysis method by comparing the implementation of the food safety management system and halal assurance system in PT XYZ with the requirements per IMS clauses. The non-conformity data was then further analyzed to create the recommendations. The quantitative assessment was done use scale of 0, 1, and 2 (Mustika, 2017). A score of 2 is given if all the requirements on each IMS clauses are fulfilled, a value of 1 is given if some of the requirements on each IMS clauses are fulfilled, and 0 if all the requirements on each IMS clauses are not fulfilled. The percentage of IMS clauses compliance level is calculated from clause compliance value that is divided by the total values, then multiplied with 100%, such as below formulation:

$$\% \text{ of Compliance Level} = \frac{\text{clause compliance value}}{\text{total value}} \times 100 \%$$

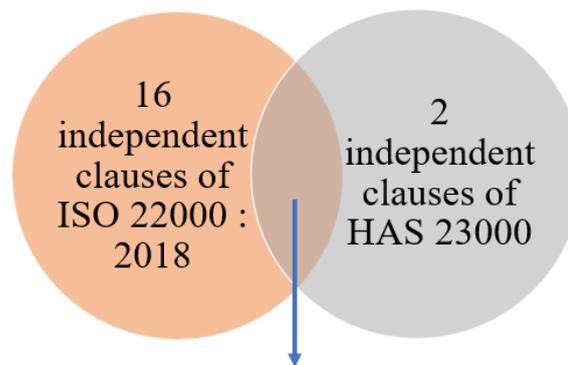
2.3. *Formulating the Recommendations*

Recommendations are made based on the results of the qualitative assessment conducted in the previous step. Recommendations are obtained based on a root cause analysis. Identification of root causes can make it easier to determine appropriate recommendations. Recommendations are then proposed to corned beef producers to make a corrective action and preventive action (CAPA) plan.

3. **Results and Discussion**

3.1. *Mapping and Integration of ISO 22000:2018 and HAS 23000*

According to the analysis of requirements equality on each requirement objective, 14 of ISO 22000 : 2018 sub-clauses can be integrated with 9 HAS Criteria (Figure 2). There are 2 HAS criteria that cannot be integrated with sub-clauses of ISO 22000 : 2018, namely criteria number 4 materials and criteria number 5 products. Therefore according to Ivada (2015), all requirements on the criteria of materials and criteria of products will only refer to the HAS criteria. Breakdown of the 32 IMS clauses are described in Table 1.



14 integrated clauses (14 of ISO 22000 : 2018 sub clauses that can be integrated with 9 HAS Criteria)

Figure 2. Clauses of integrated management system

Table 1. Integrated management system clause analysis

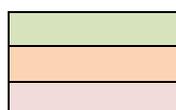
	ISO 22000 : 2018 Clause and Subclause	HAS Criteria	Clause of Integrated Management System
4	Context of the organization		
	4.1 Understanding the organization and its context		Refer to ISO 22000 requirement.
	4.2 Understanding the needs and expectations of interested parties		Refer to ISO 22000 requirement.
	4.3 Determining the scope of the food safety management system (FSMS)	6 Production facility	The organization shall determine implementation scope of FSMS and HAS. The organization shall establish, implement, maintain, update and continually improve a FSMS and HAS according to scope that has been determined.
	4.4 Food safety management system		Refer to ISO 22000 requirement.
5	Leadership		
	5.1 Leadership and commitment	2 Halal management team	The top management shall demonstrate leadership and commitment, as well provide supporting needed in the implementation of FSMS and HAS. a. Top management shall establish, implement and maintain food safety policy and halal policy,
	5.2 Policy	1 Halal policy	b. The food safety policy and halal policy shall be communicated, understood and applied at all levels within the organization including relevant external stakeholder such as material supplier. Top management shall assign food safety management team and halal management team, that has clear task, responsibilities, and authorities on maintaining the implementation of FSMS and HAS. The assignment is proven by assignment letter.
	5.3 Organization roles, responsibilities and authorities	2 Halal management team	
6	Planning		
	6.1 Action to address risks and opportunities		Refer to ISO 22000 requirement.
	6.2 Objectives of FSMS and planning to achieve		Refer to ISO 22000 requirement.
	6.3 Planning of changes		Refer to ISO 22000 requirement.
7	Support		
	7.1 Resources	2 Halal management team	The top management shall determine and provide the resources needed for the establishment, implementation, maintenance, update and continual improvement of FSMS and HAS. The resources consist of people, infrastructure, and work environment. a. The organization shall determine the necessary competence of people and ensure the people are competent based on appropriate education, training, and / or experience for FSMS and HAS.
	7.2 Competence	2 Halal management team 3 Training and Education	b. Ensure that the food safety management team and halal management have combination of multi-disciplinary knowledge and experience, as well come

	ISO 22000 : 2018 Clause and Subclause	HAS Criteria	Clause of Integrated Management System
	7.3 Awareness	1 Halal Policy	<p>from in charged department of critical activities.</p> <p>The organization shall ensure that all relevant persons from department of critical activities shall be aware of food safety policy, halal policy, the objectives of the FSMS and HAS relevant to their task, and the implications of not conforming with HAS and requirement.</p>
	7.4 Communication		Refer to ISO 22000 requirement.
	7.5 Documented of information		The documented information in FSMS and HAS implementation need to be made, updated and controlled.
8	Operation		
	8.1 Operational planning and control	7 Procedure of critical activities	<p>a. Establishing criteria for the process, implementing control process according to criteria and keeping document information,</p> <p>b. Production procedures need to ensure that halal product is produced using approved halal material and production facility that meet HAS criteria of production facility,</p> <p>c. The standard formulation shall be available and used as reference in production process</p> <p>The PRP should be established, PRP shall consider following points:</p> <p>a. construction, lay-out of buildings and associated utilities,</p> <p>b. lay-out of premises, including zoning, workspace and employee facilities,</p> <p>c. supplies of air, water, energy and other utilities,</p> <p>d. pest control, waste and sewage disposal and supporting services,</p> <p>e. the suitability of equipment and its accessibility for cleaning and maintenance,</p> <p>f. supplier approval and assurance processes (e.g., raw materials, ingredients, chemicals and packaging),</p>
	8.2 Prerequisite programmes (PRP)	6 Production facility 7 Procedure of critical activities	<p>g. reception of incoming materials, storage, dispatch, transportation, and handling of products,</p> <p>h. measures for the prevention of cross contamination.</p> <p>i. cleaning and disinfecting,</p> <p>j. personal hygiene,</p> <p>k. product information/consumer awareness,</p> <p>l. others, as appropriate</p> <p>For a, b, h, i point of PRP need also meet following production facility and cleaning activity criteria of HAS:</p> <p>i. Facilities shall not handle pork meat in the same facility (sharing facility) to produce halal products. If the company also produces processed pork products, the factory must not be in the same area (address) as the facility that produces halal meat and meat processed product.</p>

ISO 22000 : 2018 Clause and Subclause	HAS Criteria	Clause of Integrated Management System
8.3 Traceability system	8 Traceability	<p>ii. Facilities such as chiller/refrigerator and freezer to store the meat and meat processed need to be halal dedicated.</p> <p>iii. Beside facility that is mentioned on point ii, then it can be sharing facility as long as direct contact facility (for example mixer) shall be pork free and there has proper cleaning before it is used to produce halal products.</p> <p>iv. Cleaning agent and media used for cleaning validation (if any) shall be meet requirement of halal supporting document.</p> <p>For f points of PRP Supplier approval and assurance processes (e.g., raw materials, ingredients, and packaging) shall also consider about halal material selection activities. The organization shall establish procedure of new material selection that ensure new material for halal product need to be approved by LPPOM MUI. The approval can be in the form of halal positive list material or database from www.halalmui.org website or obtain approval letter. New material can be new material item or same material item with different producer.</p> <p>For g points of PRP, reception of incoming materials, storage, dispatch, transportation, and handling of products shall also consider about halal material incoming checking procedure. The organization shall establish procedure of incoming material checking that ensure information conformity of material name, producer name, origin country, and halal logo (if needed) that is written on material label and halal supporting document that is checked during material selection step. Especially for imported meat, information such as lot number, slaughtering date), and / or packing date and abattoir number/establishment of origin, need to be checked the conformity between label and shipment halal certificate.</p> <p>The traceability system shall be able to uniquely identify incoming material from the suppliers and the first stage of the distribution route of the end product. For halal product, traceability needs to be ensured that halal product is produced using approve material and production facility that meet HAS criteria of production facility. If organization apply for material code system, then it needs to be ensured that same code for halal products will have same halal status.</p>
8.4 Emergency preparedness and response		Refer to ISO 22000 requirement
8.5 Hazard control		Refer to ISO 22000 requirement
8.6 Updating the information specifying the PRPs and the hazard control plan		Refer to ISO 22000 requirement

ISO 22000 : 2018 Clause and Subclause	HAS Criteria	Clause of Integrated Management System
8.7 Control of monitoring and measuring		Refer to ISO 22000 requirement
8.8 Verification related to PRPs and the hazard control plan		Refer to ISO 22000 requirement
8.9 Control of product and process nonconformities	9 Procedure of handling halal non-conformance product	The organization shall take action to prevent potentially unsafe products and halal nonconformance product from entering the food chain that require halal, it can be done by implement evaluation of release. Withdrawn/recalled products and end products still in stock shall be secured or held under the control of the organization until they are managed. If the product has been produced using material that is not approved or facility that do not meet criteria, then the product needs to be identified as halal non-conformance product. If it is happened, then the products cannot be reworked, downgraded, reformulated or sold to consumer who require halal.
9 Performance evaluation		
9.1 Monitoring, measurement, analysis and evaluation		Refer to ISO 22000 requirement
9.2 Internal audit	10 Internal audit	The organization shall determine audit programme, including the frequency, methods, responsibilities, planning requirements and reporting, audit criteria and scope for each audit. The audit shall be done by competent auditor and need to ensure objectivity and the impartiality of the audit process. The results of the audits are reported to the food safety team, halal management and relevant management. Especially for HAS audit, the result needs to be sent to LPPOM MUI as regular report. The HAS internal audit shall be implemented twice a year.
9.3 Management review	11 Management review	Management review shall include decisions and actions related to continual improvement of FSMS and HAS. It needs to be conducted at least once a year.
10 Improvement		
10.1 Non-conformity and corrective action		Refer to ISO 22000 requirement
10.2 Continual improvement		Refer to ISO 22000 requirement
10.3 Update of the FSMS		Refer to ISO 22000 requirement
	4 Material	Refer to HAS Criteria on HAS 23000
	5 Product	Refer to HAS Criteria on HAS 23000

Remarks :



Integrated clause
 ISO 22000 : 2018 Independent clause
 HAS Independent clause

3.2. Compliance Assessment of IMS clauses

PT XYZ is one of the corned beef producers located in East Java province. The corned beef

product is distributed at the national level and can be exported to the overseas market in the future. For this reason, PT XYZ has implemented a food safety management system and halal assurance system.

Before the compliance assessment is conducted, identifying business processes was done by assessing the critical activities carried out at PT XYZ. This identification is done to ensure the compliance assessment of ISO 22000 : 2018 and HAS 23000 is relevant to the business processes at PT XYZ. PT XYZ has implemented 11 criteria of HAS. The scope of implementation for the HAS at PT XYZ is the product handling process at the factory, from material procurement to product storage. For this reason, PT XYZ has set up procedures to control the identified critical activities. Critical activities are activities in the production process chain that can affect the product's halal status (LPPOM MUI, 2012). PT XYZ has created some procedures to control their critical activities such as procedures of controlling raw materials, purchasing, new product development, material receiving control, production, production facilities cleaning and sanitation, storage and materials or products handling, shipping and transportation, and procurement for supplier service.

Process risks that may arise during the production of corned beef are also identified before the audit. These include poor sanitation practices, storage and transportation temperatures that are not maintained, and unsanitary storage and transportation environments. It is necessary to identify risk factors of the corned beef production process to become a concern during compliance checking. The identified process risk factors are described in Table 2. Good raw material quality will affect the fulfillment of the final product's food safety. Meat is a suitable medium for microbial growth, which can grow due to poor post-slaughter handling. Bacteria that can contaminate the meat due to poor sanitation practices are coliform groups such as *Escherichia coli* and *Enterobacter aerogenes*, which can cause slime in meat. There is also the possibility of contamination from *Salmonella* sp., *Shigella* sp., *Bacillus proteus*, *B. cereus*, *Staphylococcus aureus*, *S. albus*, *Clostridium welchii* and *Streptococcus*, which can grow when the meat surface is in contact with the soil (Harlia et al., 2005). Sanitary practices during meat handling as well as temperatures during frozen storage and thawing also need to be well maintained. Low-temperature treatment can stop the potential for pathogenic bacteria from proliferating (Manios & Skandamis, 2015). In the study of Ingham et al. (2004), frozen meat should not be stored in temperatures between 5-10°C for more than 8 hours or between 5-22°C for more than 2 hours.

The process of seaming cans, sterilization, and cooling is an essential step in canned corned beef production. Microbial growth in corned beef can occur due to the sterilization temperature and time that is not reached, the temperature is not cold enough after the sterilization process and can leak due to the imperfect seaming process. The shape of the can indicate damage to the product (which is flat) and the taste of the product becomes sour (flat sour), the form of the can swell, and the taste of the product becomes sour (thermophilic anaerobic), and the shape of the can is flat and the color of the product becomes black and smells (sulphur stinker) (Hanby, 2008). The sterilization and cooling processes are carried out to kill spore-forming thermophilic microbes. The sterilization process is carried out on a retort machine. The sterilizing temperature of the retort machine depends on the dimensions of the can, the viscosity of the product, and the position of the can. The heat in the retort machine will be distributed longer in larger cans, with higher liquid viscosity, and the position of the cans is far from the heat source (Nurhikmat et al., 2010). BPOM has set the minimum sterilization temperature at 121°C and F0 for a minimum of 3 minutes (BPOM, 2016, 2019b).

Besides microbiological, chemical, and physical hazards also need to be considered as risks in corned beef production. The excessive use of nitrite salt as a food additive needs to be considered. Nitrite salt is used as a preservative because it can inhibit the neurotoxins produced by *Clostridium botulinum*. Nitrite can also be added to the processed meat in the curing process to provide the distinctive red color of meat. However, excessive use of nitrite salts can form nitrosamine compounds that are teratogenic, mutagenic, and carcinogenic (Andrée et al., 2010). Based on the regulation of the BPOM No. 11 of 2019, the maximum limit for nitrite salt in processed meat products is 30 mg/kg (BPOM, 2019a). Meanwhile, the physical hazards that may occur are the presence of the metal pieces from equipment used in the processing of products, such as cutting and grinding equipment (Spellman & Bieber, 2011).

Table 2. List of risk factor during production process of corned beef in can

Process	Risk Factor	Literature
Meat receiving	Meat do not meet the following requirement, such as : 1. Stink 2. Containing pathogenic bacteria (TPC is less than 104 colonies/g).	(Harlia et al., 2005)
Packaging receiving	Corrosion cans.	(Perdana, 2019)
Meat storage	The meat is damaged because it is not stored according to the proper temperature (less than -18°C).	(Ingham et al., 2004; Manios & Skandamis, 2015)
Meat thawing	Product temperature cannot be maintained during thawing on 0-5°C.	(Manios & Skandamis, 2015)
Meat slicing and grinding	1. Cross contamination due to SSOP not being implemented properly. 2. Physical hazards of metal.	(Sofos & Geornaras, 2010 ; Manea et al., 2017) (Spellman & Bieber, 2011)
Food additive weighing	Nitrite is weighed not in accordance with the requirements.	(Andrée et al., 2010)
Seaming	<i>Defect</i> during seaming process.	(Hanby, 2008)
Sterilization	1. The temperature and time are not in accordance with the established process criteria, which is the minimum temperature is 121°C, with F0 is a minimum for 3 minutes, 2. Heat distribution test was not conducted at retort facility (cold point), 3. thermometer calibration was not conducted properly and incompetent retort operator.	(Rohaman & Siregar, 2020)
Cooling	1. Chlorin residual is more than 5 ppm. 2. Cooling is not carried out until the cooling water temperature reaches 30 – 40°C for 30 minutes	

Table 3. Amount of question on audit checklist based on integrated management system

Cycles	HAS 23000	ISO 22000 : 2018	Amount of question
Plan	1. Halal policy	4. Context of the organization	4
	2. Halal management team	5. Leadership	4
	3. Education and training	6. Planning	3
Do	4. Material	7. Support	12
	5. Product	-	2
	6. Production facility	-	
	7. Procedure of critical activities	8. Operation	35
Check, Act	8. Traceability	9. Performance evaluation	6
	9. Handling of product that do not meet criteria	10. Improvement	3
	10. Internal audit		
	11. Management Review		

Clause of the integrated management system that has been analyzed on the first step of the research was then used to create a checklist based on integrated management system audit. Questions are made based on PDCA cycles (Plan-Do-Check-Act), and there are totally 69 questions (Table 3). Therefore, quantitatively if the PT XYZ fulfill all IMS based checklist, then the total value of the compliance level is 138, because 2 point is given for each question for complete fulfillment. Based on the results of the audit at PT XYZ using an audit checklist based on an integrated management system, the percentage of compliance with the requirements is 90.6%. The value is obtained based on the following calculations:

$$\% \text{ compliance level} = \frac{125}{138} \times 100 \%$$

90.6% indicates that there are some nonconformities found. The nonconformities are related to ISO 22000: 2018, meanwhile PT XYZ has fulfilled HAS requirement. The requirements that have not been fulfilled are clause 4.1 understanding the organization and its context, 4.2 understanding the needs and expectations of interested parties, 6.1 action to address risk and opportunities, 6.2 objectives of the food safety management system and planning to achieve them and 9.2 internal audit. There were also found partial compliance in clause of 8.5 hazard control, there are some requirements on clause 8.5 that has not been fulfilled. The detail of the non-conformities list are explained on Table 4. PT XYZ has not fulfilled clause 4.1 on understanding the organization and its context and clause 4.2 on understanding the needs and expectations of interested parties. These clauses are new clauses that have not existed on the previous version ISO 22000 : 2005 (ISO 22000, 2018). Meanwhile some part of clause 6.1 action to address risk and opportunities and 6.2 objectives of the food safety management system and planning to achieve them in 22000 : 2005 are explained on 5.3 planning of FSMS, but ISO also identify this clauses as new clause (ISO 22000, 2018) PT XYZ also has not conducted internal audit based on requirement of ISO 22000 : 2018, because they have not implemented ISO 22000 : 2018. This study becomes a preliminary study for them to know the gap to fulfill the ISO 22000 : 2018 requirements.

Table 4. List of nonconformities

IMS Clause	Nonconformities
4.1 Understanding the organization and its context	There has no identified external and internal issues that are relevant to the objectives of achieving FSMS.
4.2 Understanding the needs and expectations of interested parties	<ol style="list-style-type: none"> 1. The organization has not determined the relevant interested parties for the implementation of the FSMS along with the relevant requirements of the interested parties. 2. The organization has not determined the needs and expectations of the relevant interested parties.
6.1 Action to address risk and opportunities	<ol style="list-style-type: none"> 1. Even the organization has determined risk relate with process, the organization has not determined the risks and opportunities of internal and external issues that need to be identified according to clause (4.1) and the needs and expectations of interested parties (4.2). 2. The organization has not determined actions for the identified risks and/or opportunities
6.2 objectives of the food safety management system and planning to achieve them	The organization has not set a plan to achieve the FSMS objectives
8.5.1.5.1 Preparation of the flow diagrams	The production flow chart has not explain in detail the process criteria such as temperature, pressure, time, and so on
8.5.2.2 Hazard identification and determination of acceptable level	<p>Several stages and materials have not been included in the HACCP plan, such as:</p> <ol style="list-style-type: none"> 1. Weighing of food additive, because it is part of the stages during production process, 2. Several materials are not included on HACCP plan such as water and can packaging, 3. Residues of antibiotics in meat raw material receiving has not been considered as chemical hazards that need to be identified in the HACCP plan.
8.5.4.1 Hazard control plan (HACCP/OPRP plan)	The organization needs to establish a hazard control plan for the OPRP
9.2 Internal audit	The scope of internal audit has not examined all the requirements of ISO 22000 : 2018

3.3. Formulating the Recommendations

Table 5. Recommendation list of integrated management system from assessment results

IMS Clause	Recommendation
4.1 Understanding the organization and its context	Organizations need to identify external and internal issues that are relevant to the objectives of achieving the FSMS. The identified issues can be in the form of law, technology, competition, market, culture, social and economic environment, cyber security and food fraud, food defense and intentional contamination, knowledge and performance of organizations, whether international, national, regional or local.
4.2 Understanding the needs and expectations of interested parties	<ol style="list-style-type: none"> 1. The organization needs to determine the relevant interested parties to the implementation of the SMKP along with the relevant requirements of the interested parties. 2. The organization needs to determine the needs and expectations of the relevant interested parties.
6.1 Action to address risk and opportunities	<ol style="list-style-type: none"> 1. The organization needs to determine the risks and/or opportunities of the identified internal and external issues (4.1) and the needs and expectations of interested parties (4.2). 2. Organizations need to establish actions for identified risks and/or opportunities.
6.2 objectives of the food safety management system and planning to achieve them	The organization needs to establish plan to achieve the SMKP objectives.
8.5.1.5.1 Preparation of the flow diagrams	The production flow chart needs to add detailed criteria (such as temperature, pressure, time, etc.).
8.5.2.2 Hazard identification and determination of acceptable level	<p>The organization should review the HACCP plan by:</p> <ol style="list-style-type: none"> 1. Food additive weighing process is addressed in the HACCP plan because it is part of the stages during production process, 2. Water used as material is addressed in the HACCP plan, 3. Can packaging materials is addressed in the HACCP plan, 4. Antibiotic residues in meat raw materials need to be considered as a chemical hazard and addressed in the HACCP plan.
8.5.4.1 Hazard control plan (HACCP/OPRP plan)	The organization needs to establish hazard control plan for the OPRP
9.2 Internal audit	The scope of internal audit needs to check all the requirements of ISO 22000 : 2018.

Table 6. Calculation of mandays for independent audit if ISO 22000 and HAS

Variable	ISO 22000 : 2018	HAS 23000
Amount of employee	1.5	-
Product scope	2.25	
Facility amount		2
Material amount	-	
Product amount	-	
Total mandays	3.75 / 2 = 1.875 (Counted as 2 mandays)	2 mandays

IMS-based audit that has been conducted found gaps and recommendations (Table 5) that PT XYZ needs to enhance their internal management system both food safety and halal effectively and efficiently. IMS makes the audit be more effective and efficient (Villar, 2012). The efficiency of IMS-based audit can be measured from the audit mandays. The provision for the minimum audit time / mandays that is used as a reference by the conformity inspection body refers to ISO/TS 22003 : 2007. There are some variables to decide audit mandays such as employee number, product scope, and facility line amount. In addition, to select audit mandays for halal audit also consider for the amount of material and products.

Table 6 shows us the mandays calculation based on condition in PT XYZ, when an independent audit is carried out for each ISO 22000: 2018 and HAS 23000 audit. Minimum 4 mandays needed to

audit each ISO 22000: 2018 and HAS 23000. 4 mandays means that 2 auditor can carry out the audit in 2 days or 4 auditors in 1 day. IMS-based PT XYZ audit, which was held on January 25, 2021, was carried out by two auditors in 1 day. The IMS mandays audit is less than the mandays if the audit is independently carried out for each ISO 22000: 2018 and HAS 23000 systems, and it shows the time is more efficient.

4. Conclusion

According to the analysis of requirements equality on each requirement objective, there are 14 of 30 sub-clauses of ISO 22000 : 2018 that can be integrated with 9 HAS Criteria. There are 2 HAS criteria that cannot be integrated with sub-clauses of ISO 22000 : 2018, namely criteria number 4 materials and criteria number 5 products. The IMS clauses are used in audit to one of corned beef company, PT XYZ. The percentage of compliance with the requirements is 90.6%. The non-conformities found are related to ISO 22000: 2018 conformities for the new clause that have not existed on previous version ISO 22000 : 2005, such as clause 4.1 understanding the organization and its context, 4.2 understanding the needs and expectations of interested parties, 6.1 action to address risk and opportunities, 6.2 objectives of the food safety management system and planning to achieve them. This gap creates some recommendations for PT XYZ to fulfill the IMS requirements. The IMS mandays audit is less than the mandays if the audit is independently carried out for each ISO 22000: 2018 and HAS 23000 systems, and it shows the time is more efficient. The identified clause of IMS can be adopted in other food production systems, but this evaluation result is specific to the corned beef producer.

Acknowledgements

The authors gratefully acknowledge the support of LPPOM MUI and The management of PT XYZ in this research.

References

- Andrée, S., Jira, W., Schwind, K. H., Wagner, H., & Schwägele, F. (2010). Chemical safety of meat and meat products. *Meat Science*, 86(1), 38–48. <https://doi.org/10.1016/j.meatsci.2010.04.020>
- BPOM. (2016). Peraturan BPOM No. 24 Tahun 2016 tentang persyaratan pangan steril komersial. Lembaran Negara Republik Indonesia Tahun 2016 Nomor 1144. Jakarta (Indonesia).
- BPOM. (2017). Peraturan BPOM No. 27 Tahun 2017 tentang pendaftaran pangan olahan. Lembaran Negara Republik Indonesia Tahun 2017 Nomor 23. Jakarta (Indonesia).
- BPOM. (2019a). Peraturan BPOM No. 11 tahun 2019 tentang bahan tambahan pangan (BTP). Lembaran Negara Republik Indonesia Tahun 2019 Nomor 723. Jakarta (Indonesia).
- BPOM. (2019b). Peraturan BPOM No. 19 tahun 2019 tentang pedoman cara produksi yang baik untuk pangan steril komersial yang diolah dan dikemas secara aseptik. Lembaran Negara Republik Indonesia Tahun 2019 Nomor 825. Jakarta (Indonesia).
- BPOM. (2019c). Peraturan BPOM No. 21 Tahun 2019 tentang program manajemen risiko keamanan pangan di industri pangan. Lembaran Negara Republik Indonesia Tahun 2019 Nomor 945. Jakarta (Indonesia).
- Fajri, M. (2020). Integrated food assurance system. *IOP Conference Series: Earth and Environmental Science*, 443(1). <https://doi.org/10.1088/1755-1315/443/1/012095>
- Hanby, E. (2008). In-pack processed foods : advances in sealing and seaming and methods to detect defects. (pp. 55–68). Woodhead Publishing Limited.
- Harlia, E., Astuti, Y., & Eulies Tanti Marlina. (2005). Deteksi logam berat kadmium (Cd) dalam hati ayam buras dan upaya reduksi secara fisik (penggorengan) dan kimiawi. Prosiding Seminar Lokakarya Nasional Keamanan Pangan Produk Peternakan.
- Ingham, S. C., Buege, D. R., Dropp, B. K., & Losinski, J. A. (2004). Survival of *Listeria monocytogenes* during storage of ready-to-eat meat products processed by drying, fermentation, and/or smoking. *Journal of Food Protection*, 67(12), 2698–2702. <https://doi.org/10.4315/0362-028X-67.12.2698>
- ISO (The International Organization for Standardization). (2005). ISO 22000 Food safety management systems — Requirements for any organization in the food chain. Geneva (Switzerland).
- ISO (The International Organization for Standardization). (2007). ISO/TS 22003 Food safety management systems — Requirements for bodies providing audit and certification of food safety management systems. Geneva (Switzerland).
- ISO (The International Organization for Standardization). (2018). ISO 22000 Food safety management

- systems — Requirements for any organization in the food chain. In.
- Ivada, P. A. (2015). Integrasi sistem manajemen ISO 9001, ISO 22000 dan HAS 23000 dan penerapannya di industri pengolahan susu. *Jurnal Mutu Pangan*, 2(1), 66–73.
- Khan, S., Haleem, A., & Khan, M. I. (2020). Assessment of risk in the management of Halal supply chain using fuzzy BWM method. *Supply Chain Forum*, 00(00), 1–17. <https://doi.org/10.1080/16258312.2020.1788905>
- LPPOM MUI (Lembaga Pengkajian Pangan Obat-obatan dan Kosmetika). (2012). HAS 23000 : Persyaratan sertifikasi halal. Bogor (Indonesia).
- Manea, L., Buruleanu, L., Rustad, T., Manea, I., & Barascu, E. (2017). Overview on the microbiological quality of some meat products with impact on the food safety and health of people. *The 6th IEEE International Conference on E-Health and Bioengineering*. <https://doi.org/10.1109/EHB.2017.7995372>
- Manios, S. G., & Skandamis, P. N. (2015). Effect of frozen storage, different thawing methods and cooking processes on the survival of Salmonella spp. and Escherichia coli O157:H7 in commercially shaped beef patties. *Meat Science*, 101, 25–32. <https://doi.org/10.1016/j.meatsci.2014.10.031>
- Mustika, P. (2017). Evaluasi sistem manajemen terpadu berdasarkan PAS 99:2012 di industri perisa. *Tesis*. Institut Pertanian Bogor.
- Nurhikmat, A., Kurniadi, M., Susanto, A., & Rahayu, E. (2010). Pengaruh posisi kaleng pada retort terhadap nilai F0 tuna dan udang. *Seminar Nasional Kimia dan Pendidikan Kimia*, 2, 441–445.
- Patriani, P., Hafid, H., Mirwandhono, E., & Wahyuni, T. H. (2020). *Teknologi Pengolahan Daging*. CV. Anugrah Pangeran Jaya Press.
- Perdana, W. W. (2019). Analisis Logam Berat Di Kemasan Kaleng. *Agroscience (Agsci)*, 9(2), 215. <https://doi.org/10.35194/agsci.v9i2.785>
- Rohaman, M., & Siregar, N. (2020). Food safety assurance through thermal process on canned corned beef. *IOP Conference Series: Materials Science and Engineering*, 885(1). <https://doi.org/10.1088/1757-899X/885/1/012064>
- Sofos, J., & Geornaras, I. (2010). Overview of current meat hygiene and safety risks and summary of recent studies on biofilms, and control of Escherichia coli O157:H7 in nonintact, and Listeria monocytogenes in ready-to-eat, meat products. *Meat Science*, 86(1), 2–14. <https://doi.org/10.1016/j.meatsci.2010.04.015>
- Spellman, F., & Bieber, R. (2011). *Physical hazard control*. UK : The scaregrow press inc. Retrieved 4 Juli 2021 from https://books.google.co.id/books?hl=en&lr=&id=MtW6SbppyhsC&oi=fnd&pg=PR3&dq=metal+physical+hazard&ots=A8IPjHdn_P&sig=d1uAVZC3_6prBZ7CH2xdfJI9HqQ&redir_esc=y#v=onepage&q&f=false
- Suratmono. (2005). Keamanan pangan produk olahan berbasis produk ternak. *Prosiding Seminar Lokakarya Nasional Keamanan Pangan Produk Peternakan*. Retrieved 25 Oktober 2020 from <http://balitnak.litbang.pertanian.go.id/index.php/publikasi/category/28-3#>.
- Villar, A. S. i. (2012). *An Empirical Analysis of Integrated Management Systems*. *Thesis*. Girona (Spain): Universitat de Girona.
- Undang-Undang Republik Indonesia Nomor 18 Tahun 2012. Pangan. (2012). *Lembaran Negara Republik Indonesia Tahun 2012 Nomor 227*. Jakarta.



© 2021 by Indonesian Journal of Halal Research (IJHAR). Submitted for possible open access publication under the terms and conditions of the Creative Commons Attribution (CC BY SA) license (<https://creativecommons.org/licenses/by-sa/4.0/>).